

Safety Data Sheet (SDS)

BROMINE




Section 1: Product and Company Identification

Product Name:	BROMINE	Index Number:	035-001-00-5
Product Number(s):	S021201, S021201-SSEP01, S021201-SSNP01, S021201-SSRP01		
Synonyms:	Diatomic bromide; Dibromine; Elemental bromine; Molecular bromine		
Chemical names:	DE Brom; ES Bromo; FR Brome; IT Bromo; NL Broom		
Supplier:	Seastar Chemicals Inc		
Address:	10005 McDonald Park Road, Sidney, BC V8L 5Y2 CANADA		
Phone Number:	250-655-5880	Fax Number:	250-655-5888
CANUTEC (CAN):	613-996-6666		

Section 2: Hazards Identification

Emergency Overview

Appearance:	Dark reddish-brown, dense fuming liquid.
Target Organs:	Eyes, skin, mucous membranes.

Classification:	Acute toxicity, Inhalation – Category 2 Skin corrosion – Category 1A Aquatic toxicity, Acute – Category 1	Pictograms:	  
Signal Word:	Danger		<div style="display: flex; justify-content: space-around; font-size: small;"> GHS06 GHS05 GHS09 </div>

Hazard Statements:

- H330:** Fatal if inhaled.
- H314:** Causes severe skin burns and eye damage.
- H400:** Very toxic to aquatic life.

Precautionary Statements:

- P260: Do not breathe fume/gas/mist/vapours/spray.
- P264: Wash thoroughly after handling.
- P271: Use only in a well-ventilated area.
- P273: Avoid release to the environment.
- P280: Wear protective gloves/protective clothing/eye protection/face protection.
- P284: Wear respiratory protection.
- P301 + P330 + P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
- P303 + P361 + P353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
- P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position 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.
- P310: Immediately call a POISON CENTER or doctor/physician.
- P363: Wash contaminated clothing before reuse.
- P391: Collect spillage.
- P403 + P233: Store in a well-ventilated place. Keep container tightly closed.
- P405: Store locked up.
- P501: Dispose of contents/container according to federal, regional and local government requirements.

Section 3: Composition/Information on Ingredients

CAS No.	Chemical Name	Percent	EINECS / ELINCS No.
7726-95-6	Bromine	≥99%	231-778-1

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Section 4: First Aid Measures

In case of contact:	
Inhalation:	Take proper precautions to ensure your own safety before attempting rescue (e.g., wear appropriate protective equipment, use the "buddy" system). Remove source of contamination or move victim to fresh air. If breathing is difficult, trained personnel should administer emergency oxygen. DO NOT allow victim to move about unnecessarily. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. If breathing has stopped, trained personnel should begin artificial respiration (AR) or, if the heart has stopped, cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED) immediately. Avoid mouth-to-mouth contact by using mouth guards or shields. Quickly transport victim to an emergency care facility.
Skin:	Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, remove contaminated clothing, shoes and leather goods. Immediately flush with lukewarm, gently flowing water for at least 30 minutes. If irritation persists, repeat flushing. DO NOT INTERRUPT FLUSHING. If necessary and it can be done safely, continue flushing during transport to emergency care facility. Quickly transport victim to an emergency care facility. Wash contaminated clothing before reuse.
Eye:	Avoid direct contact. Wear chemical protective gloves, if necessary. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for at least 30 minutes, while holding the eyelid(s) open. If a contact lens is present, DO NOT delay irrigation or attempt to remove the lens. Neutral saline solution may be used as soon as it is available. DO NOT INTERRUPT FLUSHING. If necessary, continue flushing during transport to emergency care facility. Take care not to rinse contaminated water into the unaffected eye or onto the face. Quickly transport victim to an emergency care facility.
Ingestion:	NEVER give anything by mouth if victim is rapidly losing consciousness, is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. If vomiting occurs naturally, have victim rinse mouth with water again. Quickly transport victim to an emergency care facility.
Notes to Physician/Doctor:	Provide general supportive measures (comfort, warmth, rest). Consult a doctor and/or the nearest Poison Control Centre for all exposures. Some first aid procedures recommended above require advanced first aid training. Protocols for undertaking advanced procedures must be developed in consultation with a doctor and routinely reviewed. All first aid procedures should be periodically reviewed by a doctor familiar with the material and its conditions of use in the workplace.

Section 5: Fire Fighting Measures

Fire Hazard Summary:

Bromine will enhance the burning rate and may cause spontaneous ignition of combustible materials. Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated. During a fire, corrosive and highly toxic gases may be generated by thermal decomposition or combustion. Firefighter's normal protective equipment (Bunker Gear) will not provide adequate protection. Chemical protective clothing (e.g. chemical splash suit) and positive pressure self-contained breathing apparatus (NIOSH approved or equivalent) may be necessary.

Extinguishing Media:	Bromine does not burn. Use extinguishing agent suitable for the surrounding fire. Use water in flooding quantities as fog. Use water spray to cool fire exposed containers and knock-down vapours.
Extinguishing Media to be Avoided:	Carbon dioxide or other extinguishing agents that smother flames are not effective on oxidizers. Do NOT get water inside containers.
Flash Point:	Will not burn.
Lower Flammable (Explosive) Limit (LFL/LEL):	Not applicable
Upper Flammable (Explosive) Limit (UFL/UEL):	Not applicable
Autoignition Temperature:	Not applicable
Sensitivity to Mechanical Impact:	Probably not sensitive. Normally stable.
Sensitivity to Static Charge:	Not available.
Electrical Conductivity:	Not available.
Minimum Ignition Energy:	Not applicable
Combustion and Thermal Decomposition Products:	Hydrogen bromide (toxic, highly corrosive).

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NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) HAZARD IDENTIFICATION – Bromine

Health:	3 – Short exposure could cause serious temporary or residual injury.
Flammability:	0 – Will not burn under typical fire conditions.
Reactivity:	0 – Normally stable, even under fire conditions, and not reactive with water.
Special Hazard:	OXIDIZING MATERIAL

Section 6: Accidental Release Measures

Spill Precautions:

Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. Ventilate area. Eliminate all ignition sources. Remove all flammable and combustible materials. Notify government occupational health and safety and environmental authorities.

Clean-up:

Do not touch spilled material. Stop or reduce leak if safe to do so. Prevent material from entering sewers, waterways or confined spaces. Keep materials which can burn away from spilled material. Approach spill from upwind. A vapour suppressing foam may be used to reduce vapours.

Absorb spill with inert material (e.g., dry sand or earth). Transfer to a container for waste disposal. Neutralize spill with solution or slurry of 10-50% potassium carbonate, 10-13% sodium carbonate, 5-10% sodium bicarbonate, or saturated hypo solution (prepared by dissolving 4 kg of sodium thiosulphate in 9.5 L of water and adding 113 g of soda ash). Ventilate area and flush with cold water. *Maintain mild ammonia atmosphere while cleaning up to minimize vapour attack.*

Section 7: Handling and Storage

Handling:

This material is a CORROSIVE, MODERATE OXIDIZING liquid. Before handling, it is extremely important that engineering controls are operating and that protective equipment requirements and personal hygiene measures are being followed. People working with this chemical should be properly trained regarding its hazards and its safe use. Maintenance and emergency personnel should be advised of potential hazards.

Immediately report leaks, spills or failures of the engineering controls. No contact with materials which can burn. Eliminate all ignition sources. Post "NO SMOKING" signs in area. Do not perform any welding, cutting, soldering, drilling or other hot work on an empty vessel, container or piping until all material has been cleared. Consider using closed handling systems for processes involving this material. If a closed handling system is not possible, use bromine in the smallest possible amounts, in an area separate from the storage area. Avoid generating vapours or mists. Prevent the release of vapours or mists into the air.

Handle bromine only with equipment made of Kynar, Teflon, Monel, Pyrex, glass or lead-lined steel. Inspect containers for damage or leaks before handling. Label containers. Cautiously, dispense into sturdy containers made of compatible materials. Use corrosion-resistant transfer equipment when dispensing. Secondary protective containers must be used when this material is being carried. Do not return unused or contaminated material to the original container. Do not use with incompatible materials such as organic compounds. See Section 10 for more information.

Avoid damaging containers. Keep containers closed when not in use. Always assume that empty containers contain hazardous residues. Never reuse empty containers, even if they appear to be clean. Have suitable emergency equipment for fires, spills and leaks readily available. Practice good housekeeping. Comply with applicable regulations.

Storage:

Store in a cool, dry, well-ventilated area away from combustible materials, heat, ignition sources, sparks, and flame. Do not store in metal or glass containers. Do not store in direct sunlight. Store away from incompatible materials, such as organic compounds. See Section 10 for more information. Keep quantities stored as small as possible. Empty container may contain hazardous residue.

Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Keep storage area separate from work areas. Storage facilities should be made of fire resistant materials. Construct walls, floors, shelving and fittings in storage areas from non-combustible materials that resist attack from bromine.

Inspect all incoming containers to make sure they are properly labelled and not damaged. Store in suitable, labelled containers (usually the shipping container). Protect from damage. Have appropriate fire extinguishers and spill clean-up

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equipment in storage area. Contain spills or leaks by storing in trays made from compatible materials. Keep absorbents for leaks readily available.

Section 8: Exposure Controls/Personal Protection

General Exposure Precautions:

NOTE: Exposure to this material can be controlled in many ways. The measures appropriate for a particular worksite depend on how this material is used and on the extent of exposure. This general information can be used to help develop specific control measures. Ensure that control systems are properly designed and maintained. Comply with occupational, environmental, fire, and other applicable regulations.

Engineering Controls:

Engineering methods to control hazardous conditions are preferred. Methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions, and process modification (e.g., substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required.

Because of the high potential hazard associated with this substance, stringent control measures such as enclosure or isolation should be considered for large scale operations. Supply sufficient replacement air to make up for air removed by exhaust systems. Do not use organic or combustible materials such as wood in the construction of ventilation or control systems.

Personal Protective Equipment:

If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal protective equipment including approved respiratory protection. Have appropriate equipment available for use in emergencies such as spills or fire.

If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection. Refer to the CSA Standard Z94.4-11, "Selection, Use and Care of Respirators," available from the Canadian Standards Association.

Eye / Face protection:	Wear a face shield and/or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin protection:	Wear impervious gloves and appropriate protective clothing. Choose body protection according to the amount and concentration of the substance at the work place. A chemical protective full-body encapsulating suit and respiratory protection may be required in some operations. Have a safety shower/eye-wash fountain readily available in the immediate work area.
Resistance of Materials for Protective Clothing:	Guidelines for bromine: RECOMMENDED (resistance to breakthrough longer than 8 hours): Nitrile rubber. RECOMMENDED (resistance to breakthrough longer than 4 hours): Trelchem™ HPS and VPS. CAUTION, use for short periods only (resistance to breakthrough within 1 to 4 hours): Neoprene rubber. NOT RECOMMENDED for use (resistance to breakthrough less than 1 hour): Butyl rubber; natural rubber; polyethylene; Viton™/Butyl rubber; Tychem™ CPF 3, F, BR/LV, Responder®, and TK.
Inhalation / Ventilation:	Use in a chemical fume hood. Where risk assessment shows air-purifying respirators are appropriate use a full-facepiece respirator with cartridge(s) to protect against bromine (only nonoxidizable sorbents are allowed) (US) or type B-P2 (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a positive pressure supplied air respirator with an auxiliary positive pressure SCBA. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).
Personal Hygiene:	Remove contaminated clothing immediately. Keep contaminated clothing in closed containers. Discard or launder before rewearing. Inform laundry personnel of contaminant's hazards. Do not eat, drink or smoke in work areas. Wash hands thoroughly after handling this material. Maintain good housekeeping. Handle in accordance with good industrial hygiene and safety practice.

EXPOSURE GUIDELINES – Listed under Bromine, as Br₂

NIOSH:	REL-TWA: 0.1 ppm (0.7 mg/m ³); REL-STEL: 0.3 ppm (2 mg/m ³); IDLH: 3 ppm
ACGIH:	TLV-TWA: 0.1 ppm; TLV-STEL: 0.2 ppm
OSHA PEL:	PEL-TWA: 0.1 ppm (0.7 mg/m ³)

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Section 9: Physical and Chemical Properties

Form:	Dense fuming liquid	Melting/Freezing Point:	-7.25 °C (18.95 °F)
Colour:	Dark reddish-brown	Boiling Point:	58.78 °C (137.80 °F)
Odour:	Lachrymatory halogens	Critical Temperature:	315 °C (599 °F) @ 102 atm
Odour Threshold:	<0.0099 ppm (detection)	pH:	No information available.
Chemical Formula:	Br ₂	Density:	3.1055 g/mL @ 25 °C
Formula Weight:	159.808 g/mol	Solubility in Water:	Moderately soluble, 36.5 g/L @ 25 °C
Vapour Density:	5.515 @ 15 °C	Solubility in Other Liquids:	Common solvents (ethanol, diethyl ether, chloroform, carbon disulfide)
Vapour Pressure:	175 mm Hg @ 20 °C		
Latent Heat of Fusion:	15.8 cal/g (28.4 BTU/lb)	Viscosity, Dynamic:	1.02 mPa·s @ 20 °C
Latent Heat of Vapourization:	44.9 cal/g (80.8 BTU/lb)	Refractive Index:	1.6083 @ 20 °C

Section 10: Stability and Reactivity

Normally stable.

Incompatibility – Materials to Avoid:

NOTE: Chemical reactions that could result in a hazardous situation (e.g. generation of flammable or toxic chemicals, fire or detonation) are listed here. Many of these reactions can be done safely if specific control measures (e.g. cooling of the reaction) are in place. Although not intended to be complete, an overview of important reactions involving common chemicals is provided to assist in the development of safe work practices.

ACETALDEHYDE – reacts violently.

ACETYLENE, ACRYLONITRILE, AMMONIA, DIMETHYL FORMAMIDE, ETHYL PHOSPHINE, HYDROGEN, NICKEL CARBONYL, NITROGEN TRIIODIDE, OZONE, OXYGEN DIFLUORIDE, SILVER AZIDE, or SODIUM CARBIDE – reacts explosively.

ALUMINUM – vigorous, incandescent reaction with bromine vapour.

ANTIMONY – spontaneously flammable.

COPPER CARBIDE – spontaneously flammable with bromine vapour.

LITHIUM, SODIUM or POTASSIUM (with moderate to heavy mechanical shock) – vigorous reaction with incandescence (gas). Explodes violently in contact with liquid bromine.

METHYL ALCOHOL – violent exothermic reaction.

OZONE – severe explosions occur in attempts to form tribromine octoxide.

PHOSPHORUS (white) – ignites and causes dangerous explosions with liquid bromine.

RUBBER – reacts violently with natural rubber and more slowly with some synthetic rubbers.

Conditions to avoid:	High temperatures, open flames, ignition sources, moisture, reducing agents.
Hazardous Decomposition Products:	Hydrogen bromide.
Hazardous Polymerization:	None reported.
Corrosivity to metals:	Attacks most metals including platinum and palladium.

Section 11: Toxicological Information

Potential Health Effects

Inhalation:	May be fatal if inhaled. HIGHLY TOXIC. Concentrations ≥10 ppm cause severe respiratory irritation with mucous secretion in upper airways, coughing, nosebleeds, respiratory difficulties, dizziness, and headache. High exposure to vapours may cause respiratory failure, pulmonary edema and pneumonia.
Skin:	Corrosive. May be fatal in contact with skin. Corrosive materials are capable of producing severe burns, blisters, ulcers and permanent scarring, depending on the concentration of the solution and the duration of contact. Skin exposures not immediately removed result in skin destruction and slow to heal ulcerations.
Eye:	Corrosive. Low concentrations of the vapour (less than 1 ppm) are very irritating to the eyes

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	and cause inflammation and lachrymation. Corrosive materials are capable of producing severe eye burns, and permanent injury, including blindness, depending on the concentration of the solutions and duration of contact.
Ingestion:	May be fatal if swallowed. May cause gastrointestinal tract irritation and burns with loss of appetite, joint pain, abdominal pain, nausea, and diarrhea. Probable lethal oral dose for an adult is 1 mL.
Chronic:	Long term exposure may have negative effects on the respiratory and male reproductive systems.

Effects of Long-Term (Chronic) Exposure

RTECS#:	EF9100000
LD50/LC50:	VCVN5* "Vrednie chemicheskije veshstva. Neorganicheskie soedinenia elementov V-VII groopp": LD50 (lethal dose, 50% kill) Oral, mouse – 3,100 mg/kg LD50 Oral, rat – 1,700 mg/kg LC50 (lethal concentration, 50% kill) Inhalation, rat – 2,700 mg/m ³ – Lungs, Thorax or Respiration: other changes GTPZAB Gigiena Truda i Professional'nye Zabolevaniya.
Epidemiology:	Inhalation exposure to 180 ppm causes severe irritation and corneal clouding in 3 animal species.
Teratogenicity:	No information available.
Reproductive Effects:	No information available.
Neurotoxicity:	No information available.
Mutagenicity:	No information available.
Carcinogenicity:	Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.

Section 12: Ecological Information

Ecotoxicity: LC50 – Rainbow trout – 0.31 ppm/24H; LC50 – Bluegill – 0.52 ppm/24H; LC50 – Water flea – 1 mg/L/48H

Section 13: Disposal Considerations

Review local/regional/international regulations or requirements prior to disposal. Store material for disposal as indicated in Storage Conditions. **Contaminated packaging:** Dispose of as unused product.

Section 14: Transport Information

US DEPARTMENT OF TRANSPORT (DOT) HAZARDOUS MATERIALS SHIPPING INFORMATION (49 CFR)

Shipping Name and Description: BROMINE
 Identification Number: UN1744 Hazard Class or Division: 8 Packing Group: I

NOTE: This information was taken from the US Code of Federal Regulations Title 49 - Transportation and is effective April 30, 2013.

CANADIAN TRANSPORTATION OF DANGEROUS GOODS (TDG) SHIPPING INFORMATION

Shipping Name and Description: BROMINE
 UN Number: UN1744 Class: 8 (6.1) Packing Group/Category: I
 Special Provisions: --- Marine Pollutant: --- Passenger Carrying Road/Railway Vehicle Index: Forbidden

NOTE: This information incorporates the Transportation of Dangerous Goods Regulations SOR/2001-286, effective January 2, 2013.

International Maritime Dangerous Goods (IMDG)

Proper Shipping Name / Description: BROMINE
 UN Number: 1744 Class or Division (Sub Risk): 8 (6.1) Packing Group/Category: I
 Special Provisions: --- Marine Pollutant: --- EMS Number: F-A, S-B

International Air Transport Association (IATA)

Proper Shipping Name / Description: Bromine
 UN/ID Number: 1744 Class or Division (Sub Risk): 8 (6.1) Packing Group: I
 Special Provisions: A2 Passenger / Cargo Aircraft: Forbidden Cargo Aircraft Only: Forbidden

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Section 15:	Regulatory Information
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Bromine	CAS# 7726-95-6	
US Federal:		
TSCA	CAS# 7726-95-6 is listed on the TSCA Inventory. CAS# 56-23-5 is listed on the TSCA Inventory. CAS# 67-66-3 is listed on the TSCA Inventory.	
SARA Title III: Section 302	Reportable quantity: 500 lbs bromine 7726-95-6 ($\geq 99.8\%$) Reportable quantity: 10 lbs chloroform 67-66-3 (≤ 40 ppm)	
SARA Title III: Section 313	De minimis concentration: 1 % De minimis concentration: 0.1 % De minimis concentration: 0.1 %	bromine 7726-95-6 ($\geq 99.8\%$) carbon tetrachloride 56-23-5 (≤ 40 ppm) chloroform 67-66-3 (≤ 40 ppm)
US State:		
Massachusetts Right To Know	Extraordinarily hazardous Extraordinarily hazardous, carcinogen Extraordinarily hazardous, carcinogen	bromine 7726-95-6 ($\geq 99.8\%$) carbon tetrachloride 56-23-5 (≤ 40 ppm) chloroform 67-66-3 (≤ 40 ppm)
Pennsylvania Right To Know	Environmental hazard, hazardous substance Environmental hazard, special hazardous substance Environmental hazard, special hazardous substance	bromine 7726-95-6 ($\geq 99.8\%$) carbon tetrachloride 56-23-5 (≤ 40 ppm) chloroform 67-66-3 (≤ 40 ppm)
New Jersey Right To Know	Special health hazard substance, corrosive Special health hazard substance, carcinogen Special health hazard substance, carcinogen	bromine 7726-95-6 ($\geq 99.8\%$) carbon tetrachloride 56-23-5 (≤ 40 ppm) chloroform 67-66-3 (≤ 40 ppm)
California Prop. 65	Carcinogen Carcinogen	carbon tetrachloride 56-23-5 (≤ 40 ppm) chloroform 67-66-3 (≤ 40 ppm)
Canada:		
DSL/NDSL Status:	CAS# 7726-95-6 is listed, record number: 8356	
WHMIS Classifications:	C – Oxidizing material D1A – Highly toxic by inhalation D2B – Serious toxic effects E – Corrosive material	
WHMIS Ingredient Disclosure List:	Included for disclosure at 1% or greater.	

Section 16:	Other Information
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Revision Date:	07-2014, Supersedes 05-2014 & 04-2011
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The statements contained herein are offered for informational purposes only and are based upon technical data. SEASTAR CHEMICALS Inc. believes them to be accurate but does not purport to be all-inclusive. The above-stated product is intended for use only by persons having the necessary technical skills and facilities for handling the product at their discretion and risk. Since conditions and manner of use are outside our control, we (SEASTAR CHEMICALS Inc) make no warranty of merchantability or any such warranty, express or implied with respect to information and we assume no liability resulting from the above product or its use. Users should make their own investigations to determine suitability of information and product for their particular purposes.