9.0 Material Safety Data Sheet

MATERIAL SAFETY DATA SHEET

Product Name: **ZBB ELECTROLYTE**
Revision Date: 12/05/12 Revision: 6
Supersedes: 07/07/10

1. Identification Of The Substance And The Company

Chemical name Mixture

Chemical formula Not applicable

Type of product Solution used in batteries

Company ZBB Energy Corp.
N93 W14475 Whittaker Way
Menomonee Falls, WI 53051
(8am-5pm ET) (262) 253-9800

Emergency Contact ZBB Energy Corp. (262) 253-9800
INFOTRAC 1-800-535-5053 (24 hours)

NFPA Profile: **Health = 3 Flammability = 0 Reactivity = 0**
Personal Protection = Oxidizer

2. Composition / Information on Ingredients

Componenets	CAS	Weight %	ACGIH-TLV Data	OSHA (PEL) Data
Zinc Bromide	7699-45-8	30-35	Not determined	Not determined
N-ethyl-N-methylpyrrolidinium Bromide	69227-51-6	7-12	Not determined	Not determined
Zinc Chloride	7646-85-7	3-7	1 mg/m^3 (as fume)	1 mg/m^3 (as fume)
Water	7732-18-5	45-55	Not determined	Not determined
Bromine	7726-95-6	< 1%	0.1 ppm (0.66 mg/m^3) TWA 0.2 ppm (1.3 mg/m^3) STEL	0.1 ppm (0.7 mg/m^3)

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3. Hazards Identification / Health Information

Emergency overview	Corrosive to eyes, skin and mucous membranes. May cause skin sensitization. Bromine vapors are highly irritating and painful to the respiratory tract.
Eye Contact	May cause eye irritation.
Skin Contact	May cause dermatitis.
Inhalation	May cause irritation to the respiratory tract.
Ingestion	May cause severe burns to the mucous membranes of the mouth, esophagus, and stomach, abdominal pain, nausea and vomiting. May cause falling asleep, muscular incoordination and respiratory depression.

4. First Aid Procedures

Eye Contact	Holding the eyelids apart, flush eyes promptly with copious flowing water for at least 20 minutes. Get medical attention immediately.
Skin Contact	Remove contaminated clothing. Wash skin thoroughly with mild soap and plenty of water for 15 minutes. Wash clothes before re-use. Get medical attention immediately.
Inhalation	In case of inhalation, remove person to fresh air. Keep him quiet and warm. Apply artificial respiration if necessary and get medical attention immediately.
Swallowing	If swallowed, wash mouth thoroughly with plenty of water and give water or milk to drink. Get medical attention immediately. ********** Note: Never give an unconscious person anything to drink. **********
Notes to physician:	Corrosive In case of ingestion DO NOT induce vomiting No specific antidote. Treat symptomatically and supportively.

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5. Fire and explosion hazards

Flash point	None
Auto-ignition Temperature	Not applicable
Flammable limits in air	Not flammable
Extinguishing media	Material is not combustible. Use extinguishing media appropriate to surrounding fire conditions.
Fire fighting procedures	Stay upwind. Avoid any bodily contact. Wear self-contained breathing apparatus in a positive pressure mode and appropriate protective clothing. Use water from side and from safe distance to keep fire exposed containers cool.

Unusual fire & explosion hazards

When heated to decomposition, may release poisonous and corrosive fumes of hydrobromic acid (HBr) and Bromine (Br_2). Although not combustible itself, the fuming liquid will react with combustible materials and may cause them to ignite. Hydrogen, many organic compounds and some metals will burn in a bromine atmosphere.

6. Accidental Release Measures

Personal precautions	Evacuate area. Full protective clothing, including self-contained breathing apparatus or power air purifying respirator, must be used.
Methods for cleaning up	Neutralize, then absorb on sand or vermiculite and place in closed container for disposal. Ventilate area and wash spill site after material pickup is complete. Avoid access to streams, lakes or ponds.

The following neutralizing agents for bromine are listed in order of neutralizing efficiency:

1. 10-50% potassium carbonate solution
2. 10-30% sodium carbonate solution
3. 5-10% sodium bicarbonate solution
4. Sodium thiosulfate solution (prepared by dissolving 4 kg of technical grade sodium thiosulfate in 9 liters of water and adding 100 gr of soda ash). Please note that there is a high heat of reaction released in this procedure.
5. 5% magnesium hydroxide slurry (very slow neutralizing action).
6. 5% slaked lime
7. 5% sodium hydroxide solution

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7. Handling and Storage

Handling	Avoid breathing vapors and any other bodily contact. Keep containers tightly closed.
Storage	Store in a dry, well-ventilated area away from incompatible materials (see "materials to avoid").

8. Exposure control / personal protection

PEL/TWA (OSHA Permissible Exposure Limit/Time Weighted Average):
For Bromine: 0.1 ppm, Not established for other components.

TLV/TWA (ACGIH Threshold Limit Value/Time Weighted Average):
For Bromine: 0.1 ppm, Not established for other components.

Ventilation requirements	Provide adequate ventilation. Use local exhaust as necessary, especially under misting conditions.

Personal protective equipment:

- Respiratory protection	Respirator with cartridge providing protection against bromine (up to 5 ppm) or self-contained breathing apparatus (above 5 ppm). For short term exposure to low concentrations, an approved combination acid gas-organic vapor gas mask is suitable. The wearer should be warned to get out of the area at the first sign of bromine gas odor coming through the mask. NIOSH recommendation for respirator selection includes any chemical cartridge respirator with a full face piece and cartridge.
- Hand protection	Neoprene or rubber gloves, (tucked under sleeves.
- Eye protection	Chemical safety goggles or face shield with safety glasses.
- Skin and body protection	Protective impervious clothing, hard hat and neoprene or rubber boots.
Hygiene measures	Avoid bodily contact. Safety shower and eye bath should be provided. Do not eat, drink or smoke until after-work showering and changing clothes.

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9. Physical And Chemical Properties

Appearance and Odor:	Yellow to slightly orange liquid with a slightly irritating odor.
Boiling Point/Range:	136°C
Melting Point/Range:	ca. -8°C
Vapor Pressure:	5.2 mm Hg at 25°C
Specific Gravity:	1.4 - 1.6
Vapor Density (Air = 1)	Not available
Evaporation (ether = 1)	Of water
Solubility in Water:	Soluble
Thermal Decomposition	Not available

10. Stability and Reactivity

Stability	Stable under normal conditions
Materials to avoid	Strong oxidants
Conditions to avoid	Not available
Hazardous decomposition products	Hydrogen bromide and bromine
Hazardous polymerization	Will not occur

11. Toxicological Information

Toxicity:

- Rat oral LD50	For zinc bromide 100% (1047 mg/kg)
- Rat inhalation LC50	For bromine 2700 mg/m^3
- Mouse inhalation LC50	for bromine 750 ppm/9 min.

Effects of overexposure

- Ocular	Corrosive Symptoms include redness, pain and blurred vision. Lachrimation occurs at less than 1 ppm.
- Dermal	Corrosive. Mild irritant to intact skin
- Inhalation	Corrosive to mucous membranes and upper respiratory tract. Symptoms include sore throat, dizziness, headache, nosebleed, coughing, abdominal pain, and sometimes rash. Concentrated bromine vapors may cause severe burns that ulcerate and are slow to heal.
- Ingestion	Corrosive by ingestion. Symptoms of inhalation.

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-Chronic toxicity

Prolonged exposure may cause chronic bronchitis, contact and allergic dermatitis.
Repeated oral intake of bromides (.9 mg/kg of body weight/day) may affect the central nervous system. Warning symptoms include mental dullness, slurred speech, weakened memory, apathy, anorexia, constipation, drowsiness and loss of sensitivity to touch and pain.

Mutagenicity

Not mutagenic by the Ames Test.
MEP is positive in in vivo somatic cell mutagenicity assay, the bone marrow micronucleous test.

Carcinogenicity

Not known to be a carcinogen.
Not classified by IARC.
Not included in NPT 10th Annual Report on carcinogens.

12. Ecological Information

Ecological Effects

Zinc bromide is classified by IMO as a marine pollutant.
Bromine is not biodegradable.
Because of its high vapor density, bromine id not transferred to the high atmospheric levels.

Note: The following data refer to zinc bromide ($ZnBr_2$)

Aquatic toxicity:

- 96 Hour-LC50, Fish 115.9 mg/l (Juvenile turbot)

- 72 Hour-EC50, Marine alga
6.6 mg/l (Skeletenoma costatum)

- 48 Hour-EC50, Marine invertebrate
2.4 mg/l (Acatia tonsa)

- 48 Hour-EC50, Daphnia magna 8.8 mg/l

13. Disposal Considerations

Waste disposal

May be disposed of by absorption on vermiculite or other equivalent absorbent. Dispose of waste in suitable containers covered with sodium carbonate or bicarbonate. Remove to approved incinerator or landfill. Observe all federal, state and local environmental regulations when disposing of this material.

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14. Transportation Information

UN No.	1760
DOT	Proper shipping name: Corrosive Liquid, n.o.s. (contains zinc bromide and bromine) Class: 8 – Corrosives Label: CORROSIVE (8) Marking: MARINE POLLUTANT Packing Group: II
IMO	Proper shipping name: Corrosive Liquid, n.o.s. (contains zinc bromide and bromine) Class: 8 – Corrosives Label: CORROSIVE (8) Marking: MARINE POLLUTANT Packing Group: II
ICAO / IATA	Class: 8 Hazard Label (s): Corrosive Packing Group: II

15. Regulatory Information

USA	Reported in the EPA TSCA Inventory
EPCRA (SARA title III)	Zinc compounds and Bromine (CAS #7726-95-6) are subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 and of 40CFR 372. Section 311/312 Categorization (40CFR 370): Zinc bromide & zinc chloride are categorized as an immediate and delayed health hazard. Under the provisions of Section 311 of the Clean Water Act, zinc compounds are designated a hazardous substance if discharged in navigable waters. The Reportable Quantity (RQ) for notification is 1,000 lb/454 kg.
EEC	Not all ingredients in the preparation are reported in EINECS
Japan	Listed in MITI
Australia	Listed in AICS

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16. Other information

The information presented herein is believed to be factual as it has been derived from the works and opinions of persons believed to be qualified experts; however, nothing contained in this information is to be taken as a warranty or representation for which ZBB Technologies, Inc., bears legal responsibility. The user should review any recommendations in the specific context of the intended use to determine whether they are appropriate.

PREPARED BY:

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