

Safety Data Sheet – GEM Mod 3

Product Name: GEM (Mod 3) Green Electrical Monopropellant

Synonyms: Stabilized Liquid Monopropellant; Electrical Liquid Propellant (ELP)

SDS prepared: 01 December 2015 (basic)

Date revised: NA

1. Company and Product Identification

Substance or preparation trade name: GEM Mod 3; Electrical Liquid Propellant (ELP); Electrically Controlled Liquid Propellant, Green Electrical Monopropellant

EMERGENCY CONTACT INFORMATION: INFOTRAC, 24HR 1-800-535-5053 or +1-352-323-3500 if outside USA

Company Name & Address:
Digital Solid State Propulsion Inc.
5475 Louie Lane Ste D
Reno, Nevada 89511-1861 USA
Telephone: +1 775-851-4443



2. Hazard(s) Identification

Chemical Type: Propellant, Liquid-Form (monopropellant)

Proprietary: Yes

Ingredient(s): Hydroxylammonium Nitrate/2,2'-dipyridyl/Ammonium Nitrate/Water/1,2,4-triazole/1H-pyrazole



Signal Word: Warning

Hazards:

Water - not hazardous

2,2'-dipyridyl - toxic if swallowed or in contact with skin

Ammonium Nitrate – causes skin/eye/respiratory irritation

Hydroxylammonium Nitrate – may be harmful if swallowed, toxic in contact with skin (causes skin irritation), causes eye irritation, if inhaled may cause asthma symptoms or breathing difficulties, toxic to aquatic life, corrosive
H303 H311 H315 H319 H334 H400 H290 respectively

1,2,4-triazole – Acute toxicity (oral) Cat 4 H302, Eye Irritation Cat 2A H319, Harmful if swallowed H315, May cause respiratory irritation H335

Pyrazole (1H-pyrazole, 1,2-diazole) – Acute toxicity, oral Cat 4, H302; skin irritation Cat 2, H315; eye irritation Cat 2A, H319; specific target organ toxicity single exposure Cat 3 respiratory system, H335; acute aquatic toxicity Cat 3, H402; chronic aquatic toxicity Cat 3, H412

Precautionary:

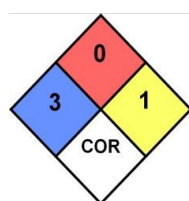
Avoid breathing mist/spray, wash skin thoroughly upon contact, do not eat/drink/smoke while using product, avoid release to environment, wear protective gloves/clothing, if in eyes rinse with water several minutes and remove contacts if present, if experiencing respiratory symptoms call a poison center or doctor/physician. P261 P264/P302/P352 P270 P273 P280 P305+P351+P338 P342+P311

The following description based on major ingredient (Hydroxylammonium nitrate):

Electrical Liquid Propellant (ELP) Green Electrical Monopropellant (GEM)	
HEALTH	3
FLAMMABILITY	0
PHYSICAL HAZARD	1
PERSONAL PROTECTION	2

HMIS Classification
Health hazard: 3
Flammability: 0
Physical hazards: 1

Minimum recommended PPE is safety eyeglasses/eyesield, impervious labcoat or apron, impervious gloves



NFPA Rating
Health hazard: 3
Fire: 0
Reactivity Hazard: 1
Corrosive

Potential Health Effects:

Inhalation: May be harmful if inhaled. Causes respiratory tract irritation.

Skin: Toxic if absorbed through skin. Causes skin irritation.

Eyes: Causes eye irritation. Ingestion: Harmful if swallowed.

3. Composition/Information on Ingredients

Material is not a substance, but is a mixture. The material is trade-secret with normal batch-to-batch variations, but conforms to the following range of components and percentages by weight

Component	CAS No.	Classification	Concentration
Ammonium Nitrate	6484-52-2	Ox. Sol. 3; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H272, H315, H319, H335	0.5 - 10 %
Hydroxylammonium Nitrate	13465-08-2	Acute Tox. 3; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2; Skin Sens. 1; STOT RE 2; Aquatic Acute 1; H319, H315, H373, H400, H201, H290, H302, H311, H317	65 - 75 %
1,2,4-triazole	288-88-0	Skin Irritant H315 Harmful if swallowed H302 Causes serious eye irritation H319 May cause respiratory irritation H335 Suspected of damaging fertility or the unborn child H361	5 - 15%
2,2'-dipyridyl	366-18-7	Acute Tox. 3; H301 + H311	0 - 1%
1H-Pyrazole	288-13-1	Skin Irritant H315 Harmful if swallowed H302 Causes serious eye irritation H319 May cause respiratory irritation H335 Harmful to aquatic life H412	0 - 10 %
Water	7732-18-5	Not hazardous	0.5 - 10.0 %

For the text of the H-Statements and R-Phrases mentioned in this Section, see Section 16

4. First aid measures

General advice:

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled, or if breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact:

Wash off with soap and plenty of water. If clothing comes in contact with material, the clothing should be removed and laundered before re-use. Consult a physician.

In case of eye contact:

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed:

Never give anything by mouth to an unconscious person. Rinse mouth with water. DO NOT induce vomiting. Consult a physician.

Notes to physician: treat for methemoglobinemia.

5. Fire fighting measures

Product is **not known** to be flammable, combustible, pyrophoric or explosive.

Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media: NA

Special hazards in fire: exposure to heat may result in violent decomposition

Required special protective equipment for fire fighters: if advised, use self-contained breathing apparatus

Hazardous decomposition products: may include ammonia, oxides of nitrogen (NO_x), carbon oxides

6. Accidental release measures

Personal precautions:

Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

Environmental precautions:

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up:

Soak up with inert absorbent material such as paper, pulp, clean cotton rags, etc. and dispose of as hazardous waste.

Keep in suitable, closed containers for disposal.

Do not allow to be exposed to sunlight for extended periods of time – contaminated product may be light-catalyzed to decompose, releasing heat and gas (steam, nitrogen, ammonia and/or NO_x)

7. Handling and storage

Precautions for safe handling: Avoid contact with skin and eyes. Avoid inhalation of vapor or mist.

Conditions for safe storage: Keep container tightly closed in a dry and well-ventilated place. Do not expose to sunlight. Do not expose to extremes of temperature, hot or cold – store at room temperature. Containers which are opened must be carefully resealed. Do not contaminate with other materials such as metallic rust, dirt, dust. Keep containers upright to prevent leakage.

8. Exposure Controls

Personal protective equipment, Respiratory protection:

Where risk assessment shows likelihood of mists or spray, and respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection:

Handle with gloves. Nitrile, butyl, impervious textiles recommended. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands before leaving workplace, prior to eating or drinking.

Eye protection:

Face shield and safety glasses use recommended to prevent exposure to splash. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection:

Impervious protective clothing recommended under scenarios of possible exposure to liquid.

Hygiene measures:

Avoid contact with skin, eyes and clothing. Do not smoke/eat/drink when using product. Wash hands before breaks and immediately after handling the product.

9. Physical and chemical properties

Appearance: clear, pink solution

Viscosity: approximately 20 centipoise at 25°C

Odor: slight musty indications

pH: 2 to 4

Boiling point: NA, decomposes at approx. 170°C

Melting point, freezing point: Less than 0°C (32°F)

Flashpoint: None (nonflammable, noncombustible)

Explosive properties: Not known to occur

Autoignition Temperature: not determined

Vapor pressure: 5-24mmHg, 25°C, due to moisture content

Vapor density: <0.1kg/m³

Specific Gravity: approx 1.5

Solubility in Water: Completely Soluble

Partition coefficient, octanol/water: not determined

10. Stability and reactivity

Stability: Stable, unreactive in typical storage conditions with materials of known compatibility

Chemical Incompatibility: strong alkali, strong reducing agents, strong oxidizing reagents, transition metals such as iron rust, noble metals (catalysts for decomposition, i.e., iridium, platinum palladium, etc.), or soluble metals such as copper, nickel, iron, or contamination by high surface area dust or debris – results of incompatibility may indicate slow buildup to gas evolution and decomposition accompanied by evolved heat. Decomposition may be accelerated by exposure to heat sources, incompatible materials, or photocatalysis by exposure to sunlight for prolonged periods. Storage in mild steel or carbon steel drums or carboys not advised.

Hazardous decomposition products: ammonia, oxides of nitrogen

11. Toxicological information (provided for major ingredient, hydroxylammonium nitrate)

Acute toxicity: Oral LD₅₀ Rat 325mg/kg

Inhalation LC₅₀, Rat (4h) >1603mg/m³ Animals exposed to saturated vapor for eight (8) hours exhibited no adverse effects

Dermal LD₅₀, Rabbit 2000mg/kg

Other information on acute toxicity: no data available

Skin corrosion/irritation: no data available

Serious eye damage/eye irritation: no data available Respiratory or skin sensitization: no data available

Germ cell mutagenicity: NEGATIVE Ames test; no known mutagen characteristics

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity: the major component, Hydroxylammonium Nitrate, has not been found to be a mutagen via Ames testing for bacterial mutation leading to carcinogenicity potential in humans

Teratogenicity: no data available

Specific target organ toxicity - single exposure (Globally Harmonized System): no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System): no data available

Aspiration hazard: no data available

Potential health effects: Inhalation May be harmful if inhaled. May cause skin irritation or respiratory tract irritation.

Ingestion: Harmful if swallowed.

Skin: Toxic hazard if absorbed through skin.

Eyes: Causes eye irritation.

Signs and Symptoms of Exposure: To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects: no data available

Additional Information, RTECS: Not available

12. Ecological information

Toxicity: no data available

Persistence and degradability: no data available

Bioaccumulative potential: no data available

Mobility in soil: no data available

PBT and vPvB assessment: no data available

Other adverse effects: An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life¹.

13. Disposal Considerations

Product:

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Provide SDS information, pH, storage or use history, other physical properties as appropriate.

See firefighting recommendations, Section 5. Water residues contain desensitized monopropellant ingredients – prevent release to sewers or drainage to waterways, aquifers, or ponds. Contain spills, collect and dispose as local regulations allow.

Contaminated packaging: Dispose of as unused product.

14. Transport information

Not established. DoT (US), IMDG, IATA classification as ‘dangerous goods’ requiring HazMat controls anticipated.

15. Regulatory information

OSHA Hazards: Harmful by ingestion. Toxic by skin absorption, Irritant

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold

SARA 311/312 Hazards: Acute Health Hazard

California Prop. 65 Components: This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. Other Information

Text of H-code(s) and R-phrase(s) mentioned in Section 3

Acute Tox. Acute toxicity

Aquatic Acute Acute aquatic toxicity

Eye Irrit. Eye irritation

H272 May intensify fire; oxidizer

H290 May be corrosive to metals

H301 Toxic if swallowed

H302 Harmful if swallowed.

H311 Toxic in contact with skin.

H315 Causes skin irritation.

H317 May cause an allergic skin reaction.

H319 Causes eye irritation

H335 May cause respiratory irritation

H361 Suspected of damaging fertility or the unborn child

H373 May cause damage to organs through prolonged or repeated exposure.

H400 Very toxic to aquatic life.

H412 Harmful to aquatic life

Skin Irrit. Skin irritation
Skin Sens. Skin sensitization
STOT RE Specific target organ toxicity - repeated exposure

Further information: *FOR RESEARCH USE ONLY*

¹ *European harmonized classification and labeling of carcinogenic, mutagenic, and toxic to reproduction (CMR) substances according to the criteria of the CLP Regulation as of 22 Jan 2011*

Copyright 2014 Digital Solid State Propulsion Inc.

License granted to make paper copies for internal use only.

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product.

Digital Solid State Propulsion Inc shall not be held liable for any damage resulting from handling or from contact with the above product.

Revision History: 01 Dec 2015 (basic)