SECTION 1: PRODUCT & COMPANY IDENTIFICATION

1.1 Product Identifiers

Product Name / Description: Lithium Phosphorus Sulfide (Li₃PS₄) powder

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advised Against

Identified Uses: Solid electrolyte material; Laboratory chemicals; Synthesis of substances; R&D

1.3 Details of the Supplier of the Safety Data Sheet

Company: NEI Corporation
Address: 400 Apgar Drive, Unit E | Somerset, NJ 08873 – USA
Phone: +1 (732) 868-3141 Fax: +1 (732) 868-3143
Email: productinfo@neicorporation.com

1.4 Emergency Telephone Numbers

Manufacturer: +1 (732) 868-3142 (9am to 6pm ET)
U.S. Poison Control Center: +1-800-222-1222
ChemTel (North America): +1 (800) 255-3924 (during transportation only)
ChemTel (International): +1 (813) 248-0585 (during transportation only – collect calls accepted)

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the Substance or Mixture

Emergency Overview

OSHA Hazards: Water Reactive, Toxic by Ingestion, Corrosive, Teratogen, Target Organ Effect, Toxic By Inhalation, Flammable Solid
Target Organs: Lungs, Nerves, Skin

The information in this SDS is related to the formulation ingredients of the material and may not reflect all hazards of the product.

GHS Classification

Flammable solids (Category 1) – H228 (P₂S₅)
Substances, which in contact with water, emit flammable gases (Category 1) – H260 (P₂S₅)
Acute toxicity, Oral (Category 3) – H301 (Li₂S)
Skin corrosion (Category 1B) – H314 (Li₂S)
Serious eye damage (Category 1) – H318 (Li₂S)
Acute toxicity, Inhalation (Category 4) – H332 (P₂S₅)
Acute aquatic toxicity (Category 1) – H400 (P₂S₅)

2.2 Label Elements

GHS Label Elements, including precautionary statements

Pictogram(s): ☢️ ☢️ ☢️ ☢️ ☢️
Signal Word: Danger

Hazard Statement(s):

H228: Flammable solid
H260: In contact with water releases flammable gases which may ignite spontaneously
H301: Toxic if swallowed
H302 + H332: Harmful if swallowed or if inhaled
H314: Causes severe skin burns and eye damage
H318: Causes serious eye damage
H332: Harmful if inhaled
H400: Very toxic to aquatic life

Revised: 2019-May-01 (v3.0)
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Lithium Phosphorous Sulfide (Li₃PS₄) powder
Precautionary Statement(s):

- **P210**: Keep away from heat / sparks / open flames / hot surfaces – No smoking
- **P223**: Do not allow contact with water
- **P231 + P232**: Handle under inert gas. Protect from moisture
- **P260**: Do not breathe dust or mist
- **P264**: Wash skin thoroughly after handling
- **P270**: Do not eat, drink or smoke when using this product
- **P271**: Use only outdoors or in a well-ventilated area
- **P273**: Avoid release to the environment
- **P280**: Wear protective gloves, protective clothing, & eye protection.
- **P301 + P310 + P330**: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth.
- **P301 + P331**: IF SWALLOWED: 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 + P310**: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
- **P305 + P351 + P338 + P310**: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
- **P335 + P334**: Brush off loose particles from skin. Immense in cool water/ wrap in wet bandages.
- **P363**: Wash contaminated clothing before reuse.
- **P370 + P378**: In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
- **P402 + P404**: Store in a dry place. Store in a closed container.
- **P422**: Store contents under inert gas.

### 2.3 Other Hazards (not otherwise classified) or not covered in GHS

Contact with water liberates toxic gas; Lachrymator; Stench

### SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

#### 3.1 Substances

<table>
<thead>
<tr>
<th>Component</th>
<th>Formula</th>
<th>CAS #</th>
<th>EC #</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium Sulfide</td>
<td>Li₂S</td>
<td>12136-58-2</td>
<td>235-228-1</td>
<td>75%</td>
</tr>
<tr>
<td>Hazard Classifications:</td>
<td>Acute toxicity, Oral (Category 3), H301; Skin corrosion (Category 1B), H314; Serious eye damage (Category 1), H318</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphorus Sulfide</td>
<td>P₂S₅</td>
<td>1314-80-3</td>
<td>215-242-4</td>
<td>25%</td>
</tr>
<tr>
<td>Hazard Classifications:</td>
<td>Flammable solids (Category 1), H228; Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260; Acute toxicity, Oral (Category 4), H302; Acute toxicity, Inhalation (Category 4), H332; Acute aquatic toxicity (Category 1), H400</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### SECTION 4: FIRST AID MEASURES

#### 4.1 Description of First Aid Measures

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

**After Inhalation:**
Remove to fresh air. If not breathing give artificial respiration. Seek medical attention.

**After Skin Contact:**
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.
After Eye Contact:
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

After Swallowing:
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most Important Symptoms and Effects, Both Acute and Delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) To the best of our knowledge the acute and chronic toxicity of this substance is not fully known. See section 8.1 for details. No classification data on carcinogenic properties of this material is available from EPA, IRAC, NTP, OSHA or ACGIH.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed
No Data Available

SECTION 5: FIREFIGHTING MEASURES

5.1 Suitable Extinguishing Media
DO NOT USE WATER – use dry powder or dry sand

5.2 Special hazards arising from the substance or mixture
Metal oxides, metal sulfides, hydrogen sulfide, phosphorus sulfide, phosphorus oxide, sulfur oxides (SOx)

5.3 Advice for Firefighters
Wear full protective clothing and self-contained breathing apparatus approved for firefighting. Do not breathe smoke, gases, or vapors generated.

5.4 Further Information
React violently with water. Flammable in the presence of a source of ignition, through friction or retained heat. May burn in presence of air, or emit a flammable gas in the presence of water or water vapor. Keep away from heat / sparks / open flame / hot surface. No smoking.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Avoid breathing dust. For more personal protection information, see Section 8.

6.2 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.

6.3 Methods and Materials for Containment and Cleaning Up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Do not flush with water. Keep in suitable, closed containers for disposal. Dispose of as hazardous waste

6.4 Reference to Other Sections
For disposal see Section 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for Safe Handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. Keep away from sources of ignition – No smoking. Take measures to prevent the buildup of electrostatic charge. For additional precautions, see section 2.2.

7.2 Conditions for Safe Storage (including any incompatibilities)
Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage. Store under inert gas. Recommended storage temperature 2 - 8 °C. Stench. Hygroscopic. Keep in a dry place. Storage class (TRGS 510): Non-combustible, acute toxic Cat. 3 / toxic hazardous materials or hazardous materials causing chronic effects.
7.3 Specific End Uses

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control Parameters

Components with workplace control parameters:

<table>
<thead>
<tr>
<th>Component Name</th>
<th>CAS #</th>
<th>Value</th>
<th>Control Parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphorus pentasulphide</td>
<td>1314-80-3</td>
<td>TWA 1.00 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1314-80-3</td>
<td>STEL 3.00 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1314-80-3</td>
<td>TWA 1.00 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1314-80-3</td>
<td>TWA 1.00 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1314-80-3</td>
<td>ST 3.00 mg/m³</td>
<td>USA. NIOSH Recommended Exposure Limits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1314-80-3</td>
<td>PEL 1 mg/m³</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1314-80-3</td>
<td>STEL 3 mg/m³</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
<td></td>
</tr>
</tbody>
</table>

Remarks: Upper Respiratory Tract irritation

8.2 Exposure Controls

Appropriate Engineering Controls

Handle under inert gas. Handle in accordance with good industrial hygiene and safety practice. Keep away from food and beverages. Remove all soiled and contaminated clothing immediately. Wash hands before breaks and at the end of workday.

Personal Protective Equipment

Respiratory Protection:

Where risk assessment shows air-purifying respirators are appropriate, use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the 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).

Eye / Face Protection:

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin / Hand Protection:

Handle with gloves. 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.

Body Protection:

Complete suit protecting against chemicals, the type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Control of Environmental Exposure

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

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on Basic Physical and Chemical Properties

Physical State: Solid (powder)
Color: Off-white, yellowish
Odor: Rotten eggs (sulfur) smell, Stench
Odor Threshold: No Data Available
pH: No Data Available
Melting Point / Range: No Data Available
Boiling Point / Range: No Data Available
Flash Point: No Data Available
Evaporation Rate: No Data Available
Flammability (solid, gas): The substance or mixture is a flammable solid with the category 1.
Upper Explosion Limit: No Data Available
Lower Explosion Limit: No Data Available
Vapor Pressure: No Data Available
Vapor Density: No Data Available
Relative Density: No Data Available
Water Solubility: No Data Available
Partition Coefficient: No Data Available
Auto-ignition Temperature: No Data Available
Decomposition Temperature: No Data Available
Viscosity: No Data Available

9.2 Other Information
No additional information available

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity
No Data Available

10.2 Chemical Stability
Stable under recommended storage conditions (see Section 7.2); handle under inert gas

10.3 Possibility of Hazardous Reactions
Reacts violently with water

10.4 Conditions to Avoid
Heat, flames, and sparks. Avoid exposure to moisture

10.5 Incompatible Materials
Strong oxidizing agents, acids, alcohols, reacts violently with water

10.6 Hazardous Decomposition Products
In the event of fire: Lithium oxides, sulfur oxides (SOx), oxides of phosphorus

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on Toxicological Effects

<table>
<thead>
<tr>
<th>Acute Toxicity</th>
<th>Lithium Sulfide</th>
<th>Phosphorus Pentasulfide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral LD50:</td>
<td>Rat - 240 mg/kg</td>
<td>Rat - 389 mg/kg</td>
</tr>
<tr>
<td>Remarks:</td>
<td>Behavioral – tremor, convulsions or</td>
<td></td>
</tr>
<tr>
<td></td>
<td>effect on seizure threshold.</td>
<td></td>
</tr>
<tr>
<td>Inhalation LC50:</td>
<td>No Data Available</td>
<td>No Data Available</td>
</tr>
<tr>
<td>Dermal LD50:</td>
<td>No Data Available</td>
<td>Rabbit - 3,160 mg/kg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Remarks: Prolonged skin contact</td>
</tr>
<tr>
<td></td>
<td></td>
<td>may cause skin irritation and/or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>dermatitis.</td>
</tr>
<tr>
<td>Other Information:</td>
<td>No Data Available</td>
<td>No Data Available</td>
</tr>
</tbody>
</table>

Skin corrosion/irritation
Causes severe skin burns (Lithium Sulfide)
Serious eye damage/eye irritation
Causes serious eye damage (Lithium Sulfide)

Respiratory or skin sensitization
No Data Available

Germ cell mutagenicity
No Data Available

Carcinogenicity
No Data Available

Carcinogenicity
No Data Available

Reproductive toxicity
Lithium and its compounds are possible teratogens by analogy to lithium carbonate which has equivocal human teratogenic data and positive animal teratogenic data.

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

Additional Information

RTECS (Lithium Sulfide): OJ6439500
Large doses of lithium ion have caused dizziness and prostration, and can cause kidney damage if sodium intake is limited. Dehydration, weight loss, dermatological effects, and thyroid disturbances have been reported. Central nervous system effects that include slurred speech, blurred vision, sensory loss, ataxia, and convulsions may occur. Diarrhea, vomiting, and neuromuscular effects such as tremor, clonus, and hyperactive reflexes may occur as a result of repeated exposure to lithium ion. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin, cough, shortness of breath

RTECS (Phosphorous Pentasulfide): TH4375000
Cough, shortness of breath, headache, nausea, vomiting, pulmonary edema. Effects may be delayed. Hydrogen sulfide is strongly bound to methemoglobin in a manner similar to cyanide. Toxicologically, its reaction with enzymes in the blood stream inhibits cell respiration resulting in pulmonary paralysis, sudden collapse, and death. It is recognized by its characteristic odor of "rotten eggs". The detectable, minimum perceptible odor occurs at 0.13ppm, rapid olfactory fatigue can occur at high concentrations (>100 ppm). At concentrations of 20ppm hydrogen sulfide begins acting as an irritant on the mucous membranes of the eyes and respiratory tract and increases with concentration and exposure time. Eye irritation is characterized by irritation of the conjunctiva with photophobia to keratoconjunctivitis and vesiculation of the cornea epithelium. Prolonged exposure to moderate concentrations (250ppm) may cause pulmonary edema. At concentrations over 500ppm, drowsiness, dizziness, excitement, headache, unstable gait, and other systemic symptoms occur within a few minutes. Sudden loss of consciousness without premonition, anxiety, or sense of struggle are characteristic of acute exposure at concentrations above 700ppm. At concentrations of 1000-2000ppm hydrogen sulfide is rapidly absorbed through the lung into the blood. In this range a single inhalation may cause coma and may be rapidly fatal. Initially hyperpnea occurs, followed by rapid collapse and respiratory inhibition. At higher concentrations, hydrogen sulfide exerts an immediate paralyzing effect on the respiratory centers. When concentration reaches 5,000 ppm, imminent death almost always results.

Stomach - Irregularities - Based on Human Evidence
To the best of our knowledge, the chemical, physical, and toxicological properties of this product and its components have not been thoroughly investigated.
SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity
The toxicological properties of this material have not been investigated.

12.2 Persistence and Degradability
No Data Available

12.3 Bioaccumulative Potential
No Data Available

12.4 Mobility in Soil
No Data Available

12.5 Results of PBT and vPvB Assessment
PBT/vPvB assessment not available as chemical safety assessment not conducted

12.6 Other Adverse Effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste Treatment Methods – Product
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company.

13.2 Waste Treatment Methods – Contaminated Packaging
Dispose of as unused product, clean residue from packaging (do not allow in drains), & dispose of properly.

SECTION 14: TRANSPORT INFORMATION

14.1 Department of Transportation (DOT - US)
UN number: 3131
Class: 4.3 (8)
Packing Group: II
Proper Shipping Name: Water-reactive solid, corrosive, n.o.s. (Lithium Phosphorous Sulfide)

14.2 International Maritime Dangerous Goods (IMDG)
UN number: 3131
Class: 4.3 (8)
Packing Group: II
Proper Shipping Name: Water-reactive solid, corrosive, n.o.s. (Lithium Phosphorous Sulfide)

14.3 International Air Transport Association (IATA)
UN number: 3131
Class: 4.3 (8)
Packing Group: II
Proper Shipping Name: Water-reactive solid, corrosive, n.o.s. (Lithium Phosphorous Sulfide)

14.4 Additional Transport Information
HS Code: 2830.90
Schedule B: 2830.90.9000
Air Excepted Quantities (EQ): 30g (max net, inner pkg) / 500g (max net, outer pkg) [E2] – carrier restrictions apply
Air Limited Quantities (LQ): 5kg (net/pkg) [Y475] – carrier restrictions apply

SECTION 15: REGULATORY INFORMATION

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Substance or Mixture
SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard
Right to Know Components

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS #</th>
<th>List Citations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium sulphide (Li₂S)</td>
<td>12136-58-2</td>
<td>NJ, PA Right to Know</td>
</tr>
<tr>
<td>Phosphorus pentasulphide (P₂S₅)</td>
<td>1314-80-3</td>
<td>NJ, PA, MA Right to Know</td>
</tr>
</tbody>
</table>

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

SECTION 16: OTHER INFORMATION

REACH Number
A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

HMIS Classification | NFPA Rating
--- | ---
Health Hazard: 3 | Health Hazard: 3
Flammability Hazard: 1 | Fire Hazard: 2
Physical Hazard: 1 | Reactivity Hazard: 2
Special Hazard: W

Further Information
NEI has attempted to provide current and accurate information to the best of its knowledge. NEI makes no representations regarding the accuracy or completeness of the information and assumes no liability for any loss, damage, injury of any kind which may result from or arise out of the use of or reliance on the information by any person. Employers should use this information only as a supplement to other information gathered by them and should make independent judgment of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty and any use of the product not in conformance with this Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

— END OF SDS —