Product: FROST-Y Lunar Volatile-Rich Simulant

SAFETY DATA SHEET
Compliant with OSHA's Hazard Communication Standard, 29 CFR 1910.1200(g)

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: FROST-Y Lunar Volatile-Rich Simulant
Product Use: Regolith/planetary simulant

Manufactured by: University of Central Florida
Office of Research and Commercialization
12201 Research Parkway, 5th Floor
Orlando, FL 23826-3246

Emergency Contact: 1-800-535-5053
Or contact your regional Poison Control

MSDS Issue Date: 04/01/2019

SECTION 2 - HAZARDS IDENTIFICATION

Hazard Classification:

<table>
<thead>
<tr>
<th>Physical</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combustible dust</td>
<td>Carcinogen Category 1A</td>
</tr>
<tr>
<td></td>
<td>Specific Target Organ Toxicity – Single exposure</td>
</tr>
<tr>
<td></td>
<td>Skin Corrosion/irritation</td>
</tr>
<tr>
<td></td>
<td>Serious Eye Damage/Eye Irritation</td>
</tr>
<tr>
<td></td>
<td>Target Organs - Respiratory system.</td>
</tr>
</tbody>
</table>

Signal Word: Danger

Hazard Statements: May cause cancer by inhalation. Causes damage to lungs through prolonged or repeated exposure by inhalation. May form combustible dust concentrations in air. Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.

Pictograms:

Precautionary Statements - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Do not breathe dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area

Precautionary Statements - Storage
Keep container tightly closed
Store locked up
Store frozen

Precautionary Statements - Response
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy
to do. Continue rinsing If eye irritation persists: Get medical advice/attention
If exposed or concerned: Get medical advice/attention

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Carcinogenicity: Natural terrestrial minerals are commonly contaminated with crystalline silica (quartz).
Independent laboratory analyses indicate that crystalline silica is present in one or more of the simulant components. The International Agency on Research for Cancer (IARC) has classified silica dust,
crystalline as a Group 1, known human carcinogen.

SECTION 3 – COMPOSITION/INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS Number</th>
<th>Wt. %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plagioclase</td>
<td>68476-25-5</td>
<td>83.01</td>
</tr>
<tr>
<td>Basaltic Glass</td>
<td>Not Listed</td>
<td>8.98</td>
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<tr>
<td>Water Ice</td>
<td>7732-18-5</td>
<td>5.58</td>
</tr>
<tr>
<td>Sulfur</td>
<td>7704-34-9</td>
<td>0.91</td>
</tr>
<tr>
<td>Basalt Cinder</td>
<td>Not Listed</td>
<td>0.60</td>
</tr>
<tr>
<td>Pyroxene</td>
<td>14483-19-3</td>
<td>0.36</td>
</tr>
<tr>
<td>Coal</td>
<td>Not Listed</td>
<td>0.27</td>
</tr>
<tr>
<td>Olivine</td>
<td>10034-94-3</td>
<td>0.20</td>
</tr>
<tr>
<td>Ilmenite</td>
<td>12168-52-4</td>
<td>0.08</td>
</tr>
</tbody>
</table>

SECTION 4 – FIRST AID MEASURES

Inhalation: Move to fresh air. Obtain medical attention. If not breathing, give artificial respiration.
Eyes: Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical
attention.
Skin: Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.
Ingestion: Do not induce vomiting. Obtain medical attention.

SECTION 5 – FIREFIGHTING MEASURES
Flashpoint: Not applicable (solid)
Flammable Limits: N/A
Autoignition Temperature: N/A
Extinguishing Media: Water Spray (Fog), Foam, CO₂
Unusual Fire and Explosion Hazards: N/D
Special Protective Equipment or Precautions for Firefighters: N/A

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Use of Personal Precautions: Wear protective equipment including gloves and safety glasses.
Emergency Procedures: N/A
Methods and Materials Used for Containment: N/A
Cleanup Procedures: Spray lightly with water to avoid creating dust and sweep/shovel into suitable container.

SECTION 7 – HANDLING AND STORAGE

Precautions for Safe Handling: Avoid creating dust. Wash exposed skin and clothes daily.

SECTION 8 – EXPOSURE CONTROL/PERSONAL PROTECTION

Respiratory Protection: Not required if dust levels are maintained below occupational exposure limits (TLV-TWA of 10 mg/m³). For levels above the occupational exposure limits wear an appropriate NIOSH approved respirator.
Gloves: None required. For hygiene purposes, chemically compatible gloves are appropriate.
Protective Clothing: None required. Confine work clothing to workplace and wash daily.
Eye Protection: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Light gray powder.
Upper/lower flammability or explosive limits: N/D
Odor: None.
Vapor pressure: N/D
Odor threshold: N/D
Vapor density: N/D
pH: N/D
Relative density: N/D
Melting point/freezing point: N/D
Solubility: Insoluble in water.
Initial boiling point and boiling range: N/D
Flash point: N/D
Evaporation rate: N/D
Flammability: N/D
Partition coefficient (n-octanol/water): N/D
Auto-ignition temperature: N/D
Decomposition temperature: N/D
Viscosity: N/D
SECTION 10 – STABILITY AND REACTIVITY

**Stability:** Stable.

**Incompatibility (Materials to Avoid):** Strong oxidizers.

**Hazardous Decomposition Productions:** Releases carbon monoxide, carbon dioxide, sulfur monoxide, sulfur dioxide and methane upon combustion.

**Hazardous Polymerization:** Will not occur.

**Conditions to Avoid:** Heat, open flames, sparks.

SECTION 11 – TOXICOLOGICAL INFORMATION

**Likely routes of exposure:** Inhalation, eye contact.

**Symptoms related to the physical, chemical and toxicological characteristics:** None known.

**Effects of Chronic Exposure:** Adverse health effects including silicosis, lung cancer, autoimmune and chronic kidney diseases, tuberculosis, and non-malignant respiratory diseases are attributed to respirable crystalline silica.

**Numerical Measures of Toxicity:** No data available.

**Carcinogen Listings:** The International Agency on Research for Cancer (IARC) has classified silica dust, crystalline as a Group 1, known human carcinogen.

SECTION 12 – ECOLOGICAL INFORMATION

**Ecotoxicity:** No data available.

**Persistence and Degradability:** No data available.

**Bioaccumulative Potential:** No data available.

**Mobility in Soil:** No data available.

**Other Adverse Effects:** No data available.

SECTION 13 – DISPOSAL CONSIDERATIONS

**Waste Disposal Method:** Disposed of in accordance with all applicable local, state, and federal regulations.

SECTION 14 – TRANSPORTATION INFORMATION

**UN Number:** N/A

**UN Proper Shipping Name:** N/A

**Transport Hazard Class:** N/A

**Packing Group:** N/A

**Environmental Hazards:** N/A

**Transport in Bulk:** N/A

**Special Precautions in Connection with Transport:** N/A

SECTION 15 – REGULATORY INFORMATION

**Safety, Health and Environmental Regulations for the Product in Question:** None known.

SECTION 16 – OTHER INFORMATION
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