MATERIAL SAFETY DATA SHEET

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SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: NICKEL ETCHANT TFG
TRADE NAME: Nickel Etchant TFG

SECTION II. INGREDIENTS AND HAZARDS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS#</th>
<th>%</th>
<th>TLV</th>
<th>PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thiourea</td>
<td>62-56-6</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Sodium N-Nitro Benzene Sulfonate</td>
<td>127-68-4</td>
<td>10-15%</td>
<td>5 mg/m³</td>
<td>5 mg/m³</td>
</tr>
<tr>
<td>Sulfuric Acid</td>
<td>7664-93-9</td>
<td>&lt; 10%</td>
<td>1 mg/m³</td>
<td>1 mg/m³</td>
</tr>
</tbody>
</table>

SECTION III. HEALTH HAZARD DATA

Effects of overexposure
Vapors may be irritating to skin, eyes, and mucous membranes.
Contact with skin or eyes may cause severe irritation or burns.
Inhalation of vapors may cause coughing, chest pains, or nose and throat irritation.

Medical Conditions Generally Aggravated By Exposure
None identified

Routes of entry
Inhalation, ingestion, eye contact, skin contact

SECTION IV. EFFECTS OF OVEREXPOSITION

Emergency and first aid procedures
CALL PHYSICIAN.
If swallowed, do NOT induce vomiting; if conscious, give water, milk, or milk of magnesia.
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Chronic effects of exposure
Thiourea is a sensitizer in persons who exhibit photosensitivity; it has produced goiter and bone marrow depression (anemia, leukopenia, thrombocytopenia and agranulocytosis). In experimental animals, Thiourea appears to be highly toxic orally, in animals, however, its toxicity in rats varies from strain to strain. Upon chronic administration Thiourea can cause hepatic tumors; it is an invivo and invivo mutagen via multiple test systems. It has also been shown to cause reproductive effects in animals.

SECTION V. FIRE AND EXPLOSION DATA

<table>
<thead>
<tr>
<th>Flash Point and Method</th>
<th>Autoignition Temp.</th>
<th>Flammability Limits in Air</th>
<th>LOWER UPPER</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Extinguishing media: Use extinguishing media appropriate for surrounding fire

SECTION VI: SPILL AND DISPOSAL PROCEDURES

Steps to be taken in event of a spill or discharge. Wear self-contained-breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize the spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flash spill area with water.

J.T. Baker Neutrasorb of Neutrasol "low Na" acid neutralizers are recommended for spills of this product.

SECTION VII: SPECIAL PRECAUTIONS AND COMMENTS

SAF-T-DATA™ Storage Color Code: White
Special precautions: Keep container tightly closed. Store in corrosive-proof area

SECTION VIII. SPECIAL PROTECTION INFORMATION

Respiratory protection: Wear NIOSH/MESA approved full or half face piece (with goggles) respiratory protective equipment to avoid exposure to iodine vapors above 0.1 ppm. A respiratory protection program complying with requirements of 29 CFR 1910.134 is recommended.
Ventilation: Where adequate ventilation is not available, use NIOSH approved vapor respirator with dust, fume and mist filters. Local ventilation through fume hoods or laminar flow stations is also preferred. Keep fumes away from strong bases.
Protective gloves: Skin contact should be minimized through use of rubber gloves. Other protective equipment: Steel tipped shoes/eye wash station/chemical safety Chemical protective clothing. Eye protection: Safety goggles / face shield

SECTION IX. PHYSICAL DATA
Boiling point 100 °C
Vapor pressure at N/A
Vapor density (Air = 1) N/A
Solubility (water) complete

Specific gravity, 20/4 °C 1.04
Evap. Rate (BuAc = 1) N/A
Volatiles, % 90-93%
Molecular weight N/A

Appearance & Odor: Clear, colorless

SECTION X. REACTIVITY DATA

Stability: Stable
Conditions to avoid: Excess heat
Incompatible with strong bases and oxidizers, powdered metals, ammonia.
Hazardous decomposition products: Nitrates, carbon dioxide, carbon monoxide, sulfates
Hazardous polymerization will not occur.

SECTION XI. TOXICOLOGICAL INFORMATION

Permissible exposure limit (PEL): 1 mg/m³
Toxicity LD50 (oral rat)
*Carcinogenic (thiourea) NTP:yes LARC: yes Z list: No OSHA reg: No
The International Agency for Research on Cancer has classified “strong inorganic acid mists containing Sulfuric acid” as a known human carcinogen (IARC category 1). This classification applies only to Sulfuric acid mists containing sulfuric acid and not to sulfuric acid solutions.

SECTION XII. ECOLOGICAL INFORMATION

When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.

Environmental Toxicity (sulfuric acid):
LC50 flounder 100 to 330 mg/l/48 hour aerated water/conditions of bioassay not specified. LC50 shrimp 80 to 90 mg/l/48 hours aerated water/conditions of bioassay not specified. LC50 prawn 42.5 ppm/48 hour salt water/conditions of bioassay not specified. This material may be toxic to aquatic life.

SECTION XIII. DISPOSAL INFORMATION
Disposal procedure: Dispose in accordance with all applicable federal, state, and local environmental regulations
EPA Hazardous waste number: D002 corrosive waste
SECTION XIV: TRANSPORTATION INFORMATION

Domestic (D.O.T.):  CORROSIVE LIQUIDS, N.O.S.
Proper Shipping (SULFURIC ACID AND SULFONATE)
UN/NA: UN 1760
Labels: 1000 lbs
Reportable quantity:

SECTION XV. REGULATORY

SARA Title III hazard classes:

Fire Hazard: No
Release of Pressure: No
Acute Health Hazard: Yes

NFPA Codes:

Health: 3
Flammability: 0
Reactivity: 1

SECTION XVI. OTHER INFORMATION

ADDENDUM TO MATERIAL SAFETY DATA SHEET

REGULATORY STATUS

THIS ADDENDUM MUST NOT BE DETACHED FROM THE MSDS IDENTIFIES SARA 313 SUBSTANCE(S)

Any copying or redistribution of the MSDS must include a copy of this addendum (Chem.Key: PHACD)

HAZARD CATEGORIES FOR SARA

Section 311/312 Reporting

<table>
<thead>
<tr>
<th>Acute</th>
<th>Chronic</th>
<th>Fire</th>
<th>Pressure</th>
<th>Reactive</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Product or Components Of Products</th>
<th>1A EHS Sect. 302 lbs</th>
<th>SARA Section 313 Chemicals Name List</th>
<th>RQ (lbs)</th>
<th>261.33</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulfuric acid (7664-93-9)</td>
<td>0</td>
<td>Yes</td>
<td>1000</td>
<td>No</td>
</tr>
<tr>
<td>Thiosulfuric acid (62-56-6)</td>
<td>&gt; 0</td>
<td>Yes</td>
<td>1.0</td>
<td>J219</td>
</tr>
</tbody>
</table>

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SARA Section 302 EHS RQ: Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.
SARA Section 302 EHS TPQ: Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity + 10,000 LBS.
SARA Section 313 Chemicals: Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.
CERCLA Sec 103: Comprehensive Environmental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center (800-424-8802); Listed at 40 CFR 302.4
RCRA: Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33

Information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.