Material Safety Data Sheet

I. Identification of the Substance/Preparation and Company

<table>
<thead>
<tr>
<th>Product Information: TRIETHANOLAMINE</th>
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<tbody>
<tr>
<td>Other Information: -</td>
</tr>
<tr>
<td>Suggested Use and Prohibitions: Shampoo and bath products, cosmetics, home and industrial use cleaning agents, textile auxiliaries, cement auxiliaries and pre-mixed cement additives, lubricants or metal surface treatment, resin auxiliaries, PU foaming catalyst and fluorescent whitener.</td>
</tr>
<tr>
<td>Information on Producer/Supplier Name, Addresses, Phone:</td>
</tr>
<tr>
<td>Lin Yuan Plant, Oriental Union Chemical Corporation</td>
</tr>
<tr>
<td>No.3 Industrial 3rd Rd., Industrial Zone Lin-Yuan, Kaohsiung, R.O.C</td>
</tr>
<tr>
<td>+886 7 641-3101 ~ 9</td>
</tr>
<tr>
<td>Emergency Phone: +886 7 641-3101 ~ 9 Fax: -886 7 641-9504</td>
</tr>
</tbody>
</table>

II. Hazard Identification

| Hazard Category: |
| Class 2 skin corrosion/irritation substance, class 2 serious eye injury / irritation substance, class 2 specific target organ systematic toxicity - repeated exposure, class 2 inhalation hazardous substance |
| Labeled Contents: |
| Symbols: |
| Warning sign: Danger |
| Hazard Warning Information: Causes skin irritation Causes eye irritation Prolonged or repeated exposure may cause damage to organs. Ingestion and entry into the respiratory tract may be harmful. |
| Hazard Prevention Measures: Once the clothes are contaminated, remove immediately and wash the skin with large amount of water. Wear proper protective outfits, gloves, goggles/face mask. If comes in contact with eyes, wash immediately with large amount of water and then seek medical care. |


III. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Single:</th>
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<tbody>
<tr>
<td><strong>English Name:</strong> TRIETHANOLAMINE</td>
</tr>
<tr>
<td><strong>Synonyms:</strong> 2,2',2&quot;-Nitrilotriethanol; daltogen; trolamine; TEA; triethylolamine</td>
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<tr>
<td><strong>Chemical Abstracts Number (CAS No.):</strong> 102-71-6</td>
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<tr>
<td><strong>Percentage for Chemical Ingredient (%):</strong> 100</td>
</tr>
</tbody>
</table>

IV. First Aid Measures

**Emergency and First Aid Procedures:**

**Inhalation:**
1. Remove pollution sources or move patient to area with plenty of fresh air.
2. If there is difficulty in breathing, let trained personnel provide oxygen supply under the doctor’s supervision.
3. Do not move the patient unless necessary.
4. Seek medical attention immediately.

**Skin Contact:**
1. If necessary, wear leak-proof gloves to prevent contact with this chemical substance.
2. Use gentle warm water to wash the contaminated parts for 20 to 30 minutes.
3. If irritation persists, wash repeatedly non-stop. If necessary, have the ambulance on stand-by for medical help anytime.
4. Remove the contaminated outfits, shoes and leather items when flushing with water.
5. Seek medical attention immediately.
6. Make sure to remove the dirt completely from the contaminated clothes, shoes and leather items before re-use or disposal.

**Eye Contact:**
1. If necessary, wear leak-proof gloves to prevent contact with this chemical substance.
2. Immediately lift the eyelids, use running warm water to wash contaminated eye(s) for 15 minutes.
3. If possible, wash with saline solution continuously.
4. Prevent clean water from contacting the unaffected eye.
5. If irritation persists, wash repeatedly.
6. Seek medical attention immediately.

**Ingestion:**
1. If the patient is about to lose consciousness, or is in convulsions, do not feed anything through the mouth.
2. If the patient is conscious, let the patient rinse his/her mouth completely with water and drink lots of water.
3. Do not induce vomiting.
4. If the patient is vomiting, let his/her body incline forward to reduce the danger of inhalation, rinse the mouth and give water repeatedly.

5. Seek medical attention immediately.

Major Disease and Harm Effects:

High concentration of steam may damage the lungs, such as chemically induced bronchitis and pulmonary edema. Signs of pulmonary edema may continue for hours.

First-Aid Personal Protection:

Must wear Class C protective equipment for performing first-aid in safe area.

Prompt to Doctor:

For ingestion, consider using esophagoscopy for check-up, avoid gastric lavage and inducing of vomit.

V. Fire Fighting Measure

Suitable Extinguishing Media:

Carbon dioxide, dry chemical powder, water mist or spray, alcohol-resistant foam, polymer foam.

Special Exposure Hazards: May release toxic gas at the fire site.

Special Extinguishing Procedure:

1. Retreat and extinguish the fire from a safe distance or protected area.
2. Place at upwind position to avoid hazardous vapor and toxic resolvent.
3. Use water spray, water mist or foam to extinguish the fire.
4. Water or foam may froth, so it is best to use a fine vaporizer or water mist nozzle to alleviate the water on the liquid surface, forming foam to cover or extinguish the fire.
5. Use water mist to cool the storage tanks and containers exposed in the fire site.
6. Spray water to wash the spillage away from the ignition source.
7. If the spill is not burning, spray water mist to disperse the vapor and protect personnel attempting to contain the spill.
8. Water column is ineffective for extinguishing fire and will allow the spillage spread.
9. Only allow personnel wearing special protective equipment to enter.

Special Protection Equipment:

Fire fighters must wear chemical-resistant protective outfits and positive pressure air respirators (self-contained breathing apparatus).

VI. Accidental Release Measures

Personal Protection:

1. Restrict personnel from entering the polluted area until completely cleaned.
2. Make sure that only trained personnel are allowed to clean up.
3. Wear appropriate personal protection equipment.

Environmental Protection:
1. Ventilate or change air in this area.
2. Extinguish or remove all fire sources.
3. Report to the relevant government safety, hygiene and environmental protection agencies.

**Methods for Cleaning Up:**
1. Do not touch the leaking substance.
2. Prevent the spilled substances from entering the drains or closed spaces.
3. If safety permits, try to stop or reduce the spillage.
4. Surround the leakage with sand, soil or other adsorbing substances that will not react with the leaking substance.
5. Use pump or vacuum equipment to clear liquids, place in properly sealed and labeled containers.
6. For small amount of leakage: absorb using absorbents that will not react with the leaking substance. Contaminated absorbents are as hazardous as the leakage and must be kept in covered and labeled containers. Wash the leakage area with water.)
7. For large amount of leakage, contact the fire department, emergency rescue agency and supplier for assistance.

**VII. Handling and Storage**

**Handling:**
1. During handling, engineering control and wearing of personal protective equipment are required. Work personnel must be trained properly on the dangers and the safe usage of this substance.
2. Before operation, check the container for leaks.
3. Empty vessels and containers may still contain hazardous residues and should be kept tightly closed.
4. As much as possible, pack in small containers. Use self-closing containers.
5. Use work tables with surfaces that are easily cleaned. Use anti-corrosion transport and packing equipment.
6. Operate and use under the temperature range recommended by the manufacturer or supplier.
7. Avoid causing condensation or vapor during operation. Operate in well-ventilated specified area and use the minimum amount. Operation area should be separated from the storage area.
8. Do not use with incompatible substances (such as strong oxidizers and acids).
9. Use containers made of compatible materials for storage. Pay attention not to splatter during repacking.
10. Do not use air or inert gases to pressurize and force out the liquid from the container.
11. The work area must have emergency rescue equipment for fire and leakage.
12. Use storage containers recommended by the manufacturer.
13. Do not store contaminated liquid back into the original storage container.
14. Label containers and when not in use, keep them tightly closed and prevent damages, leakages or contamination of the contents.

Storage:
1. Store in areas that are dark, cool, dry, well ventilated and without direct exposure to sunlight, far from heat sources, ignition sources and incompatible substances.
2. Store in strong and labeled containers made of compatible materials. Prevent damaging and stacking of the containers.
3. The floor must be made of non-permeable materials to prevent seeping.
4. The doorway should have a slope, doorsill or gully to discharge the spillage to safe places.
5. Storage area should be labeled clearly, free of obstacles and only specified or trained personnel are allowed to enter.
6. Work area and storage area must be separated; store far from elevators, structures, room exits or main channels.
7. The storage area surroundings should have proper fire extinguishers and facilities for cleaning spills and leakages.
8. Check if all new containers are properly labeled and without damages.
9. Limited amount of storage.
10. Empty cylinders should be separated from the storage area.
11. Check the storage area regularly for defects including cracks and damages on containers, proper management of internal affairs.
12. Store according to the storage temperature recommended by the chemical manufacturer or supplier.

VIII. Exposure Control / Personal Protection

Engineering Control:
1. Use stand-alone anti-corrosion exhaust ventilation system.
2. Exhaust opening must be connected directly outdoors.
3. Provide sufficient fresh air supply to supplement the air discharged by the exhaust ventilation system.

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<th>Control Factor</th>
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<tr>
<td>TWA</td>
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<td>5 mg/m³</td>
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Personal Protection Equipment:
Respiratory Protection:
Wear positive pressure air respirator
Hand Protection:
Leak-proof gloves made of butyl rubber, neoprene rubber, nitrile rubber, PVC, Viton, CPF3, responder.)
Eye Protection:
1. Chemical safety goggles and masks.

Skin Protection:
1. Whole-body work outfit and shoes made of butyl rubber, neoprene rubber and nitrile rubber.
2. Work area must be equipped with bathing and eye-washing facilities.

Hygiene Procedures:
1. After work, remove the contaminated clothes as quickly as possible. Throw away or wash clothes thoroughly before wearing again. Notify the laundry personnel of the danger of the contaminated clothes.
2. Smoking or eating is strictly prohibited in the work site.
3. Wash hands thoroughly after handling this substance.
4. Keep the work area clean.

IX. Physical and Chemical Properties / Characteristics

<table>
<thead>
<tr>
<th>Appearance: Colorless to yellow gluey liquid</th>
<th>Odor: ammonia odor</th>
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<tbody>
<tr>
<td>Odor threshold: -</td>
<td>Melting point: 20~21°C</td>
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<tr>
<td>pH value: 10.5</td>
<td>Boiling Point / Boiling Range: 335°C</td>
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<tr>
<td>Flammability (solid, gas): -</td>
<td>Flash Point: 179 °C</td>
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<tr>
<td>Decomposition Temperature: -</td>
<td>Test Method: Close Cup</td>
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<tr>
<td>Spontaneous Temperature: 324°C</td>
<td>Exposure Limits: 1.3% ~8.5%</td>
</tr>
<tr>
<td>Vapor Pressure: &lt; 0.01 mmHg@20°C</td>
<td>Vapor Density: 5.1 (air = 1)</td>
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<tr>
<td>Specific Gravity: 1.1242@20°C (water = 1)</td>
<td>Solubility: Soluble</td>
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<tr>
<td>Log kow: -1.32 ~ -1.75</td>
<td>Percent volatile: -</td>
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X. Stability and Reactivity

Stability:
Stable under general usage and storage conditions. Color will deepen in air and light.

Special Conditions of Hazardous Reaction:
1. Strong oxidizer: Oxidizes quickly with violent reaction.
2. Strong acid: violent reaction.
3. Acid anhydride, acyl halide, alkyl group and aromatic hydrocarbon halides: violent reaction.
4. Etched copper, brass, bronze and copper alloy, zinc and galvanized iron (sheet metal).
5. Nitrosating Agent (such as nitrous acid, nitrite, NOx): forms the cancer-causing N-nitrosodimethylamine.

Conditions to Avoid:
Heat sources, fire sources, moisture and incompatible substances.

Incompatibility:
Oxidizer, strong acid, acid anhydride, acyl halide, alkyl and aromatic halide, copper, brass, bronze and copper alloy, zinc and galvanized iron (sheet metal). Nitrosating Agent (such as nitrous acid, nitrite, NOx)

Hazardous Decomposition Products:
Combustion will produce Co, CO$_2$ and NOx.

XI. Toxicological Information

Exposure route: skin contact, inhalation, ingestion, eye contact

Symptoms:
Burns, laryngitis, coughing, wheezing, shortness of breath, headache, nausea, vomiting, pain, irritation, redness, stomachache, dysentery, skin allergy

Acute Toxicity:

Skin contact:
Will cause partial discomfort or serious irritation, redness and swelling from chemical burns, blisters, especially prolonged contact.

Inhalation:
1. The general vapor pressure of TEA is low under general temperatures; the hazard from inhalation is also very low. If heated, the vapor produced may induce harmful influence.
2. Fog or condensation will seriously irritate the eyes, nose, throat and lungs, causing burns, sore throat, coughing, wheezing, shortness of breath, headache, nausea and vomiting.

Ingestion:
1. Induces serious irritation, burns on lips, throat, gullet and stomach, causing stomachache, chest pains, nausea, vomiting and diarrhea.
2. If there is vomiting during ingestion or inhalation, may cause serious damages to the lungs.

Eye contact:
1. Induces acute irritation, discomfort, pain, visible eye redness, swelling and chemical burns.
2. Acute eye damage may lead to loss of eyesight.

LD$_{50}$ (test animal, absorption route): 4920µl/kg (Rat, ingestion)
LC$_{50}$ (test animal, absorption route): -
560 mg/24H (Rabbit, skin): mild
5620 µg (Rabbit, eyes): caused irritation

Chronic: -

XII. Ecological Information

Eco-toxicity: LC$_{50}$ (Fish): 3500 mg/l/24H
EC50 (aquatic invertebrates): 2.5 mg/l/24H  
Bio-concentration Factor (BCF): <1

Durability and Degradability:
1. In the atmosphere, due mainly to the existence of gases, a large portion is removed through the hydroxyl group produced through photodissociation. (half-life is about 0 hour). Can also be removed through sedimentation.  
Half-life (air): 1~10 hrs

Biological Accumulation: -

Fluidity in soil:
After seeping into the soil, filtration will cause it to enter into the underground water and not to evaporate.

Other adverse effects: -

XIII. Disposal Information
Disposal Information:
1. Refer to the relevant laws and regulations for handling.
2. Follow the warehouse conditions in storing waste substances waiting for disposal.
3. Dispose according to special incinerating or hygienic landfill laws.

XIV. Transport Information
The United Nations Number (Un-No): -
UN Transport Name: -
Transport Hazard Classification: -
Packaging Category: -
Marine Pollutant (Yes/No): No
Special Transport Way and Note: -

XV. Regulation Information
Apply Regulation:
1. Enforcement Rules of the Labor Safety and Health Act
2. Regulations of Hazard Communication on Dangerous and Harmful Material
3. Standards of Tolerable Hazardous Substance Concentration in the Air of Labor Working Environment
4. Traffic Safety Regulations
5. Standards for the Storage, Clearance, and Disposal of Industrial Waste
6. Toxic Chemical Substances Control Act
7. Public Hazardous Materials and Flammable Pressurized Gases Establishment Standards and Safety Control Regulations
XVI. Other Information

| Reference | 1. Council of Labor Affairs, Executive Yuan, Taiwan, GHS in Taiwan website.  
|           | 2. Oriental Union Chemical Corporation website  
|           | http://www.oucc.com.tw/tw |

<table>
<thead>
<tr>
<th>Responsible Department</th>
<th>Name: Oriental Union Chemical Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address</td>
<td>No.3 Industrial 3rd Rd., Industrial Zone Lin-Yuan, Kaohsiung, ROC</td>
</tr>
<tr>
<td>Tel</td>
<td>886 7 641-3101 ext. 2303 / 2307</td>
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<tr>
<th>Prepared by</th>
<th>Title</th>
<th>S.H.E Dept Engineer</th>
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<tbody>
<tr>
<td></td>
<td>Name</td>
<td>Sung, Jui-Hsiang</td>
</tr>
<tr>
<td></td>
<td>(Signature)</td>
<td>Yeh, Wei-Lun</td>
</tr>
</tbody>
</table>

| Date | 2013/01/02 |

| Note | The "-" symbol in the text above indicates that there is no current available data while the "/" symbol indicates that this field is not applicable to this substance. |