**Section 1: Chemical Product and Company Identification**

**Material Name:** Trisilylamine  
**Chemical Formulas:** \(\text{N(SiH}_3\text{)}_3\)  
**Synonyms:** Silanamine, N,N-disilyl-; Disilazane, 2-silyl-; Silane, nitrilotris; TSA; 3SA  
**Manufacturer:** Voltaix, LLC  
Post Office Box 5357, North Branch, New Jersey 08876-5357, USA  
Voice: 908-231-9060 or 800-VOLTAIX, Facsimile: 908-231-9063  

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**Section 2: Composition/Information on Ingredients**

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS Registry Number</th>
<th>Concentration</th>
<th>Exposure Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trisilylamine</td>
<td>13862-16-3</td>
<td>100%</td>
<td>None established</td>
</tr>
</tbody>
</table>

**Section 3: Hazards Identification**

**EMERGENCY OVERVIEW**

DANGER! TOXIC, WATER-REACTIVE, CORROSIVE, FLAMMABLE.

May be fatal if inhaled. Can cause burns. Trisilylamine is a colorless liquid with a distinctive odor. The immediate health hazard is that it’s vapors are toxic by inhalation and that it may cause chemical burns. It is flammable and may form mixtures with air that are flammable or explosive. Trisilylamine is violently reactive with oxidizers and halogens. It may form ammonia, hydrogen and silica under hydrolysis.

**NFPA 704 Rating:**

Health | 4  
Fire   | 3  
Reactivity | 3  
Special  | W

**Potential Health Effects**

**Routes of Exposure:**

Inhalation, skin, eye and mucous membrane contact. Excessive inhalation of vapors can irritate the respiratory tract and possibly lead to fluid accumulation in the lungs, which may be fatal.

**Lengths of Exposure:**

The LC\(_{50}\), 1-hour, rat has been reported to be 439 ppm.

**Severity of Effect:**

Corrosive. May be fatal if inhaled depending on concentration and duration.

**Target Organs:**

Respiratory tract, skin, eyes, and mucous membranes.

**Type of Effect:**

Skin, eye, and mucous membrane irritation, impaired respiratory function (pulmonary edema and chemical pneumonitis).

**Signs and Symptoms of Exposure:**

Skin and mucous membrane irritation, lacrimation (tearing), cough, increased saliva and sputum production, dyspnea (difficulty in breathing). Suspected to cause headache and nausea.

**Medical Conditions that may be Aggravated by Exposure:**
Section 4: First Aid Measures

Inhalation
1) Remove the affected person from the source or contaminated area. Note: Personal Protective Equipment (PPE), including positive pressure, self contained breathing apparatus, may be required to assure the safety of the rescuer.
2) If the affected person is not breathing spontaneously, administer rescue breathing.
3) If the affected person does not have a pulse, administer CPR.
4) If medical oxygen and appropriately trained personnel are available, administer 100% oxygen to the affected person.
5) Summon an emergency ambulance. If an ambulance is not available, contact a physician, hospital, or poison control center for instruction.
6) Keep the affected person warm, comfortable, and at rest while awaiting professional medical care. Monitor the breathing and pulse continuously. Administer rescue breathing or CPR if necessary.

Skin Contact
Flush with a copious stream of water while removing contaminated clothing. Continue flushing until the professional medical assistance arrives, but for no less than fifteen minutes. Treat thermal burns by assuring that affected area is cool by flushing with cool water, and then apply dry sterile dressings. If the patient is burned on the face, neck, head, or chest, assume that the airway may also have been burned and obtain professional medical assistance immediately.

Eye Contact
Flush continuously with clean water until the professional medical assistance arrives, but for no less than thirty minutes. Continuation of flushing until patient is transferred to an ophthalmologist or emergency physician is recommended. Assume that the patient may also have been exposed by inhalation and obtain professional medical assistance immediately.

Ingestion
Highly to severely toxic. See First Aid Measures for Skin Contact and seek professional medical assistance immediately. May cause severe burns of the mouth, throat, esophagus, and stomach. There may be pain in the mouth, throat, chest, and abdomen and possible swelling of the tissues in the mouth and throat. Do not induce vomiting. Do not drink diluents (e.g., water). Never give anything by mouth to an unconscious person. May cause thermal burns to gastrointestinal tract.

Chronic Effects
Residual vision or respiratory impairment may occur, as may scarring of affected skin.

Note to Physicians:
The reaction products of Trisilylamine with air include insoluble solids such as SiO₂. Therefore, skin and eye burns should be irrigated to the extent the physician feels necessary to remove the silicon oxide to an acceptable degree. Thereafter, treatment for burns is as usual.

Section 5: Fire Fighting Measures

Flammability and Explosivity
Flash Point:
-48°C (-54°F) Pensky Martens Closed Cup

**Flammability Limits in Air (% by volume):**

<table>
<thead>
<tr>
<th></th>
<th>Upper</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trisilylamine</td>
<td>Not Established</td>
<td>Not Established</td>
</tr>
</tbody>
</table>

**Autoignition Temperature:**

>101°C (>213.8°F)

**Flammability Classification (per 29 CFR 1910.1200):**

Flammable Liquid Class 1B.

**Known or Anticipated Hazardous Products of Combustion:**

Silicon oxide (silica), oxides of nitrogen.

**Properties that may Initiate or Intensify Fire:**

Heating cylinder to the point of initiating decomposition or activating the pressure relief device.

**Reactions that Release Flammable Gases:**


**Extinguishing Media**

CO₂, foam, dry chemical.

Note: Trisilylamine reacts violently with water.

**Fire Fighting Instructions**

The only safe way to extinguish a Trisilylamine fire is to stop the flow of liquid. If the flow cannot be stopped, allow the entire contents of the container to burn. Cool the container and surroundings with water from a suitable safe distance. Extinguishing the fire without stopping the flow of liquid may permit the formation of ignitable or explosive mixtures with air. These mixtures may propagate to a source of ignition.

Excessive pressure may develop in containers exposed to fire, which may result in explosion, regardless of the content. Containers with pressure relief devices (PRD’s) may release their contents through such devices if the cylinder is exposed to fire. Containers without PRD’s have no provision for controlled release and are therefore more likely to explode if exposed to fire.

Positive pressure, self contained breathing apparatus is required for all fire fighting involving hazardous materials. Full structural fire fighting (bunker) gear is the minimum acceptable attire. The need for proximity, entry, and flashover protection and special protective clothing should be determined for each incident by a competent fire fighting safety professional.

**Section 6: Accidental Release Measures**

**Containment**

Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Vapor may form explosive mixtures with air. Before entering area, especially a confined area, check atmosphere with an appropriate device. Remove all sources of ignition if without risk. Reduce vapors with coarse water spray. Shut off flow if without risk. Ventilate area or move cylinder to well-ventilated area. Prevent runoff from contaminating surrounding environment. Toxic, water-reactive, corrosive vapors may spread from spill. Do not turn on any ignition source until the area is determined to be free of fire or explosion hazard.

If possible use sandbags to contain and isolate the burning liquid.

**Clean Up**

Do not discharge Trisilylamine directly to surface waters or sewer systems. Instead, try to dike or contain any spilled liquid. To diminish fumes apply an appropriate solution of vapor-suppression foam expanded per manufacturer’s instructions. Periodic reapplication of the foam may be necessary.
Under the CERCLA/RCRA regulations this material is regulated as a hazardous waste or material. Therefore it must be disposed of in a licensed hazardous waste facility in compliance with EPA and other applicable local, state and federal regulations. It should be handled in a manner acceptable to good waste management practices.

**Evacuation**
If the release is not contained in an appropriate device or system, all personnel not appropriately protected (see Section 8) must evacuate the contaminated spaces. Consider evacuation of additional areas, as a precaution against the spread of the release or subsequent explosion or fire.

**Special Instructions**
Most, but not all, releases of Trisilylamine into air will react to form silicon oxide, a white powder that may be suspended in the air if produced in this manner. As all leaks might not react, consider the formation of ignitable or explosive mixtures with air.

**Section 7: Handling and Storage**

**Handling**
Handle this material only in sealed, purged systems. The design of handling systems for hazardous materials is beyond the scope of this MSDS, and should be performed by a competent, experienced professional. Consider the use of doubly-contained piping; diaphragm or bellows sealed, soft seat valves; backflow prevention devices; flash arrestors; and flow monitoring or limiting devices. Gas cabinets, with appropriate exhaust treatment, are recommended, as is automatic monitoring of the secondary enclosures and work areas for release.

Handle sealed gas cylinders in accordance with CGA P-1, Safe Handling of Compressed Gases in Containers.

Some material may have accumulated behind the outlet plug. Face the outlet away from you and wear appropriate protective equipment when removing the plug to connect the cylinder to your system.

Never introduce any substance into a gas cylinder. If you believe your cylinder may have been contaminated, notify Voltaix immediately. Provide as much information as possible on the nature and quantity of contamination.

This material may be supplied in containers having both liquid and vapor withdrawal outlets and a helium blanket. Opening the liquid outlet without properly venting the helium blanket can cause the liquid to flow out of the container in an unexpected manner. The helium blanket should be vented to an appropriate control device before withdrawing liquid unless the helium blanket is to be intentionally used to propel the liquid from the liquid withdrawal outlet. Any helium vented can contain Trisilylamine product and the vented mixture can be toxic, water reactive, corrosive and/or flammable.

**Storage**
Store cylinders in accordance with CGA P-1, Safe Handling of Compressed Gases in Containers, local building and fire codes and other relevant regulations. Materials should be segregated, by the hazards they comprise, for storage.

Protect the cylinders from direct sunlight, precipitation, mechanical damage, and temperatures above 55°C (130°F).

Ship and store cylinders with the outlet plug and valve protective cap in place.

Containers can generate pressure during storage. Release pressure in an inert atmosphere.

**Section 8: Exposure Control/Personal Protection**

**Engineering Controls**
Local exhaust is required. Secondary containment, with appropriate exhaust gas treatment, is strongly encouraged and is required in some jurisdictions.

Monitor the work area and the secondary containment continuously for release of the material. Automatic alerting of personnel and automatic shutdown of flow are appropriate in most applications and are required in some jurisdictions.
Purge all primary containment systems with a nonreactive gas, such as nitrogen, before introducing this material.

**Personal Protective Equipment (PPE)**

**Respiratory Protection:**
Positive pressure, full face, air supplied breathing apparatus should be used for work within the secondary containment equipment if a leak is suspected or the primary containment is to be opened, e.g., for a cylinder change. Air supplied breathing apparatus is required for response to demonstrated or suspected releases from the primary containment.

**Eye/Face Protection:**
When using respiratory protection as described above, use a face mask that provides splash and impact protection for the face and eyes. For handling sealed cylinders, wear safety glasses.

**Skin Protection:**
Wear appropriate gloves when handling sealed cylinders. Use gloves and other skin protection, as assigned by a competent safety professional, when working within the secondary enclosure with the primary enclosure compromised, e.g., cylinder changing, to protect from exposure to the material and from fire that may result from its release to the air. For response to demonstrated or suspected releases from the primary containment, the need for whole-body exposure protection should be determined by a competent safety professional.

**Other Protection:**
Wear appropriate protective footwear when moving cylinders. Select per OSHA 29CFR1901.132 and 1910.133.

**Exposure Guidelines**

<table>
<thead>
<tr>
<th></th>
<th>ACGIH TLV-TWA</th>
<th>OSHA PEL-TWA</th>
<th>NIOSH REL-TWA (10 hr)</th>
<th>NIOSH REL-STEL</th>
<th>IDLH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trisilylamine</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
<td>NE</td>
</tr>
</tbody>
</table>

NE = Not Established.

**Section 9: Physical and Chemical Properties**

**Notes:**
1) "N/A" means not applicable.
2) Unless otherwise specified, properties are reported at 0°C (32°F) and 1 atmosphere (1.0 bar, 14.7 psia).

<table>
<thead>
<tr>
<th>Property</th>
<th>Trisilylamine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Colorless</td>
</tr>
<tr>
<td>Odor</td>
<td>Distinctive</td>
</tr>
<tr>
<td>Physical state</td>
<td>Liquid</td>
</tr>
<tr>
<td>pH</td>
<td>N/A</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>109 Torr at 0 °C (32 °F)</td>
</tr>
<tr>
<td>Vapor Density</td>
<td>4.46 g/l @ 52 °C</td>
</tr>
<tr>
<td>Boiling point (at 1 atm)</td>
<td>52 °C</td>
</tr>
<tr>
<td>Melting point</td>
<td>-106 °C</td>
</tr>
<tr>
<td>Solubility in water (v/v)</td>
<td>Unknown (decomposes)</td>
</tr>
<tr>
<td>Specific gravity of liquid (water = 1)</td>
<td>0.895 g/cc @ -106 °C</td>
</tr>
<tr>
<td>Molecular weight</td>
<td>107.4</td>
</tr>
</tbody>
</table>

**Section 10: Stability and Reactivity**

**Chemical Stability:**
Stable at room temperature and atmospheric pressure.

**Conditions to Avoid:**
Sources of ignition, exposure to air or water.
Incompatibility with Other Materials:
Oxidizers, halogens, organohalides, water, alcohols, acids, alkalis.

Hazardous Decomposition, Reaction and Oxidation (other than burning) Products:
Silicon oxide, hydrogen, oxides of nitrogen, ammonia.

Hazardous Polymerization:
Not reported to occur.

Section 11: Toxicological Information

Acute Data (by route):
LC50, 1-hour, rat is 439 ppm.

Chronic and Subchronic Data:
Trisilylamine is not listed in RTECS; no information on its carcinogenicity or other chronic or subchronic effects is known to Voltaix.

Special Studies:
None known. No published exposure guidelines for Trisilylamine are known to Voltaix.

Section 12: Ecological Information

Ecotoxicity:
None known to Voltaix.

Environmental Fate:
None known to Voltaix.

Section 13: Disposal Considerations

Classification under RCRA, 40 CFR 261:
This material meets the criteria for an Acute Hazardous Waste.

US EPA waste number and descriptions:
D001 (ignitability), D002 (corrosivity), D003 (reactivity).

Special Instructions and Limitations:
Treat process and other exhaust streams appropriately before release to the atmosphere.

Notice:
The information above is derived from Voltaix’s interpretation of the US federal laws, regulations and policies concerning the material, as shipped by Voltaix, at the time this MSDS was prepared. Federal controls are subject to change and state and local controls may also apply. Proper waste disposal is the responsibility of the owner of the waste. The user is encouraged to consult with appropriate experts in developing a disposal plan.

Section 14: Transport Information

Basic Description:
UN 3491, Toxic by Inhalation Liquid, Water Reactive, Flammable, n.o.s., (Trisilylamine), 6.1, (4.3, 3, 8), Packing Group I
Toxic - Inhalation Hazard, Inhalation Hazard Zone B

Additional Information for shipment by water:
IMDG Page Number 6270-5. EmS No. 6.1-07. MFAG Table No. refer to subsection 4.2.

Additional Information for shipment by air:
Air transportation is forbidden.
Section 15: Regulatory Information

TSCA Status:
Trisilylamine is manufactured and supplied under the terms of the “Low Release and Exposure” (LoREX) exemption (40 CFR 732.50) of the Toxic Substances Control Act. According to the terms of 40 CFR 723.50(k)(1), it may only be used for the following purposes: for semiconductor device manufacturing processes using the thin film deposition process. The LoREX reflects the exposure controls described in this SDS. Further, according to CFR 723.50 (k)(2) this material cannot be distributed until the recipient has agreed in writing to use the material for the purpose above or not further distribute the substance until it has been reacted, incorporated into an article, or otherwise rendered into a physical form or state in which environmental releases and human exposures above the LoREX eligibility criteria are not likely to occur.

CERCLA Reportable Quantity (40CFR302.4):
This material is not listed. The Reportable Quantity (RQ) for “Unlisted Hazardous Wastes Characteristic of Ignitability” (D001), “Unlisted Hazardous Wastes Characteristic of Corrosivity” (D002) and “Unlisted Hazardous Wastes Characteristic of Reactivity” (D003) of 45.4 kg (100 lbs.) therefore applies.

SARA Title III Status (Section 302 (40CFR355), Section 311/312, Section 313 (40CFR372)):
No Threshold Planning Quantity (TPQ) or Reportable Quantity (RQ) is listed for these substances.
The default federal MSDS submission and inventory requirement filing threshold of 4,540 kg (10,000 lbs.) may also apply.

Note: State and local requirements may be more stringent.

Section 16: Other Information

References

Revision Indication
24 July 2006: Changed company name
14 August 2008: Revised transportation and physical property information.
03 September 2012: Revised hazard properties of trisilylamine based on new acute health study results.
12 May 2014: Modified TSCA statement, added hazard class.

Disclaimer
Voltaix cannot guarantee that these are the only hazards that exist. Users are solely responsible for the safe storage, handling, use and disposal of this material, and for compliance with the applicable laws, regulations and accepted practices.
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