The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

DuPont                        Page   1
Material Safety Data Sheet

Titanium Tetrachloride
3049CR                    Revised 15-SEP-2008

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Corporate MSDS Number : DU000219
CAS Number              : 7550-45-0
Formula                 : TiCl4
CAS Name                : TITANIUM CHLORIDE

# Tradenames and Synonyms

TITANIUM CHLORIDE
TETRACHLOROTITANIUM
ANHYDROUS TITANIUM TETRACHLORIDE
"TICKLE"
TiCl
TiCl4
Tetra

Company Identification

MANUFACTURER/DISTRIBUTOR
DuPont Titanium Technologies
1007 Market Street
Wilmington, DE  19898

PHONE NUMBERS
Product Information : 1-800-441-9485 (outside the U.S.
302-774-1000)
Transport Emergency : CHEMTREC 1-800-424-9300(outside U.S.
703-527-3887)
Medical Emergency : 1-800-441-3637 (outside the U.S.
302-774-1000)

COMPOSITION/INFORMATION ON INGREDIENTS

Components

<table>
<thead>
<tr>
<th>Material</th>
<th>CAS Number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>*TITANIUM TETRACHLORIDE</td>
<td>7550-45-0</td>
<td>99.5</td>
</tr>
</tbody>
</table>

* Disclosure as a toxic chemical is required under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.
HAZARDS IDENTIFICATION

Potential Health Effects

INHALATION

TITANIUM TETRACHLORIDE
Short-term overexposure may cause: Irritation of the nose and throat with sneezing, sore throat or runny nose. Irritation of nose, throat, and lungs with cough, difficulty breathing or shortness of breath. Non-specific effects such as headache, nausea and weakness. Repeated and/or prolonged exposure may cause: Pulmonary edema (body fluid in the lungs) with cough, wheezing, abnormal lung sounds, possibly progressing to severe shortness of breath and bluish discoloration of the skin; symptoms may be delayed.

SKIN CONTACT

TITANIUM TETRACHLORIDE
Immediate effects of overexposure may include: Skin corrosion, burns or ulcers.

EYE CONTACT

TITANIUM TETRACHLORIDE
Immediate effects of overexposure may include: Eye corrosion or ulceration - blindness may result.

INGESTION

TITANIUM TETRACHLORIDE
Short-term overexposure may cause: Burns of the mouth, throat, esophagus and stomach, with severe pain, bleeding, vomiting, diarrhea and collapse of blood pressure - damage may appear days after exposure.

ADDITIONAL HEALTH EFFECTS

TITANIUM TETRACHLORIDE
In a cross-sectional survey of titanium tetrachloride metal production workers, an association with work in areas where there is exposure to titanium tetrachloride and particulates, reduced ventilatory capacity and pleural thickening has been reported. Results of a DuPont epidemiology study of employees who had been exposed to titanium tetrachloride showed no pulmonary fibrosis and no association between respiratory disease or chest x-ray abnormalities. Based on the results of this study, DuPont concludes that titanium tetrachloride is not likely to cause lung cancer or chronic respiratory disease in humans at or below the recommended exposure concentration of 0.5 mg/m3.

Increased susceptibility to the effects of this material may be observed in persons with pre-existing disease of the: lungs, skin.
Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

# First Aid

CAUTION: DO NOT USE WATER TO REMOVE COMPOUND. TITANIUM TETRACHLORIDE REACTS WITH WATER TO FORM HYDROCHLORIC ACID.

DO NOT WASH SKIN CONTAMINATED WITH LIQUID TITANIUM TETRACHLORIDE UNTIL WIPING HAS REMOVED ESSENTIALLY ALL THE TITANIUM TETRACHLORIDE. CLOTHING AND SHOES SHOULD BE REMOVED BEFORE SHOWERING.

SEVERE CHEMICAL AND THERMAL BURNS MAY RESULT WHEN TITANIUM TETRACHLORIDE REACTS WITH WATER. IT IS VITAL, THEREFORE, TO BE PREPARED BY HAVING DRY CLOTH, SUCH AS TOWELING, READILY AVAILABLE.

INHALATION
Immediately remove the patient to an uncontaminated atmosphere. Call a physician. Check for breathing and pulse. Give oxygen as soon as possible (6 liters per minute). Check for other injuries. If not breathing, give artificial respiration. Keep the patient warm and at rest.

SKIN CONTACT
Immediately remove contaminated clothing and shoes. If contact occurs with liquid titanium tetrachloride (not vapor), first wipe titanium tetrachloride from skin with dry cloth such as toweling. Flush the skin thoroughly with water for at least 15 minutes. Call for medical help while flushing the skin. Wash clothing before reuse and destroy contaminated shoes.

EYE CONTACT
Immediately flush the eyes with large quantities of water while holding the eyelids apart. Continue flushing for at least 15 minutes. Do not try to neutralize the acid. Call a physician immediately. Transfer promptly to a medical facility. Apply cool packs on eyes while transporting patient to a medical facility.

INGESTION
Do not induce vomiting. Give large quantities of water. Call a physician immediately and transfer promptly to a medical facility. Never give anything by mouth to an
unconscious person.

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FIRE FIGHTING MEASURES
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Flammable Properties

Will not burn.

Fire and Explosion Hazards:

Contact with water when in a vessel or confined space can generate dangerous pressure and heat. Reaction with water is vigorous. Follow appropriate National Fire Protection Association (NFPA) codes.

Extinguishing Media

Foam.

Water for fires in area.

Fire Fighting Instructions

Cool tank exterior with water. Do not get water inside tanks - vigorous reaction may result, generating high temperatures and pressures.

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ACCIDENTAL RELEASE MEASURES
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Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Accidental Release Measures

Evacuate area, stay upwind and avoid contact with fumes. If contact with fumes cannot be avoided, wear acid-proof suit with hood, boots, and breathing air supply. Cover spill with fire fighting foam and maintain foam blanket for at least 30 minutes before fogging spill with water. If foam is not available, flood spill in open area with large volumes of water. Do not add water to titanium tetrachloride in tank or confined space. Comply with Federal, State, and local regulations on reporting releases.

If this product is spilled and not recovered, or is recovered as a waste for treatment or disposal, the CERCLA Reportable Quantity is 1000 lbs.

DuPont Emergency Exposure Limits (EEL) are established to
facilitate site or plant emergency evacuation and to specify airborne concentrations of brief durations which should not result in permanent adverse health effects or interfere with escape. EEL’s are expressed as airborne concentrations multiplied by time (CxT) for up to a maximum of 60 minutes and as a ceiling airborne concentration. These limits are used in conjunction with engineering controls/monitoring and as an aid in planning for episodic releases and spills. For more information on the applicability of EEL’s, contact DuPont.

The Emergency Exposure Limit (EEL) for Titanium Tetrachloride is 500 mg/m3-minute (for example, 100 mg/m3 for 5 minutes; 50 mg/m3 for 10 minutes; 16.7 mg/m3 for 30 minutes; etc.) with a not-to-exceed ceiling of 500 mg/m3.

HANDLING AND STORAGE

Handling (Personnel)

Do not breathe fumes. Do not get liquid or vapor in eyes, on skin, or on clothing. Wash thoroughly after handling.

Learn and plan proper first aid procedures before beginning work with this material.

Storage

Keep in dry, tightly closed containers. Use only clean, dry utensils for handling.

EXPOSURE CONTROLS/PERSOAL PROTECTION

Engineering Controls

Good general ventilation should be provided to keep concentrations below the exposure limit. All work with samples should be conducted in a hood.

Personal Protective Equipment

Have available and wear as needed to prevent contact with eyes or skin: chemical splash goggles, full length face shield; impervious gauntlet gloves, apron, and boots made of Neoprene, polyvinyl chloride, "SARANEX" coated "TYVEK" or "VITON" (butyl degrades rapidly in contact with titanium tetrachloride and should not be used); acid-proof suit hood. Where there is potential for inhalation exposure in excess of the given exposure limit, wear air purifying respirators equipped with acid gas cartridges and high efficiency filters, air supplied masks, or self-contained breathing apparatus depending on concentrations.
Exposure Guidelines

Exposure Limits

Titanium Tetrachloride

PEL (OSHA) : None Established
TLV (ACGIH) : None Established
AEL * (DuPont) : 0.5 mg/m³, 8 & 12 Hr. TWA
WEEL (AIHA) : 0.5 mg/m³, 8 Hr. TWA

* AEL is DuPont’s Acceptable Exposure Limit. Where governmental imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

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PHYSICAL AND CHEMICAL PROPERTIES
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Physical Data

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<tr>
<th>Property</th>
<th>Value</th>
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<tr>
<td>Boiling Point</td>
<td>136 °C (277 °F) @ 760 mm Hg</td>
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<tr>
<td>Vapor Pressure</td>
<td>12 mm Hg @ 25 °C (77 °F)</td>
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<tr>
<td></td>
<td>23 mm Hg @ 38 °C (100 °F)</td>
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<tr>
<td>Vapor Density</td>
<td>4.9 (Air = 1)</td>
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<tr>
<td>Melting Point</td>
<td>-24 °C (-11 °F)</td>
</tr>
<tr>
<td>Solubility in Water</td>
<td>Hydrolyzes to release HCl</td>
</tr>
<tr>
<td>pH</td>
<td>Acid, forms HCl in water</td>
</tr>
<tr>
<td>Odor</td>
<td>Irritating, acidic</td>
</tr>
<tr>
<td>Form</td>
<td>Clear, fuming liquid</td>
</tr>
<tr>
<td>Color</td>
<td>Colorless to light yellow</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.726 @ 20°C (68°F)</td>
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</table>

STABILITY AND REACTIVITY

Chemical Stability

Stable.

Incompatibility with Other Materials

Incompatible with water, alcohols, and reactive metals.

Decomposition

Contact with water or moist air liberates hydrogen chloride gas and titanium oxychlorides.

Polymerization

Polymerization will not occur.
TOXICOLOGICAL INFORMATION

Animal Data

EYE:
Animal testing indicates this material is corrosive to the eye.

SKIN:
LD50, rabbit: 3160 mg/kg.
Animal testing indicates this material is corrosive to the skin. This material has not been tested for skin sensitization.

INGESTION:
LD50, rat: < 464 mg/kg.

INHALATION:
LC50, rat: 0.460 mg/L.

10 & 40 mg/m3
Repeated exposure caused: Inflammation of the respiratory tract.

CARCINOGENIC, DEVELOPMENTAL, REPRODUCTIVE, MUTAGENIC EFFECTS:

In a chronic inhalation study in rats, Titanium Tetrachloride aerosol produced lung lesions in five of 150 rats at 10 mg/m3, but not at 1.0 or 0.1 mg/m3. These lesions were not considered carcinogenic and are similar to lesions produced by some other particulates (TiO2, for example) at high concentrations. No animal data are available to define the following effects of this material: developmental toxicity, reproductive toxicity. Tests have shown that this material does not cause genetic damage in bacterial or mammalian cell cultures.

ECOLOGICAL INFORMATION

Ecotoxicological Information

AQUATIC TOXICITY:
No information is available.
DISPOSAL CONSIDERATIONS

Waste Disposal

The product may be an RCRA Hazardous Waste on disposal due to its corrosive and reactive characteristics. Comply with Federal, State, and local regulations. If approved, may be diluted with ice, neutralized with lime, caustic soda, caustic potash, soda ash, or ammonia and drained to settling pond.

TRANSPORTATION INFORMATION

Shipping Information

DOT/IMO/IATA
Proper Shipping Name : Titanium Tetrachloride
Hazard Class : 8
UN No. : 1838
Packing Group : II
Label(s) : Corrosive, Poison Inhalation Hazard
Subsidiary Hazard Class : 6.1
Reportable quantity : 1000 lbs. Titanium Tetrachloride
Special Information : Inhalation hazard - Zone B
Forbidden from shipment by air.

Shipping Containers

Tank Cars.
Tank Trucks.
Isotanks.

Glass or "TEFLON" TFE Fluorocarbon Sample Bottles.

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Reported/Included.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : Yes
Fire : No
Reactivity : Yes
Pressure : No
(REGULATORY INFORMATION - Continued)

LISTS:

- SARA Extremely Hazardous Substance: Yes
- CERCLA Hazardous Material: (*)
- SARA Toxic Chemicals: Yes

*See Disposal Information.

CANADIAN WHMIS CLASSIFICATIONS:

D-1A; E; F

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OTHER INFORMATION

NFPA, NPCA-HMIS

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<tr>
<th>NFPA Rating</th>
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<tr>
<td>Health</td>
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<tr>
<td>Flammability</td>
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<tr>
<td>Reactivity</td>
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<tr>
<td>Flammability</td>
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</tr>
<tr>
<td>Reactivity</td>
<td>2</td>
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</tbody>
</table>

Personal Protection rating to be supplied by user depending on use conditions.

Additional Information

MEDICAL USE: CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications see DuPont CAUTION Bulletin No. H-50102.

The required testing has not been done to qualify any of our products for direct inclusion in food, drugs, or cosmetic formulations.

For more specific information on composition and properties, see DuPont "TI-PURE" Titanium Dioxide literature.

Please see www.titanium.dupont.com for the latest version of this MSDS.

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The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS: MSDS Coordinator
This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS