1. Product and Company Identification

Material name: Tronox® Titanium Dioxide, All Grades
Revision date: 01-30-2012
Version #: 05
Product code: 77891, Pigment White #6
MSDS Number: B-5017
Product use: White pigment for applications in coatings, inks, fibers, plastics, paper, glass, vitreous enamels, and ceramics.
Company name: Tronox LLC
3301 NW 150th Street
Oklahoma City, OK 73134
Country: USA
Email: ChemProdSteward@tronox.com
Telephone number: 1-405-775-5000 (24-hours)
Emergency number: CHEMTREC 1-877-358-7421
CHEMTREC 1-760-476-3962 (Access code: 333318)

2. Hazards Identification

Physical state: Solid.
Appearance: White powder.
Emergency overview: CAUTION
May cause eye, skin and respiratory tract irritation.
OSHA regulatory status: This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects
Routes of exposure: Inhalation. Eye contact. Skin contact.
Eyes: Dust may irritate the eyes.
Skin: Dust may irritate skin. Skin irritation occurs on contact with moist or wet skin.
Inhalation: May cause respiratory tract irritation. Dust may irritate throat and respiratory system and cause coughing.
Ingestion: May cause discomfort if swallowed.
Target organs: Eyes. Skin. Respiratory system
Chronic effects: Dusts or powder may irritate the respiratory tract, skin and eyes. Frequent inhalation of fume/dust over a long period of time may increase the risk of developing lung diseases although epidemiological studies among titanium dioxide workers could not demonstrate this.
Signs and symptoms: Upper respiratory tract irritation. Coughing. Irritation of eyes and mucous membranes. Skin irritation.
Potential environmental effects: The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

3. Composition / Information on Ingredients

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS #</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide</td>
<td>13463-67-7</td>
<td>86 - 97</td>
</tr>
<tr>
<td>Silicon dioxide</td>
<td>7631-86-9</td>
<td>0 - 15</td>
</tr>
<tr>
<td>Aluminium hydroxide</td>
<td>21645-51-2</td>
<td>0 - 10</td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>1314-23-4</td>
<td>0 - 2</td>
</tr>
</tbody>
</table>

Composition comments: Components listed make up an inseparable chemically reacted pigment.
4. First Aid Measures

First aid procedures

**Eye contact**
Immediately rinse eyes with water. Remove any contact lenses, and continue flushing eyes with running water for at least 15 minutes. Hold eyelids apart to ensure rinsing of the entire surface of the eye and lids with water. Get immediate medical attention.

**Skin contact**
Flush skin thoroughly with water. Get medical attention if irritation develops or persists.

**Inhalation**
Move to fresh air. Get medical attention if any discomfort continues.

**Ingestion**
Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center. Never give anything by mouth to an unconscious person. If ingestion of a large amount does occur, call a poison control center immediately.

Notes to physician
Treat symptomatically.

General advice
Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

**Flammable properties**
This product is not flammable.

**Extinguishing media**

**Suitable extinguishing media**
Use fire-extinguishing media appropriate for surrounding materials.

**Unsuitable extinguishing media**
No restrictions known.

**Protection of firefighters**

**Protective equipment and precautions for firefighters**
Self-contained breathing apparatus and full protective clothing must be worn in case of fire. Selection of respiratory protection for firefighting: follow the general fire precautions indicated in the workplace.

**Fire fighting equipment/instructions**
Firefighters should wear full protective clothing including self contained breathing apparatus. Move containers from fire area if you can do so without risk. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply.

**Specific methods**
In the event of fire, cool tanks with water spray. Move container from fire area if it can be done without risk.

6. Accidental Release Measures

**Personal precautions**
Avoid inhalation of dust and contact with skin and eyes. Wear appropriate protective equipment and clothing during clean-up. Local authorities should be advised if significant spillages cannot be contained.

**Environmental precautions**
Prevent further leakage or spillage if safe to do so. Do not contaminate water.

**Methods for containment**
Collect and dispose of spillage as indicated in Section 13 of the MSDS. Prevent entry into waterways, sewer, basements or confined areas.

**Methods for cleaning up**
Avoid dust formation. Collect powder using special dust vacuum cleaner with particle filter or carefully sweep into closed container. For waste disposal, see Section 13 of the MSDS.

**Other information**
Clean up in accordance with all applicable regulations.

7. Handling and Storage

**Handling**
Avoid inhalation of dust and contact with skin and eyes. Use only with adequate ventilation. Use Personal Protective Equipment recommended in section 8 of the MSDS. Wash thoroughly after handling. Observe good industrial hygiene practices.

**Storage**
Titanium dioxide is a stable chemical compound that does not decompose during storage but can pick up moisture from the environment if not stored properly effecting product performance. Store indoors in a dry place, away from rain and wet floors. Use on a first-in first-out basis from receipt of the shipment.

8. Exposure Controls / Personal Protection

**Occupational exposure limits**

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium hydroxide (21645-51-2)</td>
<td>TWA</td>
<td>1 mg/m3</td>
<td>Respirable fraction.</td>
</tr>
</tbody>
</table>
### US. ACGIH Threshold Limit Values

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>STEL</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide</td>
<td>TWA</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide</td>
<td>PEL</td>
<td>15 mg/m³</td>
<td>Total dust.</td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>PEL</td>
<td>5 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### US. OSHA Table Z-3 (29 CFR 1910.1000)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon dioxide</td>
<td>TWA</td>
<td>0.8 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(7631-86-9)</td>
<td></td>
<td>20 mppcf</td>
<td></td>
</tr>
</tbody>
</table>

### Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>STEL</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium hydroxide</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>Respirable.</td>
</tr>
<tr>
<td>(21645-51-2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicon dioxide</td>
<td>TWA</td>
<td>4 mg/m³</td>
<td>Total</td>
</tr>
<tr>
<td>(7631-86-9)</td>
<td></td>
<td>1.5 mg/m³</td>
<td>Respirable.</td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>Respirable fraction.</td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>STEL</td>
<td>10 mg/m³</td>
<td>Total dust.</td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium hydroxide</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>Respirable fraction.</td>
</tr>
<tr>
<td>(21645-51-2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silicon dioxide</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(7631-86-9)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>STEL</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Canada. Quebec OELS. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon dioxide</td>
<td>TWA</td>
<td>6 mg/m³</td>
<td>Respirable dust.</td>
</tr>
<tr>
<td>(7631-86-9)</td>
<td></td>
<td>10 mg/m³</td>
<td>Total dust.</td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide</td>
<td>STEL</td>
<td>10 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(1314-23-4)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Mexico. Occupational Exposure Limit Values

<table>
<thead>
<tr>
<th>Components</th>
<th>Type</th>
<th>Value</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Titanium dioxide</td>
<td>STEL</td>
<td>20 mg/m³</td>
<td></td>
</tr>
<tr>
<td>(13463-67-7)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Components</td>
<td>Type</td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>Zirconium dioxide (1314-23-4)</td>
<td>TWA</td>
<td>10 mg/m3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>10 mg/m3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>5 mg/m3</td>
<td></td>
</tr>
</tbody>
</table>

**Engineering controls**
Ventilate as needed to control airborne dust. Provide adequate ventilation. Observe Occupational Exposure Limits and minimize the risk of inhalation of dust.

**Personal protective equipment**

- **Eye / face protection**
  Wear dust-resistant safety goggles where there is danger of eye contact.

- **Skin protection**
  Risk of contact: Wear protective gloves. Wear appropriate clothing to prevent repeated or prolonged skin contact.

- **Respiratory protection**
  When engineering controls are not sufficient to lower exposure levels below the applicable exposure limit, use a NIOSH approved respirator for dusts. A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever work place conditions warrant a respirator's use. Seek advice from local supervisor.

- **General hygiene considerations**
  Do not breathe dust. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

**9. Physical & Chemical Properties**

- **Appearance**
  White powder.

- **Color**
  White.

- **Odor**
  Odorless.

- **Physical state**
  Solid.

- **Form**
  Powder.

- **pH**
  5 - 8.5 (10% slurry)

- **Melting point**
  3326 - 3362 °F (1830 - 1850 °C)

- **Boiling point**
  4532 - 5432 °F (2500 - 3000 °C)

- **Specific gravity**
  4.1 Approx. (@ 20°C)

- **Solubility (water)**
  Insoluble

- **Bulk density**
  600 kg/m³ Approx. (@ 20°C)

**10. Chemical Stability & Reactivity Information**

- **Chemical stability**
  Material is stable under normal conditions.

- **Conditions to avoid**
  Avoid dust formation.

- **Incompatible materials**
  None known.

- **Hazardous decomposition products**
  No hazardous decomposition products are known.

- **Possibility of hazardous reactions**
  Hazardous polymerization does not occur.

**11. Toxicological Information**

**Toxicological data**

<table>
<thead>
<tr>
<th>Components</th>
<th>Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium hydroxide (21645-51-2)</td>
<td>Acute Oral LD50 Rat: &gt; 5000 mg/kg</td>
</tr>
</tbody>
</table>

- **Acute effects**
  May cause discomfort if swallowed.

- **Local effects**
  Dusts may irritate the respiratory tract, skin and eyes.

- **Sensitization**
  Not a skin sensitizer.

- **Chronic effects**
  Frequent inhalation of dust over a long period of time may increase the risk of developing chronic lung diseases and skin irritation.
Carcinogenicity

Suspected of causing cancer. IARC has classified TiO2 as 2B Possibly carcinogenic to humans. However, the only evidence of carcinogenicity is in rats exposed to very high concentrations. Two major epidemiology studies among titanium dioxide workers in the US and in EUROPE could not demonstrate an elevated lung cancer risk.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. IARC Monographs, Volume 93 (Summary)

ACGIH Carcinogens

Aluminium hydroxide (CAS 21645-51-2) A4 Not classifiable as a human carcinogen.
Titanium dioxide (CAS 13463-67-7) A4 Not classifiable as a human carcinogen.
Zirconium dioxide (CAS 1314-23-4) A4 Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Silicon dioxide (CAS 7631-86-9) 3 Not classifiable as to carcinogenicity to humans.
Titanium dioxide (CAS 13463-67-7) 2B Possibly carcinogenic to humans.

Epidemiology

None known.

Mutagenicity

No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Neurological effects

None known.

Reproductive effects

None known.

Teratogenicity

None known.

Symptoms and target organs

Dusts or powder may irritate the respiratory tract, skin and eyes. Coughing. Frequent inhalation of dust over a long period of time increases the risk of developing lung diseases.

Further information

No other specific acute or chronic health impact noted.

12. Ecological Information

Ecotoxicity

The product is not expected to be hazardous to the environment.

Environmental effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Persistence and degradability

The degradability of the product has not been stated.

Bioaccumulation / Accumulation

Bioaccumulation is unlikely to be significant because of the low water solubility of this product.

Mobility in environmental media

The product is insoluble in water and will sediment in water systems.

13. Disposal Considerations

Waste codes

Not regulated.

Disposal instructions

Disposal recommendations are based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal. Dispose of this material and its container to hazardous or special waste collection point. Do not allow this material to drain into sewers/water supplies.

Waste from residues / unused products

Dispose of in accordance with local regulations.

Contaminated packaging

Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport Information

DOT

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

TDG

Not regulated as dangerous goods.
15. Regulatory Information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

TSCA Section 12(b) Export Notification(40 CFR 707, Subpt. D)

Not regulated.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - No
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance (40 CFR 355, Appendix A)

No

Section 311/312 (40 CFR 370)

No

Drug Enforcement Administration (DEA) (21 CFR 1308.11-15)

Not controlled

WHMIS status

Controlled

WHMIS classification

D2A - Other Toxic Effects-VERY TOXIC

WHMIS labeling

Inventory status

<table>
<thead>
<tr>
<th>Country(s) or region</th>
<th>Inventory name</th>
<th>On inventory (yes/no)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Australian Inventory of Chemical Substances (AICS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Domestic Substances List (DSL)</td>
<td>Yes</td>
</tr>
<tr>
<td>Canada</td>
<td>Non-Domestic Substances List (NDSL)</td>
<td>No</td>
</tr>
<tr>
<td>China</td>
<td>Inventory of Existing Chemical Substances in China (IECSC)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European Inventory of Existing Commercial Chemical Substances (EINECS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Europe</td>
<td>European List of Notified Chemical Substances (ELINCS)</td>
<td>No</td>
</tr>
<tr>
<td>Japan</td>
<td>Inventory of Existing and New Chemical Substances (ENCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>Korea</td>
<td>Existing Chemicals List (ECL)</td>
<td>Yes</td>
</tr>
<tr>
<td>New Zealand</td>
<td>New Zealand Inventory</td>
<td>Yes</td>
</tr>
<tr>
<td>Philippines</td>
<td>Philippine Inventory of Chemicals and Chemical Substances (PICCS)</td>
<td>Yes</td>
</tr>
<tr>
<td>United States &amp; Puerto Rico</td>
<td>Toxic Substances Control Act (TSCA) Inventory</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations

Titanium dioxide is listed as a carcinogen by the State of California under Proposition 65. This listing is a qualified listing which applies only to airborne, unbound, particles of respirable size and does not require warnings on products containing titanium dioxide such as plastics, paper, and paint.

US - California Hazardous Substances (Director's): Listed substance

Silicon dioxide (CAS 7631-86-9) Listed.
Zirconium dioxide (CAS 1314-23-4) Listed.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Titanium dioxide (CAS 13463-67-7) Listed.
US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

US - Massachusetts RTK - Substance: Listed substance
Silicon dioxide (CAS 7631-86-9) Listed.
Titanium dioxide (CAS 13463-67-7) Listed.
Zirconium dioxide (CAS 1314-23-4) Listed.

US - New Jersey RTK - Substances: Listed substance
Silicon dioxide (CAS 7631-86-9) Listed.
Titanium dioxide (CAS 13463-67-7) Listed.

US - Pennsylvania RTK - Hazardous Substances: Listed substance
Silicon dioxide (CAS 7631-86-9) Listed.
Titanium dioxide (CAS 13463-67-7) Listed.

16. Other Information

Recommended use
White pigment for applications in coatings, inks, fibers, plastics, paper, glass, vitreous enamels, and ceramics.

Further information
Nanoparticle Statement- The average primary particle size of this product is larger than the nanoparticle size range as described by ISO/TC 229 and should not be considered as manufactured nanoparticles or nanomaterials. As with other particulate materials there will be a distribution of particle sizes around the average and a small portion of these may be covered by the nanoparticle definition. In this product, the primary particle size is in the 200-300 nm range. However, the primary particle size does not represent the size of particles in this product as supplied since these tend to aggregate or agglomerate into larger particles.

HMIS® ratings
Health: 1  Flammability: 0  Physical hazard: 0

NFPA ratings
Health: 1  Flammability: 0  Instability: 0

Disclaimer
The information in the sheet was written based on the best knowledge and experience currently available.

Issue date
12-22-2009