MATERIAL SAFETY DATA SHEET

This Material Safety Data Sheet meets or exceeds the requirements of the Canadian Controlled Product Regulations (WHMIS)

1. Product and Supplier Identification

Product: Aluminum Oxide Abrasive
Product Use: Abrasive, used for blasting
Supplier: Manus Abrasive Systems, Inc.,
1040 – 78 Avenue,
Edmonton, Alberta
Canada, T6P 1L7
Telephone: 1.780.468.2588 Fax: 1.780.465.7317

2. Composition

<table>
<thead>
<tr>
<th>Component</th>
<th>% (w/w)</th>
<th>Exposure Limits (ACGIH)</th>
<th>LD_{50}</th>
<th>LC_{50}</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum oxide</td>
<td>&gt;95</td>
<td>ACGIH TLV-TWA: 1 mg/m³</td>
<td>Not available</td>
<td>Not available</td>
</tr>
<tr>
<td>CAS No 1344-28-1</td>
<td></td>
<td>OSHA PEL-TWA: 5 mg/m³ (respirable)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>1.5 – 3.8</td>
<td>ACGIH TLV-TWA: 10 mg/m³ (basis: Lung)</td>
<td>&gt; 25 g/kg (oral/rat)</td>
<td>&gt; 6820 mg/m³ (4 hr/ rat, inhalation)</td>
</tr>
<tr>
<td>CAS No 13463-67-7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-hazardous ingredients or those below disclosure limits</td>
<td>1.2 - 3.5</td>
<td>Not applicable</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

1 American Conference of Governmental Industrial Hygienists (ACGIH). Exposure limits may vary from time to time and from one jurisdiction to another. Check with local regulatory agency for the exposure limits in your area.

3. Hazards Identification

Routes of Entry:
- Skin Absorption: No
- Skin Contact: No, other than abrasion
- Eye Contact: No, other than abrasion
- Ingestion: No
- Inhalation: Yes

Emergency Overview:
This product is a gritty solid consisting of particulate in the 400 – 800 micron range. Titanium dioxide is listed by the International Agency for Research on Cancer (IARC) as a possible carcinogen to humans (Group 2B) based on sufficient evidence in experimental animals. The conclusion relates to long-term inhalation exposure to high concentrations of ultrafine powdered titanium dioxide.
If using this product to remove or clean a surface, the substance that has been removed may contain materials that represent health hazards that cannot be addressed in this Material Safety Data Sheet. The employer must ensure that a risk assessment is done before any abrasive activity, such as blasting. These operations may cause release a harmful level of an air contaminant from a surface or coating containing a toxic heavy metal or other irritant/toxin.

**Acute Health Effects:**

**Inhalation:** Inhalation of respirable silica or titanium dioxide may cause irritation to the upper respiratory tract. Exposure may cause sore throat, coughing, sneezing, and the production of phlegm in the throat. Nosebleeds may occur in cases of those with sensitive nose membranes due to abrasion of sensitive tissue.

**Skin Contact:** This product is mildly abrasive to skin, but may aggravate tender skin causing rash, cuts or sores.

**Skin Absorption:** Not applicable

**Eye Contact:** Contact with the eye will cause tearing and irritation from the “foreign” object in the eye. Rubbing of the eye may cause abrasion of the cornea.

**Ingestion:** No evidence of ill effects from ingestion of this product.

**Chronic Health Effects:**

The International Agency for Research on Cancer (IARC) has determined that some of the ingredients in this product may cause cancer if long-term inhalation exposure to high concentrations occurs. Animal evidence shows that high concentrations of ultrafine titanium dioxide can cause respiratory tract cancer in rats exposed by inhalation and intratracheal instillation. Small quantities of silicon dioxide are also present. A determination of the respirable quantity has not been determined. IARC has categorized respirable silicon dioxide as carcinogenic to humans (Group 1). The employer must determine the chronic effects of the contaminants which may result from the cleaning/abrading process. Prolonged contact with sand/grit by sensitive skin may result in skin redness, rash and sores.

**Medical Conditions Aggravated by Exposure:**

Respiratory problems may be aggravated by pre-existing lung disease such as bronchitis, emphysema, or chronic obstructive pulmonary disease.

### 4. First Aid Measures

**Inhalation:** If high concentrations are present, take proper precautions to protect your own safety before attempting to rescue the victim. Remove to fresh air. Call for medical assistance if coughing or other respiratory symptoms don’t subside.

**Skin Contact:** No health effects expected other than minor irritation. Wash affected area thoroughly. If irritation persists, seek medical attention.

**Eye Contact:** Do not allow victim to rub eyes. Immediately and thoroughly flush eyes with water until the foreign object is flushed out of the eye. If irritation, pain, swelling, or lacrimation exists, get medical attention as soon as possible.

**Ingestion:** Ingestion of particulate is not considered to be injurious to health. Give fluids to aid in the passing of the product though the digestive system. Do not give anything by mouth to a convulsing or unconscious person. If patient shows discomfort, get immediate medical attention.

**General Comments:** All first aid procedures should be periodically reviewed by a doctor familiar with aluminum oxide/ titanium dioxide and the condition of use in the workplace. Good personal hygiene is essential. Avoid eating, smoking or drinking in work areas.
5. Fire Fighting Measures

Flammability: No
Flash Point: Not applicable
Autoignition Temperature: Not applicable
Lower Explosive Limit: Not applicable
Upper Explosive Limit: Not applicable

Explosion Data:
- Sensitivity to Impact: No
- Sensitivity to Static Discharge: No

Hazardous Combustion Products: None known

Conditions to Avoid: None

Extinguishing Media: These materials are not flammable or oxidizers, therefore they will not contribute to a conflagration. Use any means appropriate for surrounding fire.

Fire Fighting Instructions: Evacuate area and fight fire from a safe distance or a protected area. Firefighters must wear self-contained breathing apparatus and full protective clothing.

6. Accidental Release Measures

Personal Protection:
Wear adequate personal protection to prevent inhalation of dusts, contact with skin or eyes. See Section 8 for specific recommendations.

Environmental Precautions:
Prevent contaminated abrasive from spilling into waterways, sewers.

Cleanup Procedures:
Ensure that methods of cleanup do not create airborne dust. If cleanup procedure creates dusting, restrict access to area until completion of cleanup. Only adequately trained personnel, wearing properly selected personal protective equipment and clothing described in Section 8, should be involved in the spill response and cleanup.

7. Handling and Storage

Handling Procedures:
Handle bags in a manner that will ensure minimal generation of dusts. Do not breathe dust, which may generate accidentally. Follow safe work procedures and wear the appropriate personal protective equipment specified in Section 8. The workers must be instructed and trained in the safe work procedures.

Do not rely on sight to determine if dust is in the air. Contaminants may be in the air without a visible dust cloud. If dust cannot be kept below permissible limits, wear a high efficiency respirator approved for abrasive dust.
Used abrasive materials must be removed from the work area at the end of the work shift and dust collection must be used to minimize airborne contaminant. Used abrasive materials must not be dry-swept.

**Storage:**

Store away from incompatible materials. See Section 10.

### 8. Exposure Controls, Personal Protection

#### Engineering Controls:

Engineering controls such as an enclosure or local exhaust ventilation with dust collection must be used to maintain airborne contaminations levels below the exposure limits, where practicable.

When an abrasive operation is conducted inside an enclosure or cabinet, the enclosure or cabinet must have exhaust ventilation that maintains air pressure below the air pressure outside the enclosure or cabinet, so as to prevent the escape of air contaminants to other work areas, and minimize worker exposure inside the enclosure.

When an abrasive blasting is conducted outside a structure, the process must be restricted to a work zone which is identified by signs or similar means as being contaminated. Only properly protected workers, who are necessary to perform the work, are permitted inside an enclosure or a restricted work zone where abrasive blasting/operation is being conducted.

The operating controls for an abrasive blasting machine or jetting gun must be located near the nozzle in a position where the operator’s hands will be when using the device.

#### Respiratory Protection:

Recommended respirators include a self-contained breathing apparatus (SCBA) that has a full facepiece and is operated in a positive pressure mode, a supplied air respirator that has a full facepiece and is operated in a pressure demand or other positive pressure mode in combination with an auxiliary SCBA operated in a pressure demand or other positive pressure mode. Respirators must be NIOSH approved and properly selected, maintained and used when working with this product. Knowledge of respiratory hazards and respiratory protection is essential to ensure appropriate selection of respirators. In selecting the appropriate respirator must reflect the contaminant likely to be present in the spent product.

#### Skin Protection:

Wear clothing to prevent contact with skin.

#### Eye and Face Protection:

Wear safety glasses to prevent contact with eyes and make immediately available appropriate emergency eye washing equipment (e.g. portable or plumbed) capable of flushing the eyes for at least 15 minutes.

### 9. Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>Brown gritty, sand like appearance</td>
</tr>
<tr>
<td>Odour</td>
<td>None</td>
</tr>
<tr>
<td>Odour Threshold</td>
<td>Not determined</td>
</tr>
<tr>
<td>pH</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Melting Point</td>
<td>Not determined</td>
</tr>
<tr>
<td>Initial Boiling Point</td>
<td>2980 °C (typical, Alumina)</td>
</tr>
<tr>
<td>Boiling Range</td>
<td>Not determined</td>
</tr>
<tr>
<td>Flash Point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Solubility</td>
<td>Insoluble in water</td>
</tr>
<tr>
<td>Partial Coefficient</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapour Pressure</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Viscosity</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Pour Point</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Upper Explosive Limit (UEL)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Lower Explosive Limit (LEL)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Auto Ignition Temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Solvent Solubility</td>
<td>Not soluble in solvents</td>
</tr>
<tr>
<td>Critical Temperature</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>4.0 (water = 1)</td>
</tr>
<tr>
<td>Evaporation Rate</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapour Density</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Decomposition Temperature</td>
<td>Not determined</td>
</tr>
<tr>
<td>Sensitivity to Impact</td>
<td>No</td>
</tr>
<tr>
<td>Sensitivity to Static Charge</td>
<td>No</td>
</tr>
</tbody>
</table>
10. Stability and Reactivity

Chemical Stability: This product is stable.
Hazardous Polymerization: Will not occur.
Incompatibility:
- Halocarbons: Chemicals such as dichloromethane and chloroform may give off heat, toxic and irritating chlorinated compounds
- Chlorine trifluoride: Reacts violently, with ignition
- Ethylene Oxide: May polymerize violently or explosively
- Oxygen difluoride: Reaction gives off heat and may be explosive under certain conditions.
- Vinyl Acetate: Vapour may react vigorously in contact with aluminum oxide.
Reactivity: None
Hazardous Decomposition Products: None reported.

11. Toxicological Information

Effects of Acute Exposure: See Section 3
Effects of Chronic Exposure: See Section 3
Irritancy: Yes. See Section 3.
Skin Sensitization: None reported
Respiratory Sensitization: None reported
Neurotoxicity: No
Carcinogenicity: See Section 3
Embryotoxicity: No
Teratogenicity: No
Reproductive Toxicity: No
Mutagenicity: No
Synergistic Products: None reported

12. Ecological Information

Environmental Toxicity: No environmental impact for uncontaminated abrasive. Determination of sandblasting contamination is required to determine environmental impact.
Biodegradability: No

13. Disposal Considerations

Review federal, provincial or state, and local government requirements prior to disposal. Store material for disposal as indicated in storage conditions. Disposal by controlled incineration may be acceptable.

14. Transport Information

Canadian Transportation of Dangerous Goods Regulations: Not regulated
International Air Transport Association (IATA): Not regulated
International Maritime Organization (IMO): Not regulated
15. Regulatory Information

CANADIAN FEDERAL REGULATIONS:

CEPA, DOMESTIC SUBSTANCES LIST: Listed
WHMIS CLASSIFICATION: D2A, Carcinogenicity, very toxic

16. Other Information

Original Preparation Date: October 9, 2009

Prepared by: Kel-Ex Agencies Ltd., P.O. Box 52201, Lynnmour RPO, North Vancouver, BC, Canada, V7J 3V5

Disclaimer: This Material Safety Data Sheet was prepared in accordance with criteria and requirements of the Hazardous Products Act and the Controlled Products Regulations using information provided by the manufacturer and other sources including CCINFO (Chemical Information published by the Canadian Centre for Occupational Health and Safety). The information in the Material Safety Data Sheet is offered for your consideration and guidance when exposed to this product. Manus Abrasive Systems Inc. expressly disclaims all expressed or implied warranties and assumes no responsibilities for the accuracy or completeness of the data contained herein. The data in this MSDS does not apply to use with any other product or in any other process.

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Revisions: None