SAFETY DATA SHEET

Pecora-Deck™ 804 Intermediate Coat

PART I  What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

IDENTIFICATION of the SUBSTANCE or PREPARATION

<table>
<thead>
<tr>
<th>TRADE NAME (AS LABELED):</th>
<th>Pecora-Deck™ 804 Intermediate Coat</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRODUCT DESCRIPTION:</td>
<td>Urethane</td>
</tr>
<tr>
<td>CHEMICAL NAME/CLASS:</td>
<td>Urethane Based Coating</td>
</tr>
<tr>
<td>SYNONYMS:</td>
<td>Pecora-Deck™ 804</td>
</tr>
<tr>
<td>RELEVANT USE:</td>
<td>General Polyurethane Sealant</td>
</tr>
<tr>
<td>USES ADVISED AGAINST:</td>
<td>Other Than Relevant Use</td>
</tr>
</tbody>
</table>

COMPANY/UNDERTAKING IDENTIFICATION:

<table>
<thead>
<tr>
<th>SUPPLIER/MANUFACTURER’S NAME:</th>
<th>Pecora Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADDRESS:</td>
<td>165 Wambold Road, Harleysville, PA 19438</td>
</tr>
<tr>
<td>EMERGENCY PHONE:</td>
<td>800-424-9300 (CHEMTREC, 24-hours)</td>
</tr>
<tr>
<td>BUSINESS PHONE:</td>
<td>215-723-6051 (Mon–Fri, 8 AM–5 PM ET)</td>
</tr>
<tr>
<td>PREPARATION DATE:</td>
<td>January 7, 2013</td>
</tr>
<tr>
<td>REVISION DATE:</td>
<td>November 22, 2013</td>
</tr>
</tbody>
</table>

This product is sold for commercial use. This SDS has been developed to address safety concerns of those individuals working with bulk quantities of this material, as well as those of potential users of this product in industrial/occupational settings. ALL United States Occupational Safety and Health Administration Standard (29 CFR 1910.1200), U.S. State equivalent Standards, and Canadian WHMIS [Controlled Products Regulations] and the Global Harmonization Standard required information is included in appropriate sections based on the U.S. ANSI Z400.1-2010 format. This product has been classified in accordance with the hazard criteria of the countries listed above.

2. HAZARD IDENTIFICATION

GLOBAL HARMONIZATION LABELING AND CLASSIFICATION: This product has been classified per GHS Standards.

Classification:
- Flammable Liquid Cat. 3, Carcinogenic Cat. 2, Germ Cell Mutagenic Cat. 2, Acute Inhalation Toxicity Cat. 2, Eye Irritation Cat. 2, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Skin Irritation Cat. 2, Respiratory Sensitizer Cat. 1, Skin Sensitization Cat. 1, Aquatic Chronic Toxicity Cat. 3

Signal Word: Danger


Hazard Symbols/Pictograms: GHS02, GHS06, GHS08

EMERGENCY OVERVIEW:

PHYSICAL DESCRIPTION: This product is a flammable, colored, viscous liquid with an odor characteristic of isocyanates.

HEALTH HAZARDS: DANGER! Inhalation of vapors may be harmful or fatal. Harmful or fatal if swallowed. This product can cause irritation by all routes of exposure. Eye irritation may be severe. Chronic inhalation may cause lung damage. May cause toxic systemic effects by skin absorption. Can cause skin and respiratory sensitization and allergic reaction. Contains compounds that are suspect carcinogens and of crystalline silica, a known human carcinogen by inhalation. Contains compound that is suspect mutagen. Contains compounds which can cause harm to aquatic organisms.

FLAMMABILITY HAZARD: This product is combustible and can ignite if exposed to high temperature or direct flame.

REACTIVITY HAZARD: Contact with water produces heat, carbon dioxide and urea polymers; reaction can be vigorous. Closed containers can rupture violently if contaminated with water or if involved in a fire. Due to the Polyether Diol component, this product may form unstable or flammable peroxides on prolonged exposure to air if stabilizer is depleted.

ENVIRONMENTAL HAZARD: This product has not been tested for environmental impact. All release to the environment should be avoided. Contains compounds that can cause harm to aquatic organisms.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS®)

<table>
<thead>
<tr>
<th>Health</th>
<th>2*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability</td>
<td>2</td>
</tr>
<tr>
<td>Physical Hazard</td>
<td>1</td>
</tr>
</tbody>
</table>

See Section 16 for definitions of ratings
0 = Minimal  3 = Serious
1 = Slight  4 = Severe
2 = Moderate  * = Chronic

HMIS® is a registered trademark of the National Paint and Coatings Association.

CANADIAN WHMIS CLASSIFICATION: Classes B2, D1A/D2A and Class D2B, See Section 15 (Regulatory Information) for all classification details.

U.S. OSHA REGULATORY STATUS: This material is classified as hazardous under OSHA regulations.

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3. COMPOSITION AND INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS #</th>
<th>W/W%</th>
<th>GHS Classification</th>
<th>Hazard Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyalkylene Glycol</td>
<td>9003-11-6</td>
<td>20.0-40.0</td>
<td>Classification: Not Applicable</td>
<td>Hazard Statement Codes: Not Applicable</td>
</tr>
<tr>
<td>Kaolin</td>
<td>1332-58-7</td>
<td>10.0-20.0</td>
<td>Classification: Not Applicable</td>
<td>Hazard Statement Codes: Not Applicable</td>
</tr>
<tr>
<td>2,4-Toluene Diisocyanate</td>
<td>584-84-9</td>
<td>10.0-20.0</td>
<td>Classification: Carcinogenic Cat. 2, Acute Inhalation Toxicity Cat. 2, Eye Irritation Cat. 2, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Skin Irritation Cat. 2, Respiratory Sensitizer Cat. 1, Skin Sensitization Cat. 1, Aquatic Chronic Toxicity Cat. 3</td>
<td>Hazard Statement Codes: H351, H330, H319, H335, H334, H317, H412</td>
</tr>
<tr>
<td>Polyether Dioxil</td>
<td>25322-69-4</td>
<td>10.0-15.0</td>
<td>Classification: Not Applicable</td>
<td>Hazard Statement Codes: Not Applicable</td>
</tr>
<tr>
<td>Naphtha Petroleum Hydrodistilled Light</td>
<td>64742-47-8</td>
<td>8.0-15.0</td>
<td>SELF CLASSIFICATION</td>
<td>Classification: Carcinogenic Cat. 2</td>
</tr>
<tr>
<td>Talc</td>
<td>14807-96-6</td>
<td>8.0-10.0</td>
<td>Classification: Not Applicable</td>
<td>Hazard Statement Codes: Not Applicable</td>
</tr>
<tr>
<td>Crystalline Silica, Quartz</td>
<td>14808-60-7</td>
<td>1.0-5.0</td>
<td>SELF CLASSIFICATION</td>
<td>Classification: Carcinogenic Cat. 1B</td>
</tr>
<tr>
<td>Pseudocumene</td>
<td>95-63-6</td>
<td>1.0-5.0</td>
<td>Classification: Flammable Liquid Cat. 3, Acute Inhalation Toxicity Cat. 4, Skin Irritation Cat. 2, Eye Irritation Cat. 2A, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Aquatic Chronic Toxicity Cat. 2</td>
<td>Hazard Statement Codes: H226, H332, H315, H193, H355, H411</td>
</tr>
<tr>
<td>1,4-Butanediol</td>
<td>110-63-4</td>
<td>1.0-5.0</td>
<td>SELF CLASSIFICATION</td>
<td>Classification: Acute Oral Toxicity Cat. 4, STOT (Inhalation-Narcotic Effect) SE Cat. 3</td>
</tr>
<tr>
<td>Calcium Carbonate (Natural)</td>
<td>1317-65-3</td>
<td>1.0-3.0</td>
<td>Classification: Not Applicable</td>
<td>Hazard Statement Codes: Not Applicable</td>
</tr>
<tr>
<td>Titanium Dioxide</td>
<td>13463-67-7</td>
<td>0.5-2.0</td>
<td>SELF CLASSIFICATION</td>
<td>Classification: Carcinogenic Cat. 2</td>
</tr>
</tbody>
</table>

Disocyanate Mixture including:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS #</th>
<th>W/W%</th>
<th>GHS Classification</th>
<th>Hazard Statements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphenylmethane 4,4’-Diisocyanate</td>
<td>101-66-8</td>
<td></td>
<td>Classification: Carcinogenic Cat. 2, Acute Inhalation Toxicity Cat. 2, Eye Irritation Cat. 2, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Skin Irritation Cat. 2, Respiratory Sensitizer Cat. 1, Skin Sensitization Cat. 1, Aquatic Chronic Toxicity Cat. 3</td>
<td>Hazard Statement Codes: H351, H330, H319, H335, H334, H317, H412</td>
</tr>
<tr>
<td>Polymeric Diphenylmethane Diisocyanate</td>
<td>9016-87-9</td>
<td>0.19</td>
<td>SELF CLASSIFICATION</td>
<td>Classification: Carcinogenic Cat. 2, Acute Oral Toxicity Cat. 5, Acute Inhalation Toxicity Cat. 4, Skin Irritation Cat. 2, Eye Irritation Cat. 2B, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Skin Sensitization Cat. 1, Respiratory Sensitization Cat. 1</td>
</tr>
<tr>
<td>Diphenylmethane-2,4-Diisocyanate</td>
<td>5873-54-1</td>
<td></td>
<td>Classification: Carcinogenic Cat. 2, Acute Inhalation Toxicity Cat. 2, Eye Irritation Cat. 2, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Skin Irritation Cat. 2, Respiratory Sensitizer Cat. 1, Skin Sensitization Cat. 1, Aquatic Chronic Toxicity Cat. 3</td>
<td>Hazard Statement Codes: H351, H330, H319, H335, H334, H317, H412</td>
</tr>
<tr>
<td>Isocyanates, Reaction Product Of Polyol With Methylenebis(phenyl) Diisocyanate</td>
<td>150449-03-9</td>
<td></td>
<td>SELF CLASSIFICATION</td>
<td>Classification: Skin Sensitization Cat. 1B</td>
</tr>
</tbody>
</table>

Other proprietary and trace components. Each of the other components is present in less than 1 percent concentration (0.1% concentration for potential carcinogens, reproductive toxins, respiratory tract sensitizers, and mutagens). Balance | Classification: Not Applicable | Hazard Statement Codes: Not Applicable |

See Section 16 for full text of Ingredient Hazard and Precautionary Statements

PART II What should I do if a hazardous situation occurs?

4. FIRST-AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: Rescuers should not attempt to retrieve victims of exposure to this material without adequate personal protective equipment. Rescuers should be taken for medical attention, if necessary. Fire protective gear may be necessary.

DESCRIPTION OF FIRST AID MEASURES: Remove victim(s) to fresh air, as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Remove and isolate contaminated clothing and shoes. Seek immediate medical attention. Take copy of label and SDS to physician or other health professional with victim(s).

INHALATION: If mists, sprays or fumes of this material are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions.

SKIN EXPOSURE: If the material contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 20 minutes. Do not interrupt flushing. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If this product enters the eyes, open victim’s eyes while under gently running water. Use sufficient force to open eyelids. Have victim “roll” eyes. Minimum flushing is for 20 minutes. Do not interrupt flushing.

INGESTION: If this material is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING, unless directly by medical personnel. Have victim rinse mouth with water or give several cupfuls of water, if conscious. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain an open airway and prevent aspiration.
4. FIRST-AID MEASURES (Continued)

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions, skin and respiratory allergies and asthma may be aggravated by overexposure to this product.

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT IF NEEDED: Treat symptoms and eliminate overexposure. Be observant for pulmonary edema. Copiously irrigate contaminated skin and eyes with saline. Non-cardiogenic pulmonary edema and bronchospasm are the most immediate serious clinical consequences of isocyanate exposure. Markedly symptomatic patients should receive oxygen, ventilatory support, and an intravenous line. Treatment for asthma includes inhaled sympathomimetics (salbutamol, metaproterenol), intravenous theophylline, parenteral sympathomimetics (epinephrine, terbutaline), and steroids.

5. FIRE-FIGHTING MEASURES

FLASH POINT (TCC): 42.2°C (108°F)
AUTOIGNITION: Not determined.
FLAMMABLE LIMITS IN AIR: LEL: 1%  UEL: 7%
EXTINGUISHING MEDIA: Use materials appropriate for surrounding materials. Water should be used for cooling of containers only due to reaction with water. 
UNSUITABLE EXTINGUISHING MEDIA: Water and halogenated media.

PROTECTION OF FIREFIGHTERS:
SPECIAL HAZARDS ARISING FROM THE PRODUCT: This is a flammable liquid which is also toxic by inhalation and skin contact and so presents a contact hazard to fire-fighters. This compound reacts with water to form urea polymers, heat and carbon dioxide. Products of thermal decomposition are highly toxic (refer to Section 10 Stability and Reactivity). This reaction can be vigorous. Not sensitive to mechanical impact under normal conditions. Closed containers may develop pressure and rupture in event of fire or if contaminated with water and when exposed to the heat of a fire.

SPECIAL PROTECTIVE ACTIONS FOR FIREFIGHTERS: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move containers from fire area if it can be done without risk to personnel. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS AND EMERGENCY PROCEDURES: An accidental release may result in a fire. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. Use only non-sparking tools and equipment during the response. The atmosphere must at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus and fire protection. Avoid contact with water.

PERSONAL PROTECTIVE EQUIPMENT: Responders should wear the level of protection appropriate to the type of chemical released, the amount of the material spilled, and the location where the incident has occurred.

Small Spills: For releases of 1 drum or less, Level D Protective Equipment (gloves, chemical resistant apron, boots, and eye protection) should be worn.

Large Spills: Minimum Personal Protective Equipment should be rubber gloves, rubber boots, face shield, and Tyvek suit. Minimum level of personal protective equipment for releases in which the level of oxygen is less than 19.5% or is unknown must be Level B: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit, fire-retardant clothing and boots, hard hat, and Self-Contained Breathing Apparatus.

METHODS FOR CLEAN-UP AND CONTAINMENT:
All Spills: Access to the spill area should be restricted. Spread should be limited by gently covering the spill with polypads. Absorb spilled liquid with clay, sand, polypads, or other suitable inert absorbent materials. All contaminated absorbents and other materials should be placed in an appropriate container and seal. Do not mix with wastes from other materials. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations). Dispose of recovered material and report spill per regulatory requirements. Remove all residue before decontamination of spill area. Clean spill area with soap and copious amounts of water. Monitor area for combustible vapor levels and confirm levels are below exposure limits given in Section 8 (Exposure Controls-Personal Protection), if applicable, and that levels are below applicable LELs (see Section 5 – Fire Fighting Measures) before non-response personnel are allowed into the spill area. Purge equipment with inert gas prior to reuse.

ENVIRONMENTAL PRECAUTIONS: Minimize use of water to prevent environmental contamination. Prevent spill or rinsate from contaminating storm drains, sewers, soil or groundwater. Place all spill residues in a suitable container and seal. Do not discharge effluent containing this product into streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

OTHER INFORMATION: U.S. regulations may require reporting of spills of this material that reach surface waters if a sheen is formed. If necessary, the toll-free phone number for the US Coast Guard National Response Center is 1-800-424-8802.

REFERENCE TO OTHER SECTIONS: See information in Section 8 (Exposure Controls – Personal Protection) and Section 13 (Disposal Considerations) for additional information.
PART III

How can I prevent hazardous situations from occurring?

7. HANDLING and STORAGE

PRECAUTIONS FOR SAFE HANDLING: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat or drink while handling this material. Avoid contact with eyes, skin, and clothing. Avoid breathing fumes, vapors or mist. Do not taste or swallow. Use only with adequate ventilation. Wash hands after handling this product. Contaminated clothing needs to be laundered prior to reuse. Keep away from heat and flame. In the event of a spill, follow practices indicated in Section 6: ACCIDENTAL RELEASE MEASURES.

CONDITIONS FOR SAFE STORAGE: Keep container tightly closed when not in use. Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Containers should be separated from oxidizing materials by a minimum distance of 20 ft. or by a barrier of non-hazardous materials. Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged. Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged. Empty containers may contain residual product; therefore, empty containers should be handled with care. Store container below 25°C (77°F) to avoid possible reactions related to heat and overpressure of containers.

PRODUCT USE: This product is used as a urethane activator. Follow all industry standards for use of this product.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/CONTROL PARAMETERS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below.

VENTILATION AND ENGINEERING CONTROLS:

EXPOSURE LIMITS/GUIDELINES:

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS #</th>
<th>Guideline</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Butanediol</td>
<td>109-82-4</td>
<td>ACGIH TLV TWA</td>
<td>0.05 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL TWA</td>
<td></td>
</tr>
<tr>
<td>Crystalline Silica/Quartz/Cristobalite</td>
<td>14085-60-7</td>
<td>ACGIH TLV TWA</td>
<td>0.025 mg/m³ Respirable Fraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA</td>
<td>30 mg/m³ / % SiO₂ + 2 Total Dust; 10 mg/m³ / % SiO₂ + 2 Respirable Fraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL TWA</td>
<td>0.05 mg/m³ Respirable Dust</td>
</tr>
<tr>
<td>Diphenylmethane-2,4-Disocyanate</td>
<td>5873-54-1</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>Diphenylmethane 4,4'-Disocyanate</td>
<td>101-68-8</td>
<td>ACGIH TLV TWA</td>
<td>0.005 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL STEL</td>
<td>0.02 ppm (ceiling)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL STEL</td>
<td>0.005 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH IDLH</td>
<td>0.02 ppm (ceiling) 15 minutes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK TWA</td>
<td>75 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK PEAK</td>
<td>0.05 ppm (inhaleable fraction)</td>
</tr>
<tr>
<td>Isocyanates, Reaction Product of Polyol with Methylene-diphenyl Diisocyanate</td>
<td>150449-03-9</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>Kaolin</td>
<td>1332-5-7</td>
<td>ACGIH TLV TWA</td>
<td>2 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA</td>
<td>15 mg/m³ (total dust); 5 mg/m³ (respirable fraction)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL TWA</td>
<td>10 mg/m³ (total dust); 5 mg/m³ (respirable fraction)</td>
</tr>
<tr>
<td>Mica</td>
<td>12001-26-2</td>
<td>ACGIH TLV TWA</td>
<td>3 mg/m³ respirable fraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA</td>
<td>20 mppcf (&lt;1% crystalline silica); vacated 1989 PEL: 3 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL TWA</td>
<td>3 mg/m³ (respirable dust containing &lt; 1% quartz)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH IDLH</td>
<td>1500 mg/m³</td>
</tr>
<tr>
<td>Naphtha Petroleum Hydrotreated Light</td>
<td>64742-47-8</td>
<td>DFG MAK TWA</td>
<td>140 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK PEAK</td>
<td>10 mg/m³ PEAK</td>
</tr>
<tr>
<td>Polyether Diol</td>
<td>25322-69-4</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>Polyalkylene Glycol</td>
<td>9903-11-6</td>
<td>NE</td>
<td>NE</td>
</tr>
<tr>
<td>Pseudocumene</td>
<td>95-63-6</td>
<td>ACGIH TLV TWA</td>
<td>25 ppm (mixed isomers)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA</td>
<td>25 ppm (vacated 1989 PEL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL TWA</td>
<td>25 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK TWA</td>
<td>20 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK PEAK</td>
<td>10 mg/m³ PEAK</td>
</tr>
<tr>
<td>Tale</td>
<td>14807-96-6</td>
<td>ACGIH TLV TWA</td>
<td>2 mg/m³ respirable fraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA/STEL</td>
<td>20 mppcf (containing &lt; 1% quartz)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NIOSH REL TWA</td>
<td>2 mg/m³ and &lt; 1% quartz respirable fraction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK TWA</td>
<td>1.5 mg/m³ respirable fraction</td>
</tr>
<tr>
<td>Toluene-2,4-Disocyanate</td>
<td>584-84-9</td>
<td>ACGIH TLV TWA</td>
<td>0.005 ppm (NIC: 0.001), Sensitizer</td>
</tr>
<tr>
<td>2,6-Disocyanate</td>
<td>91-08-7</td>
<td>ACGIH TLV STEL</td>
<td>0.02 ppm (NIC: 0.003), Sensitizer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL STEL</td>
<td>0.02 ppm (ceiling) (CAS# 584-84-9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DFG MAK TWA</td>
<td>Danger of Sensitization of the airways</td>
</tr>
<tr>
<td>Titanium Dioxide</td>
<td>13463-67-7</td>
<td>ACGIH TLV TWA</td>
<td>10 mg/m³</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OSHA PEL TWA</td>
<td>15 mg/m³</td>
</tr>
</tbody>
</table>

NE = Not Established. See Section 16 for Definitions of Terms Used.
8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)


EYE/FACE PROTECTION: Use approved safety goggles or safety glasses. If necessary, refer to appropriate regulations.

SKIN PROTECTION: Wear chemical impervious gloves (e.g., Nitrile or Neoprene). Use triple gloves for spill response. If necessary, refer to appropriate regulations.

BODY PROTECTION: Use body protection appropriate for task (e.g., lab coat, coveralls, Tyvek suit). Full-body chemical protection may be necessary. If necessary, refer to the OSHA Technical Manual (Section VII: Personal Protective Equipment) or appropriate Standards of Canadian. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee’s feet may be exposed to electrical hazards, use foot protection, as described in appropriate regulations.

RESPIRATORY PROTECTION: If masks or sprays from this product are created during use, use appropriate respiratory protection. If necessary, use only respiratory protection authorized in appropriate regulations. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure-demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under appropriate regulations. The following NIOSH respiratory equipment guidelines for components that present an inhalation hazard are presented for additional assistance in respiratory protective equipment selection.

4.4-DIPHENYLMETHANE DIISOCYANATE

**CONCENTRATION** | **RESPIRATORY PROTECTION**
--- | ---
Up to 0.5 mg/m³ | Any Supplied-Air Respirator (SAR).
Up to 1.25 mg/m³ | Any SAR operated in a continuous-flow mode.
Up to 2.5 mg/m³ | Any Self-Contained Breathing Apparatus with a full facepiece, or any SAR with a full facepiece.
Up to 7.5 mg/m³ | Any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode is sufficient protection. If a hazard of injury to the face exists due to falling objects, rolling objects, where objects may pierce the face, or where employee’s face may be exposed to electrical hazards, use face protection, as described in appropriate regulations.

Escape: Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type, SCBA.

**NAPHTHAS**

**CONCENTRATION** | **RESPIRATORY PROTECTION**
--- | ---
Up to 1000 mg/m³ | Any Chemical Cartridge Respirator with organic vapor cartridge(s), or any Supplied-Air Respirator (SAR), or any SAR operated in a continuous-flow mode, or any Powered, Air-Purifying Respirator (PAPR) with organic vapor cartridge(s).
Up to 5000 mg/m³ | Any Chemical Cartridge Respirator with a full facepiece and organic vapor cartridge(s), or any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any PAPR with a tight-fitting facepiece and organic vapor cartridge(s), or any Self-Contained Breathing Apparatus with a full facepiece, or any SAR.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR 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 pressure-demand or other positive-pressure mode.

Escape: Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, SCBA.

**2,4-TOLUENE DIISOCYANATE**

**CONCENTRATION** | **RESPIRATORY PROTECTION**
--- | ---
Based on NIOSH REL at Concentrations Above the NIOSH REL, or Where There is No REL, at Any Detectable Concentration: Any Self-Contained Breathing Apparatus (SCBA) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any Supplied-Air Respirator (SAR) 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 pressure-demand or other positive-pressure mode.

Escape: Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, SCBA.

9. PHYSICAL and CHEMICAL PROPERTIES

**FORM:** Viscous liquid.

**MOLECULAR WEIGHT:** Mixture.

**ODOR:** Characteristic of isocyanates.

**SPECIFIC GRAVITY:** 1.2

**PERCENT VOLATILE BY VOLUME:** 12-22%

**FLASH POINT (TCC):** 42.2°C (108°F)

**WATER SOLUBILITY:** Negligible, may react.

**OTHER SOLUBILITIES:** Not available.

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not available.

**MELTING POINT:** Not available.

**HOW TO DETECT THIS SUBSTANCE (WARNING PROPERTIES):** The appearance and odor of this product may act as warning properties in the event of an accidental release.

**VOC (less water and exempt):** <225 g/L

10. STABILITY and REACTIVITY

**CHEMICAL STABILITY:** Stable under normal circumstances of use and handling. May become unstable if stabilizer becomes depleted. At high temperatures the isocyanate components of this product can form carbodiimides with the release of carbon dioxide, which can cause pressure build up in closed containers.

**CONDITIONS TO AVOID:** Avoid contact with incompatible chemicals and exposure to extreme temperatures.

**INCOMPATIBLE MATERIALS:** Based on components, this product may be incompatible with amines, water, strong bases, alcohols, copper alloys, zinc, tin and aluminum compounds.
10. STABILITY and REACTIVITY (Continued)


POSSIBILITY OF HAZARDOUS REACTIONS: This product may undergo hazardous polymerization in contact with water or materials to which it is incompatible. The reaction may produce heat, carbon dioxide and urea polymers; reaction may be vigorous. Containers may rupture. Due to the high level of the Polyether Diiol components, this product may form unstable or flammable peroxides on prolonged exposure to air if stabilizer is depleted.

PART IV Is there any other useful information about this material?

11. TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS: The most significant routes of occupational overexposure are inhalation and contact with skin and eyes. The symptoms of overexposure to this product are as follows:

CONTACT WITH SKIN OR EYES: Depending on the duration of skin contact, skin overexposures can cause reddening, discomfort and moderate to severe irritation. Prolonged or further contact can cause severe inflammation, redness, rash, swelling and blistering. Repeated skin exposure to low concentration can cause dermatitis. Skin contact can cause allergic reaction. Brief contact with the liquid or vapors from this product and the eyes can cause irritation, reddening and watering. Direct eye contact may cause severe eye irritation. The trace Diphenylmethane 4,4’-Diisocyanate is a very strong sensitizing agent in humans, as well as all the other diisocyanate components. Skin sensitization may occur after only one contact with. Brief contact with the liquid or vapors from this product and the eyes can cause irritation, reddening and watering. Permanent eye injury, including blindness, could result from direct contact with the liquid.

SKIN ABSORPTION: Prolonged skin contact may cause adverse systemic toxicity by skin absorption as described under ingestion or inhalation, as well as sensitization and allergic reaction to the skin.

INGESTION: If the product is swallowed, it can irritate the mouth, throat, and other tissues of the gastro-intestinal system or cause burns and may cause nausea, vomiting, and diarrhea. Symptoms can include dizziness, vomiting and incoordination. Ingestion of large amounts may be harmful and cause systemic toxicity. Aspiration into the lungs after ingestion can pose a serious hazard of chemical and pulmonary edema. Ingestion may be fatal.

INHALATION: Inhalation of vapors, mists, or sprays of this product can moderately to severely irritate the tissues of the nose, mouth, throat, and upper respiratory system. Symptoms of overexposure may include coughing, sneezing, and difficulty breathing. Severe overexposure via inhalation may result in a potentially fatal respiratory disorder (e.g., pulmonary edema, chemical pneumonitis); symptoms may be delayed by hours or even days. Inhalation of high concentrations of this product (as may occur in a poorly ventilated area) may be fatal. Repeated inhalation of mists of this product may cause respiratory disorders (e.g., bronchitis). Inhalation can also lead to adverse central nervous system effects, including dizziness, incoordination, nausea and vomiting. Chronic inhalation of low concentration may cause permanent damage to the lungs and reduced lung function. Effects such as euphoria, muscle incoordination and loss of consciousness may have been reported after severe exposure to toluene diisocyanates. Inhalation can cause respiratory sensitization and allergic reaction as described further in this Section. Respiratory sensitization and lung damage may be permanent.

INJECTION: Accidental injection of this product (e.g. puncture with a contaminated object) may cause burning, redness, and swelling in addition to the wound.

TARGET ORGANS: Acute: Skin, eyes, respiratory system. Chronic: Skin, respiratory system, neurological system.

TOXICITY DATA: There are currently no toxicity data available for this product; the following toxicity data are available for components greater than 1% in concentration.

1,4-BUTANEDIOL

TDLo (Oral-Human) 10 mg/kg: Behavioral: sleep
TDLo (Oral-Man) 42.8 mg/kg: Behavioral: convulsions or effect on seizure threshold, coma
TDLo (Rectal-Man) 429 mg/kg
TDLo (Unopened-Woman) 0.001 mg/kg: Behavioral: altered sleep time (including change in righting reflex)
LD30 (Oral-Rat) 1525 mg/kg
LD50 (Oral-Rat) 1525 mg/kg: Behavioral: altered sleep time (including change in righting reflex), somnolence (general depressed activity); Blood: other changes
LD50 (Oral-Mouse) 2062 mg/kg: Behavioral: altered sleep time (including change in righting reflex), somnolence (general depressed activity); Blood: other changes
LD50 (Oral-Mouse) 2062 mg/kg
LD50 (Oral-Rabbit) 2531 mg/kg: Behavioral: altered sleep time (including change in righting reflex), somnolence (general depressed activity); Blood: other changes
LD50 (Oral-Guinea Pig) 1200 mg/kg
LD50 (Oral-Guinea Pig) 1200 mg/kg: Behavioral: altered sleep time (including change in righting reflex), somnolence (general depressed activity); Blood: other changes
LD50 (Intraperitoneal-Rat) 1070 mg/kg
LD50 (Intraperitoneal-Mouse) 1650 mg/kg
LD50 (Oral-Rat) 500 mg/kg: Peripheral Nerve and Sensation: recording from peripheral motor nerve: Behavioral: ataxia; Vascular: other changes
LD50 (Oral-Rat) 14 gm/kg/28 days: Blood: other changes; Biochemical: Enzyme induction, inhibition, or change in blood or tissue levels: dehydrogenases, other transferases
LD50 (Oral-Rat) 5460 mg/kg/26 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholesterae; Metabolism (intermediary): other carbohydrates
LD50 (Oral-Mouse) 250 mg/kg: Lungs, Thorax, or Respiration: changes in pulmonary vascular resistance, respiratory depression; Gastrointestinal: other changes
LD50 (Oral-Monkey) 56 mg/kg: Behavioral: food intake (animal), alteration of classical conditioning
LD50 (Oral-Monkey) 180 mg/kg: Behavioral: tremor, ataxia; Gastrointestinal: nausea or vomiting
LD50 (Oral-Monkey) 240 mg/kg: Behavioral: somnolence (general depressed activity), muscle weakness
LD50 (Intraperitoneal-Rat) 32 mg/kg: Behavioral: changes in psychophysiological tests
LD50 (Intraperitoneal-Rat) 178 mg/kg: Behavioral: alteration of operant conditioning
LD50 (Intraperitoneal-Rat) 250 mg/kg: Behavioral: ataxia
LD50 (Intraperitoneal-Rat) 36,960 mg/kg/6 weeks-intermittent: Behavioral: tolerance, alteration of operant conditioning
POLYALKYNE GLYCOL:
LD₅₀ (Oral-Rat) 5700 mg/kg: Behavioral: somnolence (general depressed activity);
Gastrointestinal: hypermotility, diarrhea

LD₅₀ (Oral-Mouse) 3 gm/kg: Behavioral: somnolence (general depressed activity);
Gastrointestinal: hypermotility, diarrhea

TDL₀ (Skin-Rat) 130 gm/kg/13 weeks- intermittent: Liver: changes in liver weight;
Kidney/Urinary Bladder: changes in bladder glycol polymers

POLYETHER DIOL:
LD₅₀ (Oral-Rat) > 4000 mg/kg
LD₅₀ (Skin-Rabbit) > 200 mg/kg
LC₅₀ (Inhalation-Rat) > 200 mg/L 1 hour

PSEUDOCUMENE:
LD₅₀ (Oral-Rat) 5 gm/kg
LD₅₀ (Oral-Mouse) 6900 mg/kg

LD₅₀ (Intraperitoneal-Rat) 5 mL/kg: Lungs, Thorax, or Respiration: other changes;
Vascular: regional or general arteriolar or venous dilation

TD (Intraperitoneal-Rat) 100 mg/kg: Tumorigenic: equivocal tumorigenic agent by RTECS criteria;
Blood: lymphoma, including Hodgkin's disease

TD (Intraperitoneal-Rat) 100 ppm/24 hours: Behavioral: changes in motor activity (specific assay), analogesia, alteration of operant conditioning
TD (Intraperitoneal-Rat) 20 mg/mL/16 weeks-continuous: Kidney/Urinary Bladder: other changes in urine composition
Sister Chromatid Exchange (Intraperitoneal-Mouse) 900 mg/kg

Talc:
Standard Dazed Test (Skin-Human) 300 µg/cm²- days- intermittent: Mld

TCI (Inhalation-Rat) 17 mg/66 hours/26 days- intermittent: Lungs, Thorax, or Respiration: other changes

TCI (Inhalation-Rat) 18 mg/66 hours/2 years- intermittent: Tumorigenic: carcinogenic by RTECS criteria; Lungs, Thorax, or Respiration: bronchogenic carcinoma; Endocrine: tumors

TCI (Inhalation-Rat) 11 mg/1 year- intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Lungs, Thorax, or Respiration: tumors

TCI (Inhalation-Mouse) 20,400 µg/m³/66 hours/26 days- intermittent: TITANIUM DIOXIDE:
Standard Dazed Test (Skin-Human) 300 µg/cm²- days- intermittent: Mld

TCI (Inhalation-Rat) 10/18 kg/16 weeks- intermittent: Tumorigenic: carcinogenic by RTECS criteria; Lungs, Thorax, or Respiration: tumors

LD (Intraperitoneal-Rat) > 100 µg/kg: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi;
Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other Enzymes

TD (Intramuscular-Rat) 260 mg/kg/8 weeks- intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Blood: lymphoma, including Hodgkin's disease; Tumorigenic: tumors at site of application

TD₅₀ (Oral-Rat) 60 µg/kg: Gastrointestinal: hypermotility, diarrhea, other changes
TD₅₀ (Intramuscular-Rat) 360 µg/kg/2 years- intermittent: Tumorigenic: neoplastic by RTECS criteria;
Blood: lymphoma, including Hodgkin's disease; Tumorigenic: tumors at site of application

TD₅₀ (Intratracheal-Rat) 1.25 mg/kg: Vascular: regional or general arteriolar constriction; Lungs, Thorax, or Respiration: other changes

TD₅₀ (Intratracheal-Rat) 1.6 mg/kg: Lungs, Thorax, or Respiration: other changes

TD₅₀ (Intratracheal-Rat) 5 mg/kg: Lungs, Thorax, or Respiration: other changes;
Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other Enzymes

TD₅₀ (Intratracheal-Mouse) 100 mg/kg: Tumorigenic: increased incidence of tumors in susceptible strains

TCI (Inhalation-Rat) 1 mg/kg: Lungs, Thorax, or Respiration: other changes;
Biochemical: Metabolism (Intermediary): effect on inactivation or mediation of inflammation

TCI (Inhalation-Rat) 250 mg/66 hours/4 weeks- intermittent: Lungs, Thorax, or Respiration: chronic pulmonary edema, other changes

TCI (Inhalation-Rat) 50 mg/66 hours/13 weeks- intermittent: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi

TCI (Inhalation-Rat) 10 mg/66 hours/13 weeks- intermittent: Lungs, Thorax, or Respiration: fibrosis (interstitial), other changes;
Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other Enzymes

TCI (Inhalation-Rat) 5 mg/66 hours/2 years- intermittent: Lungs, Thorax, or Respiration: other changes;
Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other Enzymes
11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

**TITANIUM DIOXIDE (continued):**

<table>
<thead>
<tr>
<th>TDI (Inhalation-Mouse)</th>
<th>10 mg/m³/13 weeks-intermittent: Lungs, Thorax, or Respiration: other changes; Biochemical: Metabolism (Intermediary): effect on inflammation or mediation of inflammation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDI (Inhalation-Mouse)</td>
<td>50 mg/m³/13 weeks-intermittent: Lungs, Thorax, or Respiration: sputum; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases</td>
</tr>
<tr>
<td>TDI (Inhalation-Mouse)</td>
<td>250 mg/m³/13 weeks-intermittent: Lungs, Thorax, or Respiration: sputum; Blood: changes in cell count (unspecified); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases</td>
</tr>
<tr>
<td>TDI (Inhalation-Hamster)</td>
<td>250 mg/m³/13 weeks-intermittent: Lungs, Thorax, or Respiration: sputum; Blood: changes in cell count (unspecified); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: dehydrogenases</td>
</tr>
<tr>
<td>TDI (Inhalation-Hamster)</td>
<td>250 mg/m³/6 hours/13 weeks-intermittent: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi</td>
</tr>
<tr>
<td>DNA Damage (Human Lung)</td>
<td>20 µg/disk/4 hours</td>
</tr>
<tr>
<td>DNA Damage (Human Lung)</td>
<td>20 µg/disk/4 hours</td>
</tr>
<tr>
<td>Sister Chromatid Exchange (Human Lymphocyte)</td>
<td>2 µmol/L/72 hours</td>
</tr>
<tr>
<td>Micronucleus Test (Human Lymphocyte)</td>
<td>5 µmol/L/72 hours</td>
</tr>
<tr>
<td>Micronucleus Test (Intratracheal-Mouse)</td>
<td>3 µg/kg/3 days-continuous, Lungs, Thorax, or Respiration: other changes</td>
</tr>
<tr>
<td>DNA Inhibition (Hamster Lung)</td>
<td>500 mg/L</td>
</tr>
<tr>
<td>Sister Chromatid Exchange (Hamster Ovary)</td>
<td>1 µmol/L</td>
</tr>
</tbody>
</table>

**2,4-TOLUENE DIISOCYANATE:**

| Open Irritation Test (Skin-Rabbit) | 500 mg: Severe |
| Standard Draize Test (Skin-Rabbit) | 500 mg/24 hour: Moderate |
| Standard Draize Test (Eye-Rabbit) | 100 mg: Severe |
| TDI (Inhalation-Woman) | 300 pg/ml/8 hours/5 days: Lungs, Thorax, or Respiration: respiratory obstruction |
| TCI (Inhalation-Human) | 20 pg/ml/2 years: Lungs, Thorax, or Respiration: cough, sputum |
| TCI (Inhalation-Human) | 500 ppb: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified; Lungs, Thorax, or Respiration: other changes |
| TCI (Inhalation-Human) | 500 ppb: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified; Sense Organs and Special Senses (Eye): effect, not otherwise specified; Lungs, Thorax, or Respiration: other changes |
| LC₅₀ (Inhalation-Rat) | 14 ppm/4 hours: Lungs, Thorax, or Respiration: other changes |
| LC₅₀ (Inhalation-Rabbit) | 11 ppm/4 hours: Behavioral: excitement; Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: changes in structure or function of salivary glands |
| LD₅₀ (Oral-Rat) | 6.17 mg/kg |
| LD₅₀ (Oral-Rat) | 500 mg/kg/3 days |
| LD₅₀ (Oral-Rat) | 1.7 mg/kg/17 days |
| LD₅₀ (Oral-Rabbit) | 100 mg: Severe |
| Toluene 2,4 & 2,6 Isocyanates | 2B No No Ca A4 No Yes (airborne unbound particles of respirable size) |

**2,4-TOLUENE DIISOCYANATE (continued):**

| TDI (Skin-Mouse) | 800 mg/kg/4 days-intermittent: Immunological Including Allergic: increased immune response; Biochemical: Metabolism (Intermediary): effect on inflammation or mediation of inflammation |
| TDI (Skin-Mouse) | 15 mg/kg/3 days-intermittent: Skin and Appendages: cutaneous sensitization; experimental (after topical exposure); Biochemical: Metabolism (Intermediary): effect on inflammation or mediation of inflammation |
| TDI (Skin-Mouse) | 240 mg/kg/28 days-intermittent: Immunological Including Allergic: increase in humoral immune response |
| TDI (Skin-Mouse) | 0.03 mg/L/kg/3 days-intermittent: Skin and Appendages: cutaneous sensitization; experimental (after topical exposure) |
| TDI (Skin-Mouse) | 1.8 µL/kg/3 days-intermittent: Skin and Appendages: cutaneous sensitization; experimental (after topical exposure) |
| TDI (Skin-Mouse) | 18 µL/kg/17 days-intermittent: Skin and Appendages: cutaneous sensitization, experimental (after topical exposure) |
| TDI (Skin-Mouse) | 18.2 µL/kg/31 days-intermittent: Skin and Appendages: cutaneous sensitization, experimental (after topical exposure) |
| TDI (Skin-Mouse) | 7.2 mg/kg/6 days-intermittent: Skin and Appendages: cutaneous sensitization, experimental (after topical exposure) |

**CARCINOGENIC POTENTIAL:**

The following table summarizes the carcinogenicity listing for the components of this product.

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>IARC</th>
<th>EPA</th>
<th>NTP</th>
<th>NIOSH</th>
<th>ACGIH</th>
<th>OSHA</th>
<th>PROP 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystalline Silica/Quartz &amp; Cristobalite</td>
<td>1</td>
<td>No</td>
<td>K (respirable fraction)</td>
<td>Ca</td>
<td>A2</td>
<td>No</td>
<td>Yes (airborne unbound particles of respirable size)</td>
</tr>
<tr>
<td>1,4-Butadiene</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Kaolin</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>A4</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Limestone/Calcium Carbonate</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<td>No</td>
<td>No</td>
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<td>Mica</td>
<td>No</td>
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<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Naphtha Petroleum Hydrotreated Light</td>
<td>3</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<td>No</td>
</tr>
<tr>
<td>Polyether Diol</td>
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<td>No</td>
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<tr>
<td>Pseudocumene</td>
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<td>No</td>
<td>No</td>
<td>No</td>
<td>A4</td>
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<tr>
<td>Talc</td>
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<td>No</td>
<td>No</td>
<td>A4</td>
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<td>No</td>
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<tr>
<td>Titanium Dioxide</td>
<td>2B</td>
<td>No</td>
<td>No</td>
<td>Ca</td>
<td>A4 (NIC: A3)</td>
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<td>No</td>
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<tr>
<td>Toluene 2,4 &amp; 2,6-Disocyanates</td>
<td>2B</td>
<td>No</td>
<td>No</td>
<td>Ca</td>
<td>A4 (NIC: A3)</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

11. TOXICOLOGICAL INFORMATION (Continued)

IRRITANT OF PRODUCT: This product is irritating by all routes of exposure.

SENSITIZATION TO THE PRODUCT: This product contains diisocyanate compounds, which are known human skin and respiratory sensitizers. Exposure can cause allergic reactions. Cross-sensitization between different isocyanates may occur. Skin sensitization may occur after only a few days working with products containing 4,4’-Diphenylmethane Diisocyanate. Onset of symptoms is usually delayed. Symptoms include a rash on the hands, arms, neck, face, chest or abdomen, even when contact occurs with a small amount of product. Other effects such as coughing, a burning sensation in the throat or redness and swelling of the eyes might also occur.

Respiratory Sensitization: Initial symptoms of respiratory reactions may appear to be a cold or mild hay fever. However, severe asthmatic symptoms can develop and include wheezing, chest tightness, shortness of breath, difficulty breathing and/or coughing. Fever, chills, general feelings of discomfort, headache, and fatigue can also occur. Symptoms may occur immediately upon exposure (within an hour), several hours after exposure or both, and/or at night. Typically, the asthma improves with removal from exposure (e.g. weekends or vacations) and returns, in some cases, in the form of an "acute attack", on renewed exposure. Sensitized people who continue to work with diisocyanates may develop symptoms sooner after each exposure. The number and severity of symptoms may increase. Death has occurred in sensitized individuals accidentally exposed to relatively low concentrations of some diisocyanates. Following removal from exposure, some sensitized workers may continue to show a slow decline in lung function and have persistent respiratory problems such as asthmatic symptoms, chronic bronchitis and hypersensitivity for months or years. Exposure to isocyanates is likely to aggravate existing respiratory disease, such as chronic bronchitis, and emphysema.

Skin Sensitization: Repeated skin contact with diisocyanates has caused skin sensitization in humans, although the condition is not common. Once a person is sensitized, contact with even a small amount can cause outbreaks of dermatitis with symptoms such as redness, rash, itching and swelling. This can spread from the hands or arms to the face and body. Some people who have inhaled some diisocyanates developed extensive skin rashes can last weeks.

TOXICOLOGICAL SYNERGISTIC PRODUCTS: None known.

REPRODUCTIVE TOXICITY INFORMATION: This product has not been tested for reproductive toxicity.

Mutagenicity: Based on potential benzene content, the Naphtha Petroleum Hydrotreated Light component is assumed to have mutagenic properties.

No specific data was found.

Embryotoxicity/Teratogenicity: No birth defects were seen in two independent animal (rat) studies involving the Diphenylmethane 4,4’-Diisocyanate compound. Fetotoxicity was observed at doses that were extremely toxic (including lethal) to the mother. Fetotoxicity was not observed at doses that were not maternally toxic. The doses used in these studies were maximal, respirable concentrations well in excess of the defined occupations limits. Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Maternal Effects: Other effects. Specific Developmental Abnormalities: Musculoskeletal system.

BIOLOGICAL EXPOSURES INDICES (BEIs): Currently, there are no BEI’s established for components of this product.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

MOBILITY: This product has not been tested for mobility in soil. The following information is available for the toluene diisocyanate components.

2,4-TOLUENE DIISOCYANATE: 2,4-Toluene Diisocyanate hydrolyzes rapidly in aqueous solution; therefore, leaching and adsorption to sediment will not be environmentally important.

2,6-TOLUENE DIISOCYANATE: 2,6-Toluene Diisocyanate reacts readily with water; therefore, leaching of 2,6-toluene diisocyanate in soil should not be important.

PERSISTENCE AND BIODEGRADABILITY: This product has not been tested for persistence or biodegradability. The following information is available for the toluene diisocyanate components.

2,4-TOLUENE DIISOCYANATE: If released to air, a vapor pressure of 8x10^-3 mm Hg at 25°C indicates 2,4-toluene Diisocyanate will exist solely as a vapor in the ambient atmosphere. Vapor-phase 2,4-toluene Diisocyanate will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 1.7 days. Atmospheric degradation may also occur through contact with clouds, fog or rain. If released to water or moist soil, 2,4-toluene Diisocyanate is not expected to leach or adsorb to solids due to its rapid degradation reaction with water. 2,4-Toluene Diisocyanate is not expected to volatilize from dry soil surfaces based upon its vapor pressure. If spilled on wet land, TDI is rapidly degraded. If released into water, a crust forms around the liquid TDI and >0.5% of the original material remains after 35 days. Low concentrations of TDI hydrolyze in the aqueous environment in approximately a day.

2,6-TOLUENE DIISOCYANATE: If released to air, a vapor pressure of 0.02 mm Hg at 25°C indicates 2,6-Toluene Diisocyanate will exist solely as a vapor in the ambient atmosphere. Vapor-phase 2,6-Toluene Diisocyanate will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 2.5 days. Atmospheric degradation may also occur through contact with clouds, fog or rain. If released to moist soil, 2,6-Toluene Diisocyanate is not expected to leach or adsorb to solids due to rapid degradation reaction with water. In one experiment simulating a spill, 5.5% of the original material remained after 24 hours and in a field situation; the concentration of TDI had declined to the ppm level in 12 weeks. If released to water, 2,6-Toluene Diisocyanate is not expected to leach or adsorb to solids due to its rapid degradation reaction with water. If released into water in a spill situation, a crust forms around the liquid TDI mixture and >0.5% of the original material remains after 35 days. Low concentrations of TDI hydrolyze in the aqueous environment in approximately a day.

BIO-ACCUMULATION POTENTIAL: This product has not been tested for bio-accumulation potential. The following information is available for the toluene diisocyanate components.

2,4-TOLUENE DIISOCYANATE: 2,4-Toluene Diisocyanate hydrolyzes rapidly in aqueous solution; therefore, bioconcentration will not be environmentally important.

2,6-TOLUENE DIISOCYANATE: 2,6-Toluene Diisocyanate decomposes in water; therefore, bioconcentration in aquatic organisms is not expected to be an important environmental fate process.

ECOTOXICITY: This product has not been tested for aquatic or animal toxicity. The following aquatic toxicity data are available for the toluene diisocyanate components.

2,4-TOLUENE DIISOCYANATE: LC50 (fathead minnow) 24 hours = 194.9 mg/L; LC50 (fathead minnow) 48 hours = 172.1 mg/L; LC50 (fathead minnow) 96 hours = 164.5 mg/L; TLm (fathead minnow) 96 hours = 10-1 ppm (est.);

2,6-TOLUENE DIISOCYANATE: LC50 (Pimephales promelas fathead minnow) 24 hours = 195 mg/L; Conditions of bioassay not specified.

OTHER ADVERSE EFFECTS: This material is not expected to have any ozone depletion potential.

ENVIRONMENTAL EXPOSURE CONTROLS: Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: As supplied, this product would be a hazardous waste as defined by U.S. federal regulation (40 CFR 261) if discarded or disposed. It has the characteristic of Ignitibility. State and local regulations may differ from federal regulations. The generator of the waste is responsible for proper waste determination and management.

U.S. EPA WASTE NUMBER: D001.
14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION: This product is classified as Dangerous Goods, per U.S. DOT regulations, under 49 CFR 172.101.

UN IDENTIFICATION NUMBER: UN 1263
PROPER SHIPPING NAME: Paint, flammable liquid
HAZARD CLASS NUMBER and DESCRIPTION: 3 (Flammable)
PACKING GROUP: PG III
DOT LABEL(S) REQUIRED: Class 3 (Flammable)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2012): 127

MARINE POLLUTANT: The components of this product are not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101).

Note: If non bulk packages (119 gallons or less) are shipped by ground domestically, this product is not regulated under DOT’s Hazardous Material Regulations so non-bulk packages of it ship via ground domestically as a non-hazardous material.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This product is classified as Dangerous Goods, per regulations of Transport Canada.

UN IDENTIFICATION NUMBER: UN 1263
PROPER SHIPPING NAME: Paint, flammable liquid
HAZARD CLASS NUMBER: 3 (Flammable)
PACKING GROUP: PG III

SPECIAL PROVISIONS: 59, 83
EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX: None
PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX: 60

INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA): This product is classified as dangerous goods, per the International Air Transport Association.

UN IDENTIFICATION NUMBER: UN 1263
PROPER SHIPPING NAME: Paint, flammable liquid
HAZARD CLASS NUMBER: 3 (Flammable)
PACKING GROUP: III

LIMITED QUANTITIES: E1
PASSENGER and CARGO AIRCRAFT PACKING INSTRUCTION: 355
PASSENGER and CARGO AIRCRAFT MAXIMUM NET QUANTITY PER PKG: 10 L
PASSENGER and CARGO AIRCRAFT LIMITED QUANTITY PACKING INSTRUCTION: Y344
PASSENGER and CARGO AIRCRAFT LIMITED QUANTITY MAXIMUM NET QUANTITY PER PKG: 60 L
CARGO AIRCRAFT ONLY PACKING INSTRUCTION: 364
CARGO AIRCRAFT ONLY MAXIMUM NET QUANTITY PER PKG: 220 L

SPECIAL PROVISIONS: A3, A72
ERG CODE: 3L

INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO): This product is classified as dangerous goods, per the International Maritime Organization.

UN No.: 1263
PROPER SHIPPING NAME: Paint, flammable liquid
HAZARD CLASS NUMBER: 3 (Flammable)
LABELS: Class 3 (Flammable)
PACKING GROUP: III
LIMITED QUANTITIES: 5 L
EXCEPTED QUANTITIES: E1
Packing:

IBC's: Instructions: P001, LP01; Provisions: P11
TANKS: Instructions: T2, Provisions: T1, TP29

EmS: F-E, S-E
STOWAGE CATEGORY: Category A.

MARINE POLLUTANT: No component of this product is designated by the IMO to be a Marine Pollutant.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The following components of this product are subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

<table>
<thead>
<tr>
<th>CHEMICAL</th>
<th>SECTION 302 EHS (TPQ) (40 CFR 355, Appendix A)</th>
<th>SECTION 304 RQ (40 CFR Table 302.4)</th>
<th>SECTION 313 TRI (threshold) (40 CFR 372.65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymeric Diphenylmethane Diisocyanate</td>
<td>No</td>
<td>No</td>
<td>Yes (Code N120)</td>
</tr>
<tr>
<td>Pseudocumene</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2,4-Toluene Diisocyanate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2,6-Toluene Diisocyanate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

U.S. SARA 302 EXTREMELY HAZARDOUS THRESHOLD PLANNING QUANTITY (TPQ): 2,4-Toluene Diisocyanate: 500 lb (227 kg); 2,6-Toluene Diisocyanate: 100 lb (454 kg)

U.S. SARA 304 EXTREMELY HAZARDOUS REPORTABLE QUANTITY (RQ): 2,4-Toluene Diisocyanate: 100 lb (454 kg); 2,6-Toluene Diisocyanate: 100 lb (454 kg)
15. REGULATORY INFORMATION (Continued)

ADDITIONAL U.S. REGULATIONS (continued):

kg)

U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21): ACUTE: Yes; CHRONIC: Yes; FIRE: No; REACTIVE: Yes; SUDDEN RELEASE: No

U.S. CERCLA REPORTABLE QUANTITY (RQ): 4'-Diphenylmethane Diisocyanate = 5000 lb (2270 kg); 2,4-Toluene Diisocyanate = 100 lb (45.4 kg); 2,6-Toluene Diisocyanate = 100 lb (45.4 kg). The Polymeric Diphenylmethane Diisocyanate component is a CERCLA Hazardous Substance, although no specific CERCLA RQ has been defined.

U.S. TSCA INVENTORY STATUS: All components of this product are in compliance with the inventory listing requirements of the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

U.S. CLEAN AIR ACT (CA 112) THRESHOLD QUANTITY (TQ): 2,4-Toluene Diisocyanate = 10,000 lb (4540 kg); 2,6-Toluene Diisocyanate = 10,000 lb (4540 kg). Although the Diphenylmethane 4,4-Diisocyanate compound has no TQ, it is listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems under the Clean Air Act.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): This product contains Crystalline Silica, a compound known to the State of California to Cause Cancer. It also contains Titanium Dioxide, a suspect carcinogen which is also on the list. WARNING! Due to the form of the product, the Proposition 65 warning is not applicable to these compounds in this product.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN WHMIS REGULATIONS: This product is classified as a Controlled Product, Hazard Classes, B2 (Flammable Liquid); D1A/D2A (Poisonous and Infectious Material, Other Effects/Very Toxic: Inhalation Toxicity, Teratogenicity and Embryotoxicity), D2B (Poisonous and Infectious Material, Other effects/Toxic: Skin Irritation) as per the Controlled Product Regulations.

ADDITIONAL MEXICAN REGULATIONS:

MEXICAN WORKPLACE REGULATIONS (NOM-018-STPS-2000): This product is classified as hazardous.

16. OTHER INFORMATION

U.S. ANSI STANDARD LABELING (Precautionary Statements): DANGER! FLAMMABLE LIQUID. TOXIC BY INHALATION. MAY CAUSE EYE, SKIN AND RESPIRATORY IRRITATION. CAN CAUSE SKIN AND RESPIRATORY SENSITIZATION AND ALLERGIC REACTION. CONTAINS COMPOUNDS THAT ARE SUSPECT CARCINOGENS. COMBUSTIBLE LIQUID. CONTAINS COMPOUNDS THAT CAN CAUSE HARM TO AQUATIC ORGANISMS. Avoid contact with eyes, skin, and clothing. Avoid breathing mist, vapors or fume. Do not taste or swallow. Wash thoroughly after handling. Keep container tightly closed. Use only with adequate ventilation. Keep away from heat and flame. Wear gloves, eye protection, respiratory protection, and appropriate body protection. FIRST-AID: In case of contact, immediately flush skin and eyes with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, do not induce vomiting. Get medical attention. IN CASE OF FIRE: Use water fog, dry chemical, or CO₂. IN CASE OF SPILL: Absorb spilled product with polypads or other suitable absorbing material. Place all spill residue in an appropriate container and seal. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations and those of Canada.

GLOBAL HARMONIZATION SYSTEM CLASSIFICATION:

Classification: Flammable Liquid Category 3, Carcinogenic Category 2, Germ Cell Mutagenic Category 2, Acute Inhalation Toxicity Category 2, Skin Irritation Category 2, Eye Irritation Category 2, STOT (Inhalation-Respiratory Irritation) Single Exposure Category 3, Respiratory Sensitizer Category 1, Skin Sensitization Category 1, Aquatic Chronic Toxicity Category 3

Signal Word: Danger


Precautionary Statements:


Disposal: P501: Dispose of contents/containers in accordance with all local, regional, national and international regulations.
16. OTHER INFORMATION (continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued)

Division 1.3: explosives. Explosives are flammable, unstable materials that either react extremely rapidly, usually by reason of self-heating or exposure to relatively high ambient temperatures before ignition can occur. Materials in this division would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres with air. This usually includes the following: Liquids having a flash-point at or above 37.8°C (100°F); Solid materials in the form of coarse dusts that may burn rapidly but that do not form a vaporizable mixture with air; Materials that will rapidly or completely vaporize at or above 37.8°C (100°F) (i.e. OSHA Class IB and IC); Materials that, when heated or exposed to relatively high ambient temperatures before ignition can occur. This usually includes the following: Liquids having a flash-point below 22.8°C (73°F) and a boiling point below 37.8°C (100°F) (i.e. OSHA Class IA and IB); Materials that, when heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this division produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions. This usually includes the following: Liquids having a flash-point below 22.8°C (73°F) and having a boiling point at 37.8°C (100°F) and those that are not appropriate. Dermal Toxicity LD₅₀: > 50-500 mg/kg. Dermal Toxicity LD₅₀: > 20-50 mg/kg. Dermal Toxicity LD₅₀: > 2 mg/L. Oral Toxicity LD₅₀: > 200-1000 mg/kg. Inhalation Toxicity LC₅₀: > 4 hrs Rat: > 5-10 mg/L. Inhalation Toxicity LC₅₀: > 2 mg/L. Draize: > 80 with effects irreversible in 21 days. Draize > 80 with effects irreversible in 21 days. Draize: > 80 with effects irreversible in 21 days. Draize > 80 with effects irreversible in 21 days.
DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued): Explosion hazard. Compressed Gases: Pressure ≥ 857 psig absolute at 70°F (21°C) [500 psig]. Pyrophoric: No Rating. Oxidizers: Packing Group I Oxidizers. Solids: any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3.2 potassium bromate/cellulose mixture. Liquids: any material that spontaneously ignites when mixed with air, or when heated, or when heated with a material that has a mean pressure rise time of a 1:1 perchloric acid (50%)cellulose mixture. Unstable Reactions: Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure and have a moderate potential (or moderate risk) to cause significant heat generation or explosion. Water Reactivity: Materials that react explosively with water without requiring heat or confinement. Organic Peroxides: Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressure. Explosives: Materials that are easily detonated or whose reaction rate is so fast that the gases formed are a representative diameter less than 420 microns (40 mesh). Materials that burn with extreme rapidity, usually by reason of self-contained oxygen (e.g. dry nitrocellulose and many organic peroxides). A primary irritant is a material that irritates the skin, eyes, respiratory tract, or mucous membranes. Irritant: A substance that irritates the skin, eyes, respiratory tract, or mucous membranes. An irritant causes reversible changes in exposed tissues and usually does not progress to tissue damage. A primary irritant or sensitizer is a chemical that causes damage to a developing embryo. Embryotoxic is a chemical that causes damage to a developing embryo (i.e. the within the first eight weeks of pregnancy in humans), but the damage does not propagate through generational lines. A teratogenic is a chemical that causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance that interferes in any way with the reproductive process. ECLOGICAL INFORMATION: IC: Effect concentration in water. BCF: Biocaccumulation Factor, which is used to determine if a chemical may be bioconcentrated in living tissues, i.e., lipid > water. TLm: Median threshold limit. log Kow or log Kw: Coefficient of Oil/Water Distribution is used to assess a substance’s behavior in the environment.

REGULATORY INFORMATION: This section explains the impact of various laws and regulations on fire prevention programs in the United States.


The Manual of Fire Protection Engineering is a comprehensive resource for engineers and technicians involved in fire protection systems design and evaluation. It covers the fundamentals of fire behavior, fire protection design, and regulatory requirements. It is a valuable tool for professionals in the fire protection industry who need to understand the science and engineering of fire safety.