



# SAFETY DATA SHEET (Tungsten Electrodes)

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards. This Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard (29 CFR 1910.1200). Other government regulations must be reviewed for applicability to these products.

**WARNING: PRODUCT COMPONENTS PRESENT HEALTH AND SAFETY HAZARDS. READ AND UNDERSTAND THIS SAFETY DATA SHEET (S.D.S.). ALSO, FOLLOW YOUR EMPLOYER'S SAFETY PRACTICES.** This product may contain Chromium and / or Nickel which are listed by OSHA, NTP, or IARC as being a carcinogen or potential carcinogen. Use of this product may expose you or others to fumes and gases at levels exceeding those established by the American Conference of Governmental Industrial Hygienists (ACGIH) or the Occupational Safety and Health Administration (OSHA) The information contained herein relates only to the specific product. If the product is combined with other materials, all component properties must be considered. **BE SURE TO CONSULT THE LATEST VERSION OF THE SDS. SAFETY DATA SHEETS ARE AVAILABLE FROM WELDMARK / Shaanxi Taibai Tungsten Products Factory.**

## STATEMENT OF LIABILITY – DISCLAIMER

To the best of WELDMARK / Shaanxi Taibai Tungsten Products Factory's knowledge, the information and recommendations contained in this publication are reliable and accurate as of the date prepared. However, accuracy, suitability, or completeness are not guaranteed, and no warranty, guarantee, or representation, expressed or implied is made by WELDMARK / Shaanxi Taibai Tungsten Products Factory as to the absolute correctness or sufficiency of any representation contained in this and other publications. WELDMARK / Shaanxi Taibai Tungsten Products Factory assumes no responsibility in connection therewith; nor can it be assumed that all acceptable safety measures are contained in this and other publications, or that other or additional measures may not be required under particular or exceptional conditions or circumstances. Data may be changed from time to time. **CAUTION! FUMES MAY BE HARMFUL IF INHALED. FUMES CAN CAUSE RESPIRATORY, SKIN AND EYE IRRITATION. HOT ELECTRODES CAN CAUSE THERMAL BURNS.**

## SECTION 1 – IDENTIFICATION OF THE SUBSTANCE OR MIXTURE AND OF THE SUPPLIER

GHS Product Identifier:	Tungsten Electrodes for Welding
Recommended use:	Welding
Supplier:	Shaanxi Taibai Tungsten Products Factory
Address	No.1 Taicheng Road, Baoji, Shaanxi, China
Emergency Telephone No.	CHEMTREC: 1-800-424-9300
Information Telephone No.	86-917-330-4600
SDS Version Number	2
Date of Preparation	Oct-29-2019

## SECTION 2 - HAZARD IDENTIFICATION

There are no immediate hazards with these electrodes. The chief acute health hazard associated with these products is inhalation of fumes during welding operations. The Inhalation of fumes generated by welding or dusts and powders, formed if grinding operations are performed on the product. Those electrodes that contain Thorium Oxide have a special hazard if dusts or powders are produced and inhaled during use or grinding of tips of the electrodes, as thorium compounds are suspected of being cancer-causing compounds. When exposed to extremely high temperatures, these products will produce irritating oxides of cerium, thorium, tungsten and zirconium. These electrodes present no significant fire hazard; however finely divided metal powder which may be generated during grinding of the tips of electrodes, is highly flammable (especially when exposed to oxidizing compounds at elevated temperatures). In some circumstances, powdered tungsten can be spontaneously flammable.

**CARCINOGENICITY STATUS:** Chemicals in these electrodes are listed, as follows.

THORIUM OXIDE: IARC-1, Carcinogenic to Humans ZIRCONIUM OXIDE: TLV-A4, Not Classifiable as to Human Carcinogenicity

The other components of these products are not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, and CAL/OSHA, and therefore are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** Thorium Oxide is a component of some of these alloys and is on the Proposition 65 list. **The State of California requires the following information: WARNING: This product may contain chemicals, and when used for welding may produce fumes or gases containing chemicals, known to the State of California to cause cancer, and/or birth defects (or other reproductive harm.)**

## SECTION 2 - HAZARD IDENTIFICATION (Continued)

2.1 Classification of the mixture :  
The product is placed on the market in solid form

2.1.1 Classification in accordance with GHS-US

STOT-RE 1	H315	Causes skin irritation
STOT-SE 1	H335	May cause respiratory irritation
STOT-RE 1	H372	Causes damage to organs through prolonged or repeated exposure
Aquatic Acute 1	H400	Very toxic to aquatic life
Aquatic Acute 1	H410	Very toxic to aquatic life with long-lasting effects

2.2 Label elements :  
GHS-US labelling

Hazard Pictograms (GHS-US) :



GHS07



GHS08



GHS09

Signal word (GHS-US) :

Hazard statements (GHS-US) :

H317	May cause an allergic skin reaction
H319	Causes eye irritation
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled
H340	Suspected of causing genetic defects
H351	Suspected of causing cancer
H370	Causes damage to organs (kidneys, respiratory system)
H372	Causes damage to through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long-lasting effects

Precautionary statements :

P201	Obtain special instructions before use
P202	Do not handle until all safety precautions have been read and understood
P260	Do not breathe dust / fume / gas / mist / vapours / spray
P261	Avoid breathe dust / fume / gas / mist / vapours / spray
P264	Wash thoroughly after handling
P270	Do not eat, drink or smoke when using this product
P272	Contaminated work clothing should not be allowed out of the workplace
P273	Avoid release into the environment
P280	Wear protective gloves
P284	In case of inadequate ventilation wear respiratory protection
P308+P313	IF exposed : Call a POISON CENTER or doctor / physician
P305+P351+P338	IF IN EYES : Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing. If eye irritation persists seek medical advice / attention
P342+P311	IF experiencing respiratory symptoms : Call a POISON CENTER and / or doctor / physician
P302+P352	IF ON SKIN : Wash with plenty of soap and water
P333+P313	IF skin irritation or rash occurs : Get medical advice / attention
P363	Wash contaminated clothing before reuse
P308+P311	IF exposed or concerned : Seek medical advice / attention. Collect spillage
P402+P404	Store in a dry place. Store in a closed container

For thoriated tungsten electrodes, store in tightly closed containers in a cool and well-ventilated area. Nobody should remain permanently or longer than necessary in close proximity to the stored thoriated tungsten electrodes as the electrodes may emit alpha, beta and gamma radiation. Additional measures should be taken to protect from such possible alpha, beta and gamma radiation. Thoriated tungsten electrodes may be incompatible with some strong acids.

P501 Dispose of contents and container in accordance with local regional / national international regulations.

2.3 Other hazards : No additional information available

2.4 Unknown acute toxicity (GHS-US) : No data available

### SECTION 3 - COMPOSITION / INFORMATION ON INGREDIENTS

TRADE NAME	ISO 6848	AWS A5.12	Tip Color	W (Min.)	CeO <sub>2</sub>	La <sub>2</sub> O <sub>3</sub>	ThO <sub>2</sub>	ZrO <sub>2</sub>
PURE TUNGSTEN	WP	EWP	Green	99.5				
1% THORIATED TUNGSTEN	WTh 10	EWTh-1	Yellow	98.3			0.8-1.2	
2% THORIATED TUNGSTEN	WTh 20	EWTh-2	Red	97.3			1.7-2.2	
1% LANTHANATED TUNGSTEN	WLa 10	EWLa-1	Black	98.3		0.8-1.2		
1.5% LANTHANATED TUNGSTEN	WLa 15	EWLa-1.5	Gold	97.8		1.3-1.7		
2% LANTHANATED TUNGSTEN	WLa 20	EWLa-2	Blue	97.3		1.8-2.2		
2% CERIATED TUNGSTEN	WCe 20	EWCe-2	Gray	97.3	1.8-2.2			
0.3% ZIRCONIATED TUNGSTEN	WZr 3	EWZr-1	Brown	99.1				0.15-0.40

### SECTION 4 - FIRST-AID MEASURES

**SKIN:** If the product's fumes irritate the skin, begin decontamination with running water. Minimum flushing is for 15 minutes.

**EYES:** If the product's fumes irritate the eyes, flush eyes under gently running water. Minimum flushing is for 15 minutes.

**INHALATION:** Move victim to fresh air. If necessary, use artificial respiration.

**INGESTION:** If swallowed call physician immediately! Do not induce vomiting unless directed by medical personnel.

Rinse mouth with water if person is conscious. Never give fluids or induce vomiting if person is unconscious, having convulsions, or not breathing.

**VICTIMS OF CHEMICAL EXPOSURE MUST BE TAKEN FOR MEDICAL ATTENTION, ESPECIALLY IF ADVERSE EFFECTS CONTINUE AFTER FIRST-AID TREATMENT.**

### SECTION 5 - FIRE-FIGHTING MEASURES

5.1 Extinguishing media :

Suitable extinguishing media : Use extinguishing media appropriate for surrounding fire.

Unsuitable extinguishing media : No data available.

5.2 Special hazards arising from the substance or mixture : Fire may produce irritating or poisonous gases.

Fire hazard : Not flammable.

Explosion hazard : None known.

5.3 Advice for fire-fighting : In the event of fire, wear self-contained breathing apparatus and full protective gear.

### SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures :

For non-emergency personnel : Wear appropriate personal protective equipment as specified in Section 8. Ensure adequate ventilation.

For emergency responders : No data available.

6.2 Environmental precautions : Avoid release into the environment. Avoid dispersal of spilled material and contact with soil, ground and surface water drains and sewers.

6.3 Methods and material for containment and cleaning up : Take up mechanically. Collect the material in labelled containers and dispose of according to local and regional authority requirements.

6.4 Reference to other sections : See Section 7 for information of safe handling. See Section 8 for information on personal protection equipment. See Section 13 for disposal information.

### SECTION 7 - HANDLING and STORAGE

All employees who handle these materials should be trained to handle them safely. Avoid breathing fumes during welding operations. Store these electrodes in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Store away from incompatible chemicals (see Section 10, Stability and Reactivity). Inspect all incoming containers before storage to ensure they are properly labeled and not damaged. If these products are used during welding operations, it is recommended that the requirements of the Federal Occupational Safety and Health Welding and Cutting Standard (29 CFR 1910 Subpart Q) and the Standards of the American National Standards Institute for Welding and Cutting (ANSI Z49.1) be followed. Use ventilation and other engineering controls to minimize potential exposure to fumes during welding operations or to dusts if tips of electrodes are ground. Follow good housekeeping practices to ensure powders or dusts from grinding operations do not accumulate, which can be highly flammable and can pose special health hazards if from thorium-containing electrodes. Tungsten-Thorium Oxide alloys are generally safe to handle during use and almost all normal conditions and environments. **Special precautions must be taken during the grinding or machining of tips of electrodes that contain Thorium Oxide to avoid the generation and subsequent inhalation of dusts from these operations. Any dusts generated during these operations may be considered as "Source Material", as defined by the Nuclear Regulatory Commission, and therefore be subject to the requirements of 10 CFR, Parts 20 and 40.** Routine wet mopping or vacuuming with an explosion-proof vacuum, fitted with a HEPA filter may be considered to reduce accumulation of dusts.

## SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE INFORMATION

CHEMICAL	CAS # % w/w	ACGIH-TLV mg/m <sup>3</sup>	OSHA-PEL mg/m <sup>3</sup>	NIOSH-REL mg/m <sup>3</sup>
Tungsten The exposure limits provided are for "Tungsten and Insoluble Compounds"	7440-33-7 97.3-99.5%	TWA = 5 STEL = 10	TWA = 5 (Vacated 1989 PEL) STEL = 10 (Vacated 1989 PEL)	TWA = 5 STEL = 10
Cerium Oxide (CeO <sub>2</sub> )	1306-38-3 1.8-2.2%	NE	NE	NE
Lanthanum Oxide (La <sub>2</sub> O <sub>3</sub> )	1312-81-8 0.8-2.2	NE	NE	NE
Thorium Oxide (ThO <sub>2</sub> )	1314-20-1 0.8-2.2	NE	NE	NE
Zirconium Oxide (ZrO <sub>2</sub> ) The exposure limits provided are for "Zirconium Compounds, as Zr" (CAS # 7440-67-7)	1314-23-4 0.15-0.40	TWA = 5, A4 (Not Classifiable as a Human Carcinogen) STEL = 10, A4 (Not Classifiable as a Human Carcinogen)	TWA = 5 STEL = 10 (Vacated 1989 PEL)	TWA = 5 STEL = 10

NE = Not Established.

NOTE: Fumes may be generated during the use of these electrodes. To appropriately assess inhalation hazards, one recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample in the workers breathing zone. See ANSI/AWS F1.1, from the American Welding Society, 550 NW Lejeune Rd., Miami, FL 33126.

SARA SECTION 313 SUPPLIER INFORMATION: These products contain the following chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (per 40 CFR 372). Thorium Oxide

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation to ensure exposure levels are maintained below the limits provided in Section 2 (Composition and Information on Ingredients). Ensure eyewash/safety shower stations are available.

**RESPIRATORY PROTECTION:** If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the appropriate standards of Canada and its Provinces. It is suggested that NIOSH guidelines for Welding Fumes are followed. For further information, see full SDS for these products.

**EYE PROTECTION:** Safety glasses. When used during welding, wear safety glasses, goggles or face-shield with filter lens of appropriate shade number (per ANSI Z49.1, "Safety in Welding and Cutting", as necessary).

**HAND PROTECTION:** Wear gloves that will protect against heat of metal product.

**BODY PROTECTION:** None needed for normal circumstances of use. Use body protection appropriate for task (i.e., leather apron, and coveralls).

## SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

**VAPOR DENSITY :** Not applicable.

**EVAPORATION RATE:** Not applicable.

**SPECIFIC GRAVITY (water = 1) :** 19.3.

**MELTING POINT:** 3410°C (6170°F).

**SOLUBILITY IN WATER:** Insoluble. **BOILING POINT:** 5927°C (10701°F).

**VAPOR PRESSURE:** Not applicable. **pH:** Not applicable

**APPEARANCE AND COLOR:** These electrodes are hard, brittle, silvery-gray, odorless metal electrodes.

## SECTION 10 - STABILITY and REACTIVITY

**STABILITY:** Stable.

**DECOMPOSITION PRODUCTS:** Tungsten oxide compounds may be generated.

**MATERIALS WITH WHICH PRODUCTS ARE INCOMPATIBLE:** Tungsten is not compatible with halogens and strong oxidizers (i.e. sulfuric acid, nitric acid).

**HAZARDOUS POLYMERIZATION:** Will not occur.

## SECTION 11 – TOXICOLOGICAL INFORMATION

Information on toxicological effects:

Acute toxicity: Harmful if swallowed

Substance name	CAS #	LD50 oral rat (mg/kg)	ATE (oral) (mg/kg)	Comments
Tungsten	7440-33-7			No data
Cerium Oxide	1306-38-3			No data
Lanthanum Oxide	1312-81-8			No data
Thorium Oxide	1314-20-1			No data
Zirconium Oxide	1314-23-4			No data

Skin corrosion / irritation:	Not classified
Serious eye damage / irritation:	Not classified
Respiratory or skin sensitization:	Not classified
Germ cell mutagenicity:	Not classified
Carcinogenicity:	May cause cancer

Reproductive toxicity:	Not classified
Specific target organ toxicity (single exposure):	May cause drowsiness or dizziness. May cause respiratory irritation
Specific target organ toxicity (repeated exposure):	Causes damage to organs through prolonged or repeated exposure
Aspiration hazard:	Not classified

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## SECTION 12 – ECOLOGICAL INFORMATION

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- 12.1 Toxicity :  
Ecology – general : Very toxic to aquatic life.
- 12.2 Persistence and degradability : No additional information available.
- 12.3 Bioaccumulative potential : No additional information available.
- 12.4 Mobility in soil : No additional information available.
- 12.5 Other adverse effects : No additional information available.

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## SECTION 13 – DISPOSAL CONSIDERATIONS

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- 13.1 Waste treatment methods : Dispose of in accordance with local and national regulations.
- 13.2 Waste disposal recommendations: Dispose of contents/container in accordance with local / regional / national / international regulations.

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## SECTION 14 – TRANSPORT INFORMATION

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- In accordance with DOT / ADR / RID / ADNR / IMDG / ICAO / IATA
- 14.1 UN Number : Not a dangerous good in sense of transport regulations.
- 14.2 UN proper shipping name : Not applicable.

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## SECTION 15 – REGULATORY INFORMATION

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15.1 US Federal Regulations :

<b>Tungsten</b>	<b>(CAS No.) 7440-33-7</b>
Listed on the United States TSCA (Toxic Substances Control Act) Inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	
<b>Cerium Oxide</b>	<b>(CAS No.) 1306-38-3</b>
Listed on the United States TSCA (Toxic Substances Control Act) Inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	
<b>Lanthanum Oxide</b>	<b>(CAS No.) 1312-81-8</b>
Listed on the United States TSCA (Toxic Substances Control Act) Inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	
<b>Thorium Oxide</b>	<b>(CAS No.) 1314-20-1</b>
Listed on the United States TSCA (Toxic Substances Control Act) Inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	
<b>Zirconium Oxide</b>	<b>(CAS No.) 1314-23-4</b>
Listed on the United States TSCA (Toxic Substances Control Act) Inventory	
Listed on SARA Section 313 (Specific toxic chemical listings)	

**SECTION 15 – REGULATORY INFORMATION (Continued)**

15.2 US State Regulations :

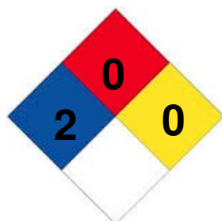
<b>Thorium Oxide</b>					<b>(CAS No.) 1314-20-1</b>				
U.S. – California – Proposition 65 – Carcinogens List		U.S. – California – Proposition 65 – Developmental Toxicity		U.S. – California – Proposition 65 – Reproductive Toxicity - Female		U.S. – California – Proposition 65 – Reproductive Toxicity - Male		No Significance risk level (NSRL)	
Yes									
<b>Tungsten</b>					<b>(CAS No.) 7440-33-7</b>				
U.S. – Massachusetts – Right to Know List U.S. – Minnesota – Hazardous Substance List U.S. – New Jersey – Right to Know Hazardous Substance List U.S. – Pennsylvania – RTK (Right to Know) List									
<b>Cerium Oxide</b>					<b>CAS No.) 1306-38-3</b>				
U.S. – Massachusetts – Right to Know List U.S. – Minnesota – Hazardous Substance List U.S. – New Jersey – Right to Know Hazardous Substance List U.S. – Pennsylvania – RTK (Right to Know) List									
<b>Lanthanum Oxide</b>					<b>(CAS No.) 1312-81-8</b>				
U.S. – Massachusetts – Right to Know List U.S. – Minnesota – Hazardous Substance List U.S. – New Jersey – Right to Know Hazardous Substance List U.S. – Pennsylvania – RTK (Right to Know) List									
<b>Thorium Oxide</b>					<b>(CAS No.) 1314-20-1</b>				
U.S. – Massachusetts – Right to Know List U.S. – Minnesota – Hazardous Substance List U.S. – New Jersey – Right to Know Hazardous Substance List U.S. – Pennsylvania – RTK (Right to Know) List									
<b>Zirconium Oxide</b>					<b>(CAS No.) 1314-23-4</b>				
U.S. – Massachusetts – Right to Know List U.S. – Minnesota – Hazardous Substance List U.S. – New Jersey – Right to Know Hazardous Substance List U.S. – Pennsylvania – RTK (Right to Know) List									

## SECTION 16 - OTHER INFORMATION

Full text of H-phrases :

Acute Tox. 2 (Inhalation)	Acute toxicity (inhal.), Category 2
Acute Tox. 3 (Oral)	Acute toxicity (oral), Category 3
Acute Tox. 4 (Oral)	Acute toxicity (oral), Category 4
Aquatic Acute 1	Hazardous to the aquatic environment – Acute Hazard, Category 1
Cara. 1A	Carcinogenicity, Category 1A
Eye Irrit. 2A	Serious eye damage / eye irritation Category 2A
Skin Irrit. 2A	Sensitisation – Skin corrosion / irritation, Category 2
Skin Sens. 1	Sensitisation – Skin Category 1
STOT-RE 1	Specific target organ toxicity – Repeated exposure, Category 1
STOT-SE 3	Specific target organ toxicity – Single exposure, Category 3, Narcosis
STOT-SE 3	Specific target organ toxicity – Single exposure, Category 3, Respiratory tract irritation
H301	Toxic if swallowed
H302	Harmful if swallowed
H315	Causes skin irritation
H317	May cause all allergic skin reaction
H319	Causes serious eye irritation
H330	Fatal if inhaled
H335	May cause respiratory irritation
H336	May cause drowsiness or dizziness
H350	May cause cancer
H372	Causes damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life

NFPA health hazard : 2 – Warning may be harmful if inhaled or adsorbed  
 NFPA fire hazard : 0 – Materials that will not burn  
 NFPA reactivity : 0 – Normally stable, even under fire exposure conditions, and are not reactive with water



HMIS III Rating

Health : 3 – Major Hazard – major injury likely unless prompt action is taken and medical treatment given  
 Flammability : 0 – Minimal hazard  
 Physical : 0 – Minimal hazard

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## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a SDS. Some of these, which are commonly used, include the following:

**CAS #:** This is the Chemical Abstract Service Number, which uniquely identifies each constituent.

### EXPOSURE LIMITS IN AIR :

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value – an airborne concentration of a substance, which represents conditions under which it is generally believed that nearly all workers, may be repeatedly exposed without adverse effect. The duration the must be considered, including the 8-hour Time Weighted Average (**TWA**), by the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration.

**PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register : 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL, which was vacated by Court Order.

**IDLH** - Immediately Dangerous to Life and Health – This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

**The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called Recommended Exposure Levels (**RELs**). When no exposure guidelines are established, an entry of **NE** is made for reference.

### HAZARD RATINGS :

#### HAZARDOUS MATERIALS IDENTIFICATION SYSTEM : Health Hazard

: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard : **0** (minimal hazard) ; **1** (materials that require substantial pre-heating before burning) ; **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and 1C flammable liquids with flash points below 38°C [100°F]); **4** (Class 1A flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]).

Reactivity Hazard : **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

#### NATIONAL FIRE PROTECTION ASSOCIATION : Health Hazard

: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual inquiry).

Flammability Hazard and Reactivity Hazard : Refer to definitions for "Hazardous Materials Identification System".

### FLAMMABILITY LIMITS IN AIR :

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point – Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION :

**Human and Animal Toxicology** : Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material

Per million parts of air or water; **mg/m<sup>3</sup>** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDL<sub>o</sub>**, the lowest dose to cause a symptom and **TCL<sub>o</sub>** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information** : The sources are: **IARC** - the International Agency for Research on Cancer ; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information** : **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information** : **EC** is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in like forms which consume contaminated plant or animal matter. Coefficient of Oil/Water Distribution is represented by **log K<sub>ow</sub>** or **log K<sub>oc</sub>** and is used to assess a substance's behavior in the environment.

### REGULATORY INFORMATION :

This section explains the impact of various laws and regulations on the material. **U.S.** : **EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute (**ANSI Z129.1**). **CANADA** : **CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances Lists. **The CPR is the Canadian Product Regulations**. This section also includes information on the precautionary warnings, which appear, on the materials package label.