

# SAFETY DATA SHEET

## 1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name:** Lincolnweld<sup>®</sup> H-560™

**Other means of identification**

**SDS number:** 200000000905

**Recommended use and restriction on use**

**Recommended use:** SAW (Submerged Arc Welding)

**Restrictions on use:** Not known. Read this SDS before using this product.

**Manufacturer/Importer/Supplier/Distributor Information**

**Company Name:** The Lincoln Electric Company  
**Address:** 22801 Saint Clair Avenue  
Cleveland, Ohio 44117  
**Telephone:** +1 (216) 481-8100  
**Contact Person:** Safety Data Sheet Questions: [www.lincolnelectric.com/sds](http://www.lincolnelectric.com/sds)  
Arc Welding Safety Information: [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety)

**Company Name:** The Lincoln Electric Company of Canada LP  
**Address:** 179 Wicksteed Avenue  
Toronto, Ontario M4G 2B9  
**Telephone:** +1 (416) 421-2600  
**Contact Person:** Safety Data Sheet Questions: [www.lincolnelectric.com/sds](http://www.lincolnelectric.com/sds)  
Arc Welding Safety Information: [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety)

**Emergency telephone number:**

USA/Canada/Mexico +1 (888) 609-1762  
Americas/Europe +1 (216) 383-8962  
Asia Pacific +1 (216) 383-8966  
Middle East/Africa +1 (216) 383-8969

**3E Company Access Code:** 333988

## 2. HAZARDS IDENTIFICATION

Classified according to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS), The United States Occupational Safety and Health Administration's Hazard Communication Standard (29 CFR 1910.1200), Canada's Hazardous Product Regulations and Mexico's Harmonized System for the Identification and Communication of Hazards and Risks from Hazardous Chemicals in the Workplace.

**Hazard Classification** Not classified as hazardous according to applicable GHS hazard classification criteria.

**Label Elements**

**Hazard Symbol:** No symbol  
**Signal Word:** No signal word.  
**Hazard Statement:** Not applicable  
**Precautionary Statements:** Not applicable

**Other hazards which do not result in GHS classification:**

Electrical Shock can kill. If welding must be performed in damp locations or with wet clothing, on metal structures or when in cramped positions such as sitting, kneeling or lying, or if there is a high risk of unavoidable or accidental contact with work piece, use the following equipment: Semiautomatic DC Welder, DC Manual (Stick) Welder, or AC Welder with Reduced Voltage Control.

Arc rays can injure eyes and burn skin. Welding arc and sparks can ignite combustibles and flammable materials. Overexposure to welding fumes and gases can be hazardous. Read and understand the manufacturer's instructions, Safety Data Sheets and the precautionary labels before using this product. Refer to Section 8.

**Substance(s) formed under the conditions of use:**

The welding fume produced from this welding electrode may contain the following constituent(s) and/or their complex metallic oxides as well as solid particles or other constituents from the consumables, base metal, or base metal coating not listed below:

| Chemical Identity | CAS-No.    |
|-------------------|------------|
| Carbon dioxide    | 124-38-9   |
| Carbon monoxide   | 630-08-0   |
| Nitrogen dioxide  | 10102-44-0 |
| Ozone             | 10028-15-6 |

### 3. COMPOSITION / INFORMATION ON INGREDIENTS

**Reportable Hazardous Ingredients  
Mixtures**

| Chemical Identity                                 | CAS number | Content in percent (%)* |
|---------------------------------------------------|------------|-------------------------|
| Chromium and chromium alloys or compounds (as Cr) | 7440-47-3  | 20 - <50%               |
| Zircon                                            | 14940-68-2 | 5 - <10%                |
| Magnesium oxide                                   | 1309-48-4  | 5 - <10%                |
| Fluorides (as F)                                  | 16984-48-8 | 5 - <10%                |
| Sodium silicate                                   | 1344-09-8  | 1 - <5%                 |
| Molybdenum                                        | 7439-98-7  | 1 - <5%                 |
| Manganese                                         | 7439-96-5  | 1 - <5%                 |
| Silicon                                           | 7440-21-3  | 0.1 - <1%               |
| Silicon dioxide (amorphous)                       | 7631-86-9  | 0.1 - <1%               |
| Aluminum oxide                                    | 1344-28-1  | 0.1 - <1%               |

\* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

**Composition Comments:**

The term "Hazardous Ingredients" should be interpreted as a term defined in Hazard Communication standards and does not necessarily imply the existence of a welding hazard. The product may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 and 8 for more information.

### 4. FIRST AID MEASURES

**Ingestion:**

Unlikely due to form of product, except for granular materials. Avoid hand, clothing, food, and drink contact with metal fume or powder which can cause ingestion of particulate during hand to mouth activities such as

drinking, eating, smoking, etc. If ingested, do not induce vomiting. Contact a poison control center. Unless the poison control center advises otherwise, wash out mouth thoroughly with water. If symptoms develop, seek medical attention at once.

- Inhalation:** Move to fresh air if breathing is difficult. If breathing has stopped, perform artificial respiration and obtain medical assistance at once.
- Skin Contact:** Remove contaminated clothing and wash the skin thoroughly with soap and water. For reddened or blistered skin, or thermal burns, obtain medical assistance at once.
- Eye contact:** Dust or fume from this product should be flushed from the eyes with copious amounts of clean, tepid water until transported to an emergency medical facility. Do not allow victim to rub or keep eyes tightly closed. Obtain medical assistance at once.

Arc rays can injure eyes. If exposed to arc rays, move victim to dark room, remove contact lenses as necessary for treatment, cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

#### **Most important symptoms/effects, acute and delayed**

- Symptoms:** Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Refer to Section 11 for more information.

- Hazards:** Welding and allied process hazards are complex and may include physical and health hazards such as but not limited to electric shock, physical strains, radiation burns (eye flash), thermal burns due to hot metal or spatter and potential health effects of overexposure to welding fume or dust. Refer to Section 11 for more information.

#### **Indication of immediate medical attention and special treatment needed**

- Treatment:** Treat symptomatically.

### **5. FIRE-FIGHTING MEASURES**

- General Fire Hazards:** As shipped, this product is nonflammable. However, welding arc and sparks can ignite combustibles and flammable products. Read and understand American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" and National Fire Protection Association NFPA 51B, "Standard for Fire Prevention During Welding, Cutting and Other Hot Work" before using this product.

#### **Suitable (and unsuitable) extinguishing media**

- Suitable extinguishing media:** As shipped, the product will not burn. In case of fire in the surroundings: use appropriate extinguishing agent.

- Unsuitable extinguishing media:** Do not use water jet as an extinguisher, as this will spread the fire.

- Specific hazards arising from the chemical:** Welding arc and sparks can ignite combustibles and flammable products.

**Special protective equipment and precautions for firefighters**
**Special fire fighting procedures:**

Use standard firefighting procedures and consider the hazards of other involved materials.

**Special protective equipment for fire-fighters:**

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

**6. ACCIDENTAL RELEASE MEASURES**
**Personal precautions, protective equipment and emergency procedures:**

If airborne dust and/or fume is present, use adequate engineering controls and, if needed, personal protection to prevent overexposure. Refer to recommendations in Section 8.

**Methods and material for containment and cleaning up:**

Absorb with sand or other inert absorbent. Stop the flow of material, if this is without risk. Clean up spills immediately, observing precautions in the personal protective equipment in Section 8. Avoid generating dust. Prevent product from entering any drains, sewers or water sources. Refer to Section 13 for proper disposal.

**Environmental Precautions:**

Avoid release to the environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water sources or sewer. Environmental manager must be informed of all major spillages.

**7. HANDLING AND STORAGE**
**Precautions for safe handling:**

Prevent formation of dust. Provide appropriate exhaust ventilation at places where dust is formed.

Read and understand the manufacturer's instruction and the precautionary label on the product. Refer to Lincoln Safety Publications at [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety). See American National Standard Z49.1, "Safety In Welding, Cutting and Allied Processes" published by the American Welding Society, <http://pubs.aws.org> and OSHA Publication 2206 (29CFR1910), U.S. Government Printing Office, [www.gpo.gov](http://www.gpo.gov).

**Conditions for safe storage, including any incompatibilities:**

Store in closed original container in a dry place. Store in accordance with local/regional/national regulations. Store away from incompatible materials.

**8. EXPOSURE CONTROLS / PERSONAL PROTECTION**
**Control Parameters**
**Occupational Exposure Limits: US**

| Chemical Identity                                         | type | Exposure Limit Values | Source                                                                      |
|-----------------------------------------------------------|------|-----------------------|-----------------------------------------------------------------------------|
| Chromium and chromium alloys or compounds (as Cr) - as Cr | TWA  | 0.5 mg/m3             | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                                                           | PEL  | 1 mg/m3               | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                                                           | REL  | 0.5 mg/m3             | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Zircon - as Zr                                            | STEL | 10 mg/m3              | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                                                           | TWA  | 5 mg/m3               | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                                                           | PEL  | 5 mg/m3               | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                                                           | REL  | 5 mg/m3               | US. NIOSH: Pocket Guide to Chemical                                         |

|                                           |         |                                                |                                                                             |
|-------------------------------------------|---------|------------------------------------------------|-----------------------------------------------------------------------------|
|                                           |         |                                                | Hazards (2005)                                                              |
|                                           | STEL    | 10 mg/m3                                       | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Magnesium oxide - Inhalable fraction.     | TWA     | 10 mg/m3                                       | US. ACGIH Threshold Limit Values (12 2010)                                  |
| Magnesium oxide - Total particulate.      | PEL     | 15 mg/m3                                       | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| Fluorides (as F) - as F                   | TWA     | 2.5 mg/m3                                      | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                                           | PEL     | 2.5 mg/m3                                      | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| Fluorides (as F) - Dust.                  | TWA     | 2.5 mg/m3                                      | US. OSHA Table Z-2 (29 CFR 1910.1000) (02 2006)                             |
| Molybdenum - Total dust. - as Mo          | PEL     | 15 mg/m3                                       | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| Molybdenum - Inhalable fraction. - as Mo  | TWA     | 10 mg/m3                                       | US. ACGIH Threshold Limit Values (03 2014)                                  |
| Molybdenum - Respirable fraction. - as Mo | TWA     | 3 mg/m3                                        | US. ACGIH Threshold Limit Values (03 2014)                                  |
| Manganese - Fume. - as Mn                 | Ceiling | 5 mg/m3                                        | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                                           | REL     | 1 mg/m3                                        | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
|                                           | STEL    | 3 mg/m3                                        | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Manganese - Inhalable fraction. - as Mn   | TWA     | 0.1 mg/m3                                      | US. ACGIH Threshold Limit Values (03 2014)                                  |
| Manganese - Respirable fraction. - as Mn  | TWA     | 0.02 mg/m3                                     | US. ACGIH Threshold Limit Values (03 2014)                                  |
| Silicon - Total dust.                     | PEL     | 15 mg/m3                                       | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| Silicon - Respirable fraction.            | PEL     | 5 mg/m3                                        | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| Silicon - Respirable.                     | REL     | 5 mg/m3                                        | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Silicon - Total                           | REL     | 10 mg/m3                                       | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Silicon dioxide (amorphous)               | TWA     | 20 millions of particles per cubic foot of air | US. OSHA Table Z-3 (29 CFR 1910.1000) (2000)                                |
|                                           | TWA     | 0.8 mg/m3                                      | US. OSHA Table Z-3 (29 CFR 1910.1000) (2000)                                |
|                                           | REL     | 6 mg/m3                                        | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Aluminum oxide - Respirable fraction.     | TWA     | 1 mg/m3                                        | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                                           | PEL     | 5 mg/m3                                        | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
| Aluminum oxide - Total dust.              | PEL     | 15 mg/m3                                       | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |

#### Occupational Exposure Limits: CANADA

| Chemical Identity                                         | type | Exposure Limit Values | Source                                                                                                                                                        |
|-----------------------------------------------------------|------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Chromium and chromium alloys or compounds (as Cr) - as Cr | TWA  | 0.5 mg/m3             | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
| Chromium and chromium alloys or compounds (as Cr)         | TWA  | 0.5 mg/m3             | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Chromium and chromium                                     | TWA  | 0.5 mg/m3             | Canada. Manitoba OELs (Reg. 217/2006,                                                                                                                         |

|                                                        |            |           |                                                                                                                                                               |
|--------------------------------------------------------|------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| alloys or compounds (as Cr) - as Cr                    |            |           | The Workplace Safety And Health Act) (03 2011)                                                                                                                |
|                                                        | TWA        | 0.5 mg/m3 | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                                                        | 8 HR ACL   | 0.5 mg/m3 | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                                        | 15 MIN ACL | 1.5 mg/m3 | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Chromium and chromium alloys or compounds (as Cr)      | TWA        | 0.5 mg/m3 | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Zircon - as Zr                                         | TWA        | 5 mg/m3   | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                                                        | STEL       | 10 mg/m3  | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                                                        | STEL       | 10 mg/m3  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                                                        | TWA        | 5 mg/m3   | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                                                        | STEL       | 10 mg/m3  | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)                                                                          |
|                                                        | TWA        | 5 mg/m3   | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)                                                                          |
|                                                        | TWA        | 5 mg/m3   | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                                                        | STEL       | 10 mg/m3  | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                                                        | 8 HR ACL   | 5 mg/m3   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                                        | 15 MIN ACL | 10 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                                        | TWA        | 5 mg/m3   | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
|                                                        | STEL       | 10 mg/m3  | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Magnesium oxide - Fume.                                | TWA        | 10 mg/m3  | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
| Magnesium oxide - Respirable dust and/or fume. - as Mg | STEL       | 10 mg/m3  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Magnesium oxide - Inhalable fume.                      | TWA        | 10 mg/m3  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Magnesium oxide - Respirable dust and/or fume. - as Mg | TWA        | 3 mg/m3   | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Magnesium oxide - Inhalable                            | TWA        | 10 mg/m3  | Canada. Manitoba OELs (Reg. 217/2006,                                                                                                                         |

|                                           |            |           |                                                                                                                                                               |
|-------------------------------------------|------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| fraction.                                 |            |           | The Workplace Safety And Health Act) (03 2011)                                                                                                                |
|                                           | TWA        | 10 mg/m3  | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                                           | 8 HR ACL   | 10 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                           | 15 MIN ACL | 20 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Magnesium oxide - Fume. - as Mg           | TWA        | 10 mg/m3  | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Fluorides (as F) - as F                   | TWA        | 2.5 mg/m3 | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                                           | TWA        | 2.5 mg/m3 | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                                           | TWA        | 2.5 mg/m3 | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                                           | TWA        | 2.5 mg/m3 | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)                                                                          |
|                                           | TWA        | 2.5 mg/m3 | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                                           | 8 HR ACL   | 2.5 mg/m3 | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                           | 15 MIN ACL | 5 mg/m3   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                           | TWA        | 2.5 mg/m3 | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Molybdenum - Inhalable                    | TWA        | 10 mg/m3  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Molybdenum - Respirable.                  | TWA        | 3 mg/m3   | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Molybdenum - Inhalable fraction. - as Mo  | TWA        | 10 mg/m3  | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                                           | 8 HR ACL   | 10 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Molybdenum - Respirable fraction. - as Mo | 8 HR ACL   | 3 mg/m3   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Molybdenum - Inhalable fraction. - as Mo  | 15 MIN ACL | 20 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Molybdenum - Respirable fraction. - as Mo | 15 MIN ACL | 6 mg/m3   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Molybdenum - as Mo                        | TWA        | 10 mg/m3  | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Molybdenum - Respirable fraction. - as Mo | TWA        | 3 mg/m3   | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |
| Molybdenum - Inhalable fraction. - as Mo  | TWA        | 10 mg/m3  | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act)                                                                                    |



|                                                |            |            |                                                                                                                                                               |
|------------------------------------------------|------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                |            |            | (03 2014)                                                                                                                                                     |
| Molybdenum - Respirable fraction. - as Mo      | TWA        | 3 mg/m3    | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)                                                                        |
| Manganese - as Mn                              | TWA        | 0.2 mg/m3  | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                                                | TWA        | 0.2 mg/m3  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                                                | 8 HR ACL   | 0.2 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                                | 15 MIN ACL | 0.6 mg/m3  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Manganese - Fume. - as Mn                      | TWA        | 1 mg/m3    | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Manganese - Dust. - as Mn                      | TWA        | 5 mg/m3    | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Manganese - Fume. - as Mn                      | STEL       | 3 mg/m3    | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Manganese - Respirable fraction. - as Mn       | TWA        | 0.02 mg/m3 | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |
| Manganese - Inhalable fraction. - as Mn        | TWA        | 0.1 mg/m3  | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |
| Manganese - as Mn                              | TWA        | 0.2 mg/m3  | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)                                                                        |
| Silicon - Total dust.                          | TWA        | 10 mg/m3   | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)                                                                        |
| Silicon                                        | 8 HR ACL   | 10 mg/m3   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                                                | 15 MIN ACL | 20 mg/m3   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
| Silicon - Total dust.                          | TWA        | 10 mg/m3   | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Silicon dioxide (amorphous) - Total            | TWA        | 4 mg/m3    | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Silicon dioxide (amorphous) - Respirable.      | TWA        | 1.5 mg/m3  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Silicon dioxide (amorphous)                    | TWA        | 10 mg/m3   | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)                                                                        |
| Silicon dioxide (amorphous) - Respirable dust. | TWA        | 6 mg/m3    | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Aluminum oxide                                 | TWA        | 10 mg/m3   | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
| Aluminum oxide - Respirable.                   | TWA        | 1 mg/m3    | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
| Aluminum oxide - Respirable                    | TWA        | 1 mg/m3    | Canada. Manitoba OELs (Reg. 217/2006,                                                                                                                         |



|                                      |            |          |                                                                                                                |
|--------------------------------------|------------|----------|----------------------------------------------------------------------------------------------------------------|
| fraction.                            |            |          | The Workplace Safety And Health Act) (03 2011)                                                                 |
|                                      | TWA        | 1 mg/m3  | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                         |
| Aluminum oxide                       | 8 HR ACL   | 10 mg/m3 | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)               |
|                                      | 15 MIN ACL | 20 mg/m3 | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)               |
| Aluminum oxide - Total dust. - as Al | TWA        | 10 mg/m3 | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008) |

### Occupational Exposure Limits: MEXICO

| Chemical Identity                                    | type | Exposure Limit Values | Source                                               |
|------------------------------------------------------|------|-----------------------|------------------------------------------------------|
| Chromium and chromium alloys or compounds (as Cr)    | CPT  | 0.5 mg/m3             | Mexico. Occupational Exposure Limit Values (03 2000) |
| Zircon - as Zr                                       | CPT  | 5 mg/m3               | Mexico. Occupational Exposure Limit Values (03 2000) |
|                                                      | CTT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
| Magnesium oxide - Fume. - as Mg                      | CPT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
| Fluorides (as F) - as F                              | CPT  | 2.5 mg/m3             | Mexico. Occupational Exposure Limit Values (03 2000) |
| Molybdenum - as Mo                                   | CPT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
|                                                      | CTT  | 20 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
| Manganese - as Mn                                    | CPT  | 0.2 mg/m3             | Mexico. Occupational Exposure Limit Values (03 2000) |
| Manganese - Fume. - as Mn                            | CPT  | 1 mg/m3               | Mexico. Occupational Exposure Limit Values (03 2000) |
|                                                      | CTT  | 3 mg/m3               | Mexico. Occupational Exposure Limit Values (03 2000) |
| Silicon                                              | CPT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
|                                                      | CTT  | 20 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
| Silicon dioxide (amorphous)                          | CPT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
| Silicon dioxide (amorphous) - Respirable dust.       | CPT  | 3 mg/m3               | Mexico. Occupational Exposure Limit Values (03 2000) |
| Silicon dioxide (amorphous) - Inhalable particulate. | CPT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |
| Aluminum oxide                                       | CPT  | 10 mg/m3              | Mexico. Occupational Exposure Limit Values (03 2000) |

### Biological Limit Values: US

| Chemical Identity                                           | Exposure Limit Values | Source              |
|-------------------------------------------------------------|-----------------------|---------------------|
| Fluorides (as F) (Fluoride: Sampling time: Prior to shift.) | 2 mg/l (Urine)        | ACGIH BEI (03 2013) |
| Fluorides (as F) (Fluoride: Sampling time: End of shift.)   | 3 mg/l (Urine)        | ACGIH BEI (03 2013) |

### Biological Limit Values: MEXICO

| Chemical Identity                                            | Exposure Limit Values         | Source           |
|--------------------------------------------------------------|-------------------------------|------------------|
| Fluorides (as F) (fluorides: Sampling time: Prior to shift.) | 3 mg/g (Creatinine in urine)  | MX IBE (06 2012) |
| Fluorides (as F) (fluorides: Sampling time: End of shift.)   | 10 mg/g (Creatinine in urine) | MX IBE (06 2012) |

### Additional exposure limits under the conditions of use: US

| Chemical Identity | type      | Exposure Limit Values   | Source                                                                      |
|-------------------|-----------|-------------------------|-----------------------------------------------------------------------------|
| Carbon dioxide    | TWA       | 5,000 ppm               | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                   | STEL      | 30,000 ppm              | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                   | PEL       | 5,000 ppm 9,000 mg/m3   | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                   | STEL      | 30,000 ppm 54,000 mg/m3 | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
|                   | REL       | 5,000 ppm 9,000 mg/m3   | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Carbon monoxide   | TWA       | 25 ppm                  | US. ACGIH Threshold Limit Values (12 2010)                                  |
|                   | PEL       | 50 ppm 55 mg/m3         | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                   | REL       | 35 ppm 40 mg/m3         | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
|                   | Ceil_Time | 200 ppm 229 mg/m3       | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Nitrogen dioxide  | TWA       | 0.2 ppm                 | US. ACGIH Threshold Limit Values (02 2012)                                  |
|                   | Ceiling   | 5 ppm 9 mg/m3           | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                   | STEL      | 1 ppm 1.8 mg/m3         | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
| Ozone             | PEL       | 0.1 ppm 0.2 mg/m3       | US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006) |
|                   | Ceil_Time | 0.1 ppm 0.2 mg/m3       | US. NIOSH: Pocket Guide to Chemical Hazards (2005)                          |
|                   | TWA       | 0.05 ppm                | US. ACGIH Threshold Limit Values (03 2014)                                  |
|                   | TWA       | 0.20 ppm                | US. ACGIH Threshold Limit Values (03 2014)                                  |
|                   | TWA       | 0.10 ppm                | US. ACGIH Threshold Limit Values (03 2014)                                  |
|                   | TWA       | 0.08 ppm                | US. ACGIH Threshold Limit Values (03 2014)                                  |

**Additional exposure limits under the conditions of use: CANADA**

| Chemical Identity | type | Exposure Limit Values   | Source                                                                                                                                                        |
|-------------------|------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Carbon dioxide    | STEL | 30,000 ppm 54,000 mg/m3 | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                   | TWA  | 5,000 ppm 9,000 mg/m3   | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                   | TWA  | 5,000 ppm               | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                   | STEL | 15,000 ppm              | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                   | TWA  | 5,000 ppm               | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)                                                                          |
|                   | STEL | 30,000 ppm              | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)                                                                          |
|                   | STEL | 30,000 ppm              | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical                                                                                          |

|                  |            |                         |                                                                                                                                                               |
|------------------|------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                  |            |                         | Agents) (11 2010)                                                                                                                                             |
|                  | TWA        | 5,000 ppm               | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                  | 8 HR ACL   | 5,000 ppm               | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                  | 15 MIN ACL | 30,000 ppm              | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                  | TWA        | 5,000 ppm 9,000 mg/m3   | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
|                  | STEL       | 30,000 ppm 54,000 mg/m3 | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Carbon monoxide  | TWA        | 25 ppm 29 mg/m3         | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                  | TWA        | 25 ppm                  | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                  | STEL       | 100 ppm                 | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                  | TWA        | 25 ppm                  | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)                                                                          |
|                  | TWA        | 25 ppm                  | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)                                                                        |
|                  | 8 HR ACL   | 25 ppm                  | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                  | 15 MIN ACL | 190 ppm                 | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                  | TWA        | 35 ppm 40 mg/m3         | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
|                  | STEL       | 200 ppm 230 mg/m3       | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Nitrogen dioxide | STEL       | 5 ppm 9.4 mg/m3         | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                  | TWA        | 3 ppm 5.6 mg/m3         | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|                  | CEILING    | 1 ppm                   | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|                  | TWA        | 0.2 ppm                 | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2012)                                                                          |
|                  | STEL       | 5 ppm                   | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                  | TWA        | 3 ppm                   | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)                                                                        |
|                  | 8 HR ACL   | 3 ppm                   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|                  | 15 MIN ACL | 5 ppm                   | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |

|       |            |          |           |                                                                                                                                                               |
|-------|------------|----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | TWA        | 3 ppm    | 5.6 mg/m3 | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
| Ozone | STEL       | 0.3 ppm  | 0.6 mg/m3 | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|       | TWA        | 0.1 ppm  | 0.2 mg/m3 | Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2) (07 2009)                                                                       |
|       | TWA        | 0.05 ppm |           | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|       | TWA        | 0.1 ppm  |           | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|       | TWA        | 0.08 ppm |           | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|       | TWA        | 0.2 ppm  |           | Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007) |
|       | TWA        | 0.1 ppm  | 0.2 mg/m3 | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)                                                                        |
|       | STEL       | 0.3 ppm  | 0.6 mg/m3 | Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)                                                                        |
|       | 15 MIN ACL | 0.15 ppm |           | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|       | 8 HR ACL   | 0.05 ppm |           | Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)                                                              |
|       | CEILING    | 0.1 ppm  | 0.2 mg/m3 | Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)                                                |
|       | TWA        | 0.20 ppm |           | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |
|       | TWA        | 0.05 ppm |           | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |
|       | TWA        | 0.08 ppm |           | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |
|       | TWA        | 0.10 ppm |           | Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)                                                                          |

**Additional exposure limits under the conditions of use: MEXICO**

| Chemical Identity | type | Exposure Limit Values |              | Source                                               |
|-------------------|------|-----------------------|--------------|------------------------------------------------------|
| Carbon dioxide    | CPT  | 5,000 ppm             | 9,000 mg/m3  | Mexico. Occupational Exposure Limit Values (03 2000) |
|                   | CTT  | 15,000 ppm            | 27,000 mg/m3 | Mexico. Occupational Exposure Limit Values (03 2000) |
| Carbon monoxide   | CTT  | 400 ppm               | 400 mg/m3    | Mexico. Occupational Exposure Limit Values (03 2000) |
|                   | CPT  | 50 ppm                | 55 mg/m3     | Mexico. Occupational Exposure Limit Values (03 2000) |
| Nitrogen dioxide  | CTT  | 5 ppm                 | 10 mg/m3     | Mexico. Occupational Exposure Limit Values (03 2000) |
|                   | CPT  | 3 ppm                 | 6 mg/m3      | Mexico. Occupational Exposure Limit Values (03 2000) |

|       |   |         |                       |                                                      |
|-------|---|---------|-----------------------|------------------------------------------------------|
| Ozone | P | 0.1 ppm | 0.2 mg/m <sup>3</sup> | Mexico. Occupational Exposure Limit Values (03 2000) |
|-------|---|---------|-----------------------|------------------------------------------------------|

### Appropriate Engineering Controls

**Ventilation:** Use enough ventilation, local exhaust at the arc, or both to keep the fumes and gases from the worker's breathing zone and the general area. Train the welder to keep his head out of the fumes. **Keep exposure as low as possible.**

### Individual protection measures, such as personal protective equipment

#### General information:

**Exposure Guidelines:** Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) are values published by the American Conference of Government Industrial Hygienists (ACGIH). ACGIH Statement of Positions Regarding the TLVs® and BEIs® states that the TLV-TWA should be used as a guide in the control of health hazards and should not be used to indicate a fine line between safe and dangerous exposures. See Section 10 for information on potential fume constituents of health interest. Threshold Limit Values are figures published by the American Conference of Government Industrial Hygienists.

**Maximum Fume Exposure Guideline™ (MFEG)™** for this product (**based on total respirable particulate**) is 5.0 mg/m<sup>3</sup>. This exposure guideline is calculated using the most conservative value of the ACGIH TLV or OSHA PEL for the stated substance.

**Maximum Dust Exposure Guideline™ (MDEG)™** for this product (based on content of Chromium and chromium alloys or compounds (as Cr)) is 1.3 mg/m<sup>3</sup>. This exposure guideline is calculated using the most conservative value of the ACGIH TLV or OSHA PEL for the stated substance. Handle to minimize generation of airborne dust. Use adequate ventilation and dust collection. Use respiratory protection, if required, to keep exposure below limits.

#### Eyeface protection:

Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes – or follow the recommendations as specified in ANSI Z49.1, Section 4, based on your process and settings. No specific lens shade recommendation for submerged arc or electroslag processes. Shield others by providing appropriate screens and flash goggles.

#### Skin Protection

##### Hand Protection:

Wear protective gloves. Suitable gloves can be recommended by the glove supplier.

#### Other:

**Protective Clothing:** Wear hand, head, and body protection which help to prevent injury from radiation, sparks and electrical shock. See Z49.1. At a minimum this includes welder's gloves and a protective face shield, and may include arm protectors, aprons, hats, shoulder protection, as well as dark substantial clothing. Wear dry gloves free of holes or split seams. Train the welder not to permit electrically live parts or electrodes to contact skin . . . or clothing or gloves if they are wet. Insulate yourself from the work piece and ground using dry plywood, rubber mats or other dry insulation.

#### Respiratory Protection:

Keep your head out of fumes. Use enough ventilation and local exhaust to keep fumes and gases from your breathing zone and the general area. An approved respirator should be used unless exposure assessments are below applicable exposure limits.

#### Hygiene measures:

Do not eat, drink or smoke when using the product. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Determine the

composition and quantity of fumes and gases to which workers are exposed by taking an air sample from inside the welder's helmet if worn or in the worker's breathing zone. Improve ventilation if exposures are not below limits. See ANSI/AWS F1.1, F1.2, F1.3 and F1.5, available from the American Welding Society, [www.aws.org](http://www.aws.org).

## 9. PHYSICAL AND CHEMICAL PROPERTIES

|                                                              |                          |
|--------------------------------------------------------------|--------------------------|
| <b>Appearance:</b>                                           | Granular welding flux.   |
| <b>Physical state:</b>                                       | Solid                    |
| <b>Form:</b>                                                 | Granular                 |
| <b>Color:</b>                                                | No data available.       |
| <b>Odor:</b>                                                 | No data available.       |
| <b>Odor threshold:</b>                                       | No data available.       |
| <b>pH:</b>                                                   | No data available.       |
| <b>Melting point/freezing point:</b>                         | No data available.       |
| <b>Initial boiling point and boiling range:</b>              | No data available.       |
| <b>Flash Point:</b>                                          | No data available.       |
| <b>Evaporation rate:</b>                                     | No data available.       |
| <b>Flammability (solid, gas):</b>                            | No data available.       |
| <b>Upper/lower limit on flammability or explosive limits</b> |                          |
| <b>Flammability limit - upper (%):</b>                       | No data available.       |
| <b>Flammability limit - lower (%):</b>                       | No data available.       |
| <b>Explosive limit - upper (%):</b>                          | No data available.       |
| <b>Explosive limit - lower (%):</b>                          | No data available.       |
| <b>Vapor pressure:</b>                                       | No data available.       |
| <b>Vapor density:</b>                                        | No data available.       |
| <b>Density:</b>                                              | 2.0000 g/cm <sup>3</sup> |
| <b>Relative density:</b>                                     | No data available.       |
| <b>Solubility(ies)</b>                                       |                          |
| <b>Solubility in water:</b>                                  | No data available.       |
| <b>Solubility (other):</b>                                   | No data available.       |
| <b>Partition coefficient (n-octanol/water):</b>              | No data available.       |
| <b>Auto-ignition temperature:</b>                            | No data available.       |
| <b>Decomposition temperature:</b>                            | No data available.       |
| <b>Viscosity:</b>                                            | No data available.       |

## 10. STABILITY AND REACTIVITY

|                                            |                                                                                    |
|--------------------------------------------|------------------------------------------------------------------------------------|
| <b>Reactivity:</b>                         | The product is non-reactive under normal conditions of use, storage and transport. |
| <b>Chemical Stability:</b>                 | Material is stable under normal conditions.                                        |
| <b>Possibility of hazardous reactions:</b> | None under normal conditions.                                                      |
| <b>Conditions to avoid:</b>                | Avoid heat or contamination.                                                       |
| <b>Incompatible Materials:</b>             | Strong acids. Strong oxidizing substances. Strong bases.                           |



## Hazardous Decomposition Products:

Fumes and gases from welding and allied processes cannot be classified simply. The composition and quantity of both are dependent upon the metal being welded, the process, procedure and electrodes used. Other conditions which also influence the composition and quantity of the fumes and gases to which workers may be exposed include: coatings on the metal being welded (such as paint, plating, or galvanizing), the number of welders and the volume of the worker area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities.)

When the electrode is consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 3. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 3, plus those from the base metal and coating, etc., as noted above. Reasonably expected fume constituents produced during arc welding include the oxides of iron, manganese and other metals present in the welding consumable or base metal. Hexavalent chromium compounds may be in the welding fume of consumables or base metals which contain chromium. Gaseous and particulate fluoride may be in the welding fume of consumables which contain fluoride. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from the arc.

## 11. TOXICOLOGICAL INFORMATION

### Information on likely routes of exposure

|                      |                                                                                                                                                                                   |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inhalation:</b>   | Potential chronic health hazards related to the use of welding consumables are most applicable to the inhalation route of exposure. Refer to Inhalation statements in Section 11. |
| <b>Skin Contact:</b> | Arc rays can burn skin. Skin cancer has been reported.                                                                                                                            |
| <b>Eye contact:</b>  | Arc rays can injure eyes.                                                                                                                                                         |
| <b>Ingestion:</b>    | Health injuries from ingestion are not known or expected under normal use.                                                                                                        |

### Symptoms related to the physical, chemical and toxicological characteristics

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Inhalation:</b> | This product contains zircon sand and other minerals that may contain trace levels of radium, uranium and thorium resulting in naturally occurring radiation in the range of 0-34 pCi/g (1.26 Bq/g) (1.26 Bq/g). Overexposure by inhalation of dust containing radioactive uranium, thorium and radium may cause lung cancer. Short-term (acute) overexposure to fumes and gases from welding and allied processes may result in discomfort such as metal fume fever, dizziness, nausea, or dryness or irritation of nose, throat, or eyes. May aggravate pre-existing respiratory problems (e.g. asthma, emphysema). Long-term (chronic) overexposure to fumes and gases from welding and allied processes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Information on toxicological effects

#### Acute toxicity (list all possible routes of exposure)

|                                |                          |
|--------------------------------|--------------------------|
| <b>Oral</b>                    |                          |
| <b>Product:</b>                | ATEmix: 23,617.8 mg/kg   |
| <b>Specified substance(s):</b> |                          |
| Zircon                         | LD 50 (Rat): 3,200 mg/kg |
| Fluorides (as F)               | LD 50 (Rat): 4,250 mg/kg |

Sodium silicate LD 50 (Rat): 1.1 g/kg

**Dermal Product:** Not classified for acute toxicity based on available data.

**Inhalation Product:** Not classified for acute toxicity based on available data.

**Specified substance(s):**  
Aluminum oxide LC 50 (Rat, 1 h): 7.6 mg/l

**Repeated dose toxicity Product:** No data available.

**Skin Corrosion/Irritation Product:** Not classified

**Serious Eye Damage/Eye Irritation Product:** Not classified

**Respiratory or Skin Sensitization Product:** Respiratory Sensitization: Not classified Skin Sensitization: Not classified

**Carcinogenicity Product:** Not classified

**IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:**  
No carcinogenic components identified

**US. National Toxicology Program (NTP) Report on Carcinogens:**  
No carcinogenic components identified

**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050):**  
No carcinogenic components identified

**Germ Cell Mutagenicity**

**In vitro Product:** Not classified

**In vivo Product:** Not classified

**Reproductive toxicity Product:** Not classified

**Specific Target Organ Toxicity - Single Exposure Product:** Not classified

**Specific Target Organ Toxicity - Repeated Exposure Product:** Not classified

**Aspiration Hazard Product:** Not applicable

**Other effects:**

Organic polymers may be used in the manufacture of various welding consumables. Overexposure to their decomposition byproducts may result in a condition known as polymer fume fever. Polymer fume fever usually occurs within 4 to 8 hours of exposure with the presentation of flu like symptoms, including mild pulmonary irritation with or without an increase in body temperature. Signs of exposure can include an increase in white blood cell count. Resolution of symptoms typically occurs quickly, usually not lasting longer than 48 hours.

**Symptoms related to the physical, chemical and toxicological characteristics under the condition of use****Additional toxicological Information under the conditions of use:****Acute toxicity****Inhalation****Specified substance(s):**

|                  |                                 |
|------------------|---------------------------------|
| Carbon dioxide   | LC Lo (Human, 5 min): 90000 ppm |
| Carbon monoxide  | LC 50 (Rat, 4 h): 1,300 mg/l    |
| Nitrogen dioxide | LC 50 (Rat, 4 h): 88 ppm        |
| Ozone            | LC Lo (Human, 30 min): 50 ppm   |

**Other effects:****Specified substance(s):**

|                  |                                    |
|------------------|------------------------------------|
| Carbon dioxide   | asphyxia                           |
| Carbon monoxide  | Carboxyhemoglobinemia              |
| Nitrogen dioxide | Lower Respiratory Tract irritation |

**12. ECOLOGICAL INFORMATION****Ecotoxicity****Acute hazards to the aquatic environment:****Fish**

**Product:** Not classified

**Specified substance(s):**

|                 |                                                                                       |
|-----------------|---------------------------------------------------------------------------------------|
| Sodium silicate | LC 50 (Western mosquitofish ( <i>Gambusia affinis</i> ), 96 h): 1,800 mg/l            |
| Molybdenum      | LC 50 (Rainbow trout, donaldson trout ( <i>Oncorhynchus mykiss</i> ), 96 h): 800 mg/l |

**Aquatic Invertebrates**

**Product:** Not classified

**Specified substance(s):**

|                 |                                                                            |
|-----------------|----------------------------------------------------------------------------|
| Sodium silicate | EC 50 (Water flea ( <i>Ceriodaphnia dubia</i> ), 48 h): 22.94 - 49.01 mg/l |
| Manganese       | EC 50 (Water flea ( <i>Daphnia magna</i> ), 48 h): 40 mg/l                 |

**Chronic hazards to the aquatic environment:****Fish**

**Product:** Not classified

**Aquatic Invertebrates**

**Product:** Not classified

**Toxicity to Aquatic Plants**

**Product:** No data available.

**Persistence and Degradability****Biodegradation**

**Product:** No data available.

**Bioaccumulative Potential****Bioconcentration Factor (BCF)**

**Product:** No data available.

**Mobility in Soil:** No data available.

### 13. DISPOSAL CONSIDERATIONS

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General information:</b>    | <p>The generation of waste should be avoided or minimized whenever possible. When practical, recycle in an environmentally acceptable, regulatory compliant manner. Dispose of non-recyclable products in accordance with all applicable Federal, State, Provincial, and Local requirements. Minerals such as Florida Zircon Sand are used as one of the components in the manufacturing of welding fluxes contain trace levels of Naturally Occurring Radioactive Material (NORM). Based on the radiological status of these materials, the scrap flux and waste slag generated in welding processes should be acceptable for disposal in RCRA Title D landfills. Flux materials containing sufficiently low concentrations of NORM are not subject to federal radiation control regulations. The regulation for classifying the flux material (zircon sand) is Title 10, Code of Federal Regulations, Part 40 Section 40.13 (10CFR40.13). <b>Materials which contain less than 0.05% (0,05%) by weight of uranium and/or thorium, are exempt from regulation.</b> The concentrations in the flux and slag are considerably lower than 0.05% (0,05%). Note: Many states are developing regulations pertaining to Naturally Occurring Radioactive Materials (NORM) above background levels. Consult with the applicable regulations and the authority with jurisdiction.</p> |
| <b>Disposal instructions:</b>  | <p>Disposal of this product may be regulated as a Hazardous Waste. The welding consumable and/or by-product from the welding process (including, but not limited to slag, dust, etc.) may contain levels of leachable heavy metals such as Barium or Chromium. Prior to disposal, a representative sample must be analyzed in accordance with US EPA's Toxicity Characteristic Leaching Procedure (TCLP) to determine if any constituents exist above regulated threshold levels. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner according to Federal, State and Local Regulations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Contaminated Packaging:</b> | <p>Dispose of contents/container to an appropriate treatment and disposal facility in accordance with applicable laws and regulations, and product characteristics at time of disposal.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

### 14. TRANSPORT INFORMATION

|                            |                  |
|----------------------------|------------------|
| <b>DOT</b>                 |                  |
| UN Number:                 |                  |
| UN Proper Shipping Name:   | NOT DG REGULATED |
| Transport Hazard Class(es) |                  |
| Class:                     | NR               |
| Label(s):                  | —                |
| Packing Group:             | —                |
| Marine Pollutant:          | No               |
| <b>IMDG</b>                |                  |
| UN Number:                 |                  |
| UN Proper Shipping Name:   | NOT DG REGULATED |
| Transport Hazard Class(es) |                  |
| Class:                     | NR               |
| Label(s):                  | —                |
| EmS No.:                   |                  |

Packing Group: –  
Marine Pollutant: No

**IATA**

UN Number:  
Proper Shipping Name: NOT DG REGULATED  
Transport Hazard Class(es):  
    Class: NR  
    Label(s): –  
Packing Group: –  
Marine Pollutant: No  
Cargo aircraft only: Allowed.

**TDG**

UN Number:  
UN Proper Shipping Name: NOT DG REGULATED  
Transport Hazard Class(es):  
    Class: NR  
    Label(s): –  
Packing Group: –  
Marine Pollutant: No

**15. REGULATORY INFORMATION****US Federal Regulations****TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)**

None present or none present in regulated quantities.

**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)**

None present or none present in regulated quantities.

**CERCLA Hazardous Substance List (40 CFR 302.4):****Chemical Identity**

Chromium and chromium alloys or  
compounds (as Cr)  
Manganese

**Reportable quantity**

5000lbs.

Included in the regulation but with no data values. See  
regulation for further details.

**Superfund Amendments and Reauthorization Act of 1986 (SARA)****Hazard categories**

Not listed.

**SARA 302 Extremely Hazardous Substance**

None present or none present in regulated quantities.

**SARA 304 Emergency Release Notification****Chemical Identity**

Chromium and chromium alloys or  
compounds (as Cr)  
Manganese

**Reportable quantity**

5000 lbs.

Included in the regulation but with no data values. See  
regulation for further details.

**SARA 311/312 Hazardous Chemical****Chemical Identity**

Chromium and chromium alloys or  
compounds (as Cr)  
Zircon  
Magnesium oxide  
Fluorides (as F)

**Threshold Planning Quantity**

10000 lbs

10000 lbs

10000 lbs

10000 lbs

|                             |           |
|-----------------------------|-----------|
| Sodium silicate             | 10000 lbs |
| Molybdenum                  | 10000 lbs |
| Manganese                   | 10000 lbs |
| Silicon                     | 10000 lbs |
| Silicon dioxide (amorphous) | 10000 lbs |
| Aluminum oxide              | 10000 lbs |

**SARA 313 (TRI Reporting)**

| <u>Chemical Identity</u>                          | <u>Reporting threshold<br/>for other users</u> | <u>Reporting threshold for<br/>manufacturing and processing</u> |
|---------------------------------------------------|------------------------------------------------|-----------------------------------------------------------------|
| Chromium and chromium alloys or compounds (as Cr) | 10000 lbs                                      | 25000 lbs.                                                      |
| Manganese                                         | 10000 lbs                                      | 25000 lbs.                                                      |

**Clean Water Act Section 311 Hazardous Substances (40 CFR 117.3)**

None present or none present in regulated quantities.

**Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130):**

None present or none present in regulated quantities.

**US State Regulations****US. California Proposition 65**

No ingredient regulated by CA Prop 65 present.

**WARNING:** This product contains or produces a chemical known to the State of California to cause cancer and birth defects (or other reproductive harm). (California Health & Safety Code Section 25249.5 et seq.)

**US. New Jersey Worker and Community Right-to-Know Act****Chemical Identity**

Chromium and chromium alloys or compounds (as Cr)  
Magnesium oxide  
Fluorides (as F)  
Molybdenum  
Manganese

**US. Massachusetts RTK - Substance List****Chemical Identity**

Chromium and chromium alloys or compounds (as Cr)  
Magnesium oxide  
Molybdenum  
Manganese

**US. Pennsylvania RTK - Hazardous Substances****Chemical Identity**

Chromium and chromium alloys or compounds (as Cr)  
Magnesium oxide  
Fluorides (as F)  
Molybdenum  
Manganese

**US. Rhode Island RTK****Chemical Identity**

Chromium and chromium alloys or compounds (as Cr)  
Manganese

**Canada Federal Regulations****List of Toxic Substances (CEPA, Schedule 1)**

Not Regulated

**Export Control List (CEPA 1999, Schedule 3)**



Not Regulated

#### National Pollutant Release Inventory (NPRI)

**Canada. National Pollutant Release Inventory (NPRI) Substances, Part 5, VOCs with Additional Reporting Requirements**

NPRI PT5 Not Regulated

**Canada. Canadian Environmental Protection Act (CEPA). National Pollutant Release Inventory (NPRI) (Parts 1-4)**

NPRI Not Regulated

#### Greenhouse Gases

Not Regulated

#### Controlled Drugs and Substances Act

CA CDSI Not Regulated

CA CDSII Not Regulated

CA CDSIII Not Regulated

CA CDSIV Not Regulated

CA CDSV Not Regulated

CA CDSVII Not Regulated

CA CDSVIII Not Regulated

#### Precursor Control Regulations

Not Regulated

**Mexico. Substances subject to reporting for the pollutant release and transfer registry (PRTR):** not applicable

#### Inventory Status:

|                                          |                                                                   |
|------------------------------------------|-------------------------------------------------------------------|
| Australia AICS:                          | One or more components are not listed or are exempt from listing. |
| Canada DSL Inventory List:               | One or more components are not listed or are exempt from listing. |
| EINECS, ELINCS or NLP:                   | One or more components are not listed or are exempt from listing. |
| Japan (ENCS) List:                       | One or more components are not listed or are exempt from listing. |
| China Inv. Existing Chemical Substances: | One or more components are not listed or are exempt from listing. |
| Korea Existing Chemicals Inv. (KECI):    | One or more components are not listed or are exempt from listing. |
| Canada NDSL Inventory:                   | One or more components are not listed or are exempt from listing. |
| Philippines PICCS:                       | One or more components are not listed or are exempt from listing. |
| US TSCA Inventory:                       | One or more components are not listed or are exempt from listing. |
| New Zealand Inventory of Chemicals:      | One or more components are not listed or are exempt from listing. |
| Japan ISHL Listing:                      | One or more components are not listed or are exempt from listing. |
| Japan Pharmacopoeia Listing:             | One or more components are not listed or are exempt from listing. |
| Mexico INSQ:                             | One or more components are not listed or are exempt from listing. |
| Ontario Inventory:                       | One or more components are not listed or are exempt from listing. |
| Taiwan Chemical Substance Inventory:     | One or more components are not listed or are exempt from listing. |

## 16. OTHER INFORMATION

#### Definitions:

**The Maximum Fume Exposure Guideline™ (MFEG)™** is a guideline limit for total welding fume exposure for a specific consumable product which may be used by employers to manage worker exposure to welding fume where that product is used. The MFEG™ is an estimate of the level of total welding fume exposure for a given product above which the exposure limit for one of the fume constituents may be exceeded. The exposure limits referenced are the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV®) and

the U.S. OSHA Permissible Exposure Limit (PEL) whichever limit is lower. The MFEG™ never exceeds 5 mg/m<sup>3</sup> which is the maximum recommended exposure limit for total welding fume. **The MFEG™ is intended to serve as a general guideline to assist in the management of workplace exposure to welding fume and does not replace the regular measurement and analysis of worker exposure to individual welding fume constituents.**

**The Maximum Dust Exposure Guideline™ (MDEG)™** is provided to assist with the management of workplace exposures where granular solid welding products or other materials are being utilized. It is derived from relevant compositional data and estimates the lowest level of total airborne dust exposure, for a given product, at which some specific constituent might potentially exceed its individual exposure limit. The specific exposure limits referenced are the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV®) and the U. S. OSHA Permissible Exposure Limit (PEL), which ever value is the lowest. The MDEG™ is never greater than 10 mg/m<sup>3</sup> as this is the airborne exposure guideline for total particulate (total dust). **The MDEG™ is intended to serve as a general guideline to assist in the management of workplace exposure and does not replace the regular measurement and analysis of worker exposure to individual airborne dust constituents.**

**Combustible Dust Hazard Rating:**

This material will not burn and has the Lincoln Electric Combustible Dust Hazard Rating: 0-CS. For additional information contact the Lincoln Electric EHS Department (216) 383-2669.

**Combustible Dust Hazard Rating Information:**

**Lincoln Electric's Combustible Dust Rating System is as follows:**

- 3: Fine solid powders or dusts which can ignite with contact with air, or have a Kst value  $\geq 300$ , and/or would have an ignition flame front faster than the speed of sound.
- 2: Fine solid powders or dusts which can ignite with contact with air, have an MIE  $< 3$  mJ, or have a Kst value  $> 200$  &  $\leq 299$ , and/or would have an ignition flame front faster than the speed of sound.
- 1.3: Fine solid powders or dusts which have an MIE  $> 3$  mJ  $< 500$  mJ, and a Kst  $\geq 25$   $< 200$  mJ.
- 1.2: Fine solid powders or dusts which have an MIE  $> 3$  mJ  $< 500$  mJ, and a Kst  $< 25$ , or MIE  $> 500$  mJ and Kst  $\geq 25$  but  $< 200$  mJ.
- 1.1: Fine solid powders or dusts which have an MIE  $> 10$  J and a positive Kst value  $< 25$ .
- 0-CS: Materials that will not burn.

**Revision Date:**

12/22/2016

**Further Information:**

Additional information is available by request.

**Disclaimer:**

The Lincoln Electric Company urges each end user and recipient of this SDS to study it carefully. See also [www.lincolnelectric.com/safety](http://www.lincolnelectric.com/safety). If necessary, consult an industrial hygienist or other expert to understand this information and safeguard the environment and protect workers from potential hazards associated with the handling or use of this product. This information is believed to be accurate as of the revision date shown above. However, no warranty, expressed or implied, is given. Because the conditions or methods of use are beyond Lincoln Electric's control, we assume no liability resulting from the use of this product. Regulatory requirements are subject to change and may differ between various locations. Compliance with all applicable Federal, State, Provincial, and local laws and regulations remain the responsibility of the user.

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