SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

**Product Name:** ER4130 Chrome Moly  
**Product Size:** 3/32” (2.4 mm)

**Other means of identification**

**SDS number:** 200000004862

**Recommended use and restriction on use**

**Recommended use:** GTAW (Gas Tungsten Arc Welding)  
**Restrictions on use:** Not known. Read this SDS before using this product.

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

**Company Name:** The Harris Products Group  
**Address:** 4501 Quality Place  
Mason, OH 45040-1971  
USA

**Telephone:** +1 (513) 754-2000  
**Contact Person:** Safety Data Sheet Questions: salesinfo@jwharris.com

**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


**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.

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>CAS-No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>124-38-9</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>630-08-0</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>10102-44-0</td>
</tr>
<tr>
<td>Ozone</td>
<td>10028-15-6</td>
</tr>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
</tr>
</tbody>
</table>

3. COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Ingredients

Mixtures

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>CAS number</th>
<th>Content in percent (%)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>7439-89-6</td>
<td>50 - &lt;100%</td>
</tr>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr)</td>
<td>7440-47-3</td>
<td>0.1 - &lt;1%</td>
</tr>
<tr>
<td>Manganese</td>
<td>7439-96-5</td>
<td>0.1 - &lt;1%</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu)</td>
<td>7440-50-8</td>
<td>0.1 - &lt;1%</td>
</tr>
<tr>
<td>Silicon</td>
<td>7440-21-3</td>
<td>0.1 - &lt;1%</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>7439-98-7</td>
<td>0.1 - &lt;1%</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>0.1 - &lt;1%</td>
</tr>
</tbody>
</table>

* 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.

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### 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.
**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.


*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**

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Type</th>
<th>Exposure Limit Values</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr) - as Cr</td>
<td>TWA</td>
<td>0.5 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (12 2010)</td>
</tr>
<tr>
<td></td>
<td>PEL</td>
<td>1 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>REL</td>
<td>0.5 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Manganese - Fume, - as Mn</td>
<td>Ceiling</td>
<td>5 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>REL</td>
<td>1 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>3 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Chemical Identity</td>
<td>Type</td>
<td>Exposure Limit Values</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------</td>
<td>------</td>
<td>-----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Manganese - Inhalable fraction. - as Mn</td>
<td>TWA</td>
<td>0.1 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td>Manganese - Respirable fraction. - as Mn</td>
<td>TWA</td>
<td>0.02 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>REL</td>
<td>0.1 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>PEL</td>
<td>0.1 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>REL</td>
<td>1 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>REL</td>
<td>1 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>TWA</td>
<td>0.2 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td>Silicon - Total dust.</td>
<td>PEL</td>
<td>15 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td>Silicon - Respirable fraction.</td>
<td>PEL</td>
<td>5 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td>Silicon - Respirable.</td>
<td>REL</td>
<td>5 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Silicon - Total</td>
<td>REL</td>
<td>10 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Molybdenum - Total dust. - as Mo</td>
<td>PEL</td>
<td>15 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td>Molybdenum - Inhalable fraction. - as Mo</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td>Molybdenum - Respirable fraction. - as Mo</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td>Nickel - Inhalable fraction.</td>
<td>TWA</td>
<td>1.5 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (12 2010)</td>
</tr>
<tr>
<td>Nickel - as Ni</td>
<td>PEL</td>
<td>1 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td>Nickel</td>
<td>REL</td>
<td>0.015 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
</tbody>
</table>

**Occupational Exposure Limits: CANADA**

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Type</th>
<th>Exposure Limit Values</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr) - as Cr</td>
<td>TWA</td>
<td>0.5 mg/m³</td>
<td>Canada, Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
</tr>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr)</td>
<td>TWA</td>
<td>0.5 mg/m³</td>
<td>Canada, British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
</tr>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr) - as Cr</td>
<td>TWA</td>
<td>0.5 mg/m³</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)</td>
</tr>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr) - as Cr</td>
<td>TWA</td>
<td>0.5 mg/m³</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
</tr>
<tr>
<td>8 HR ACL</td>
<td>0.5 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
<td></td>
</tr>
<tr>
<td>15 MIN ACL</td>
<td>1.5 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
<td></td>
</tr>
<tr>
<td>Chromium and chromium</td>
<td>TWA</td>
<td>0.5 mg/m³</td>
<td>Canada, Quebec OELs. (Ministry of Labor</td>
</tr>
<tr>
<td>Substance Description</td>
<td>Exposure Period</td>
<td>Limit Value (mg/m³)</td>
<td>Source</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------------</td>
<td>---------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Manganese - as Mn</td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
</tr>
<tr>
<td></td>
<td>8 HR ACL</td>
<td>0.2</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Manganese - Fume. - as Mn</td>
<td>TWA</td>
<td>1</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Manganese - Dust. - as Mn</td>
<td>TWA</td>
<td>5</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Manganese - Fume. - as Mn</td>
<td>STEL</td>
<td>3</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Manganese - Respirable fraction. - as Mn</td>
<td>TWA</td>
<td>0.02</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
</tr>
<tr>
<td>Manganese - Inhalable fraction. - as Mn</td>
<td>TWA</td>
<td>0.1</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
</tr>
<tr>
<td>Manganese - as Mn</td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume.</td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>TWA</td>
<td>1</td>
<td>Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>TWA</td>
<td>1</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume.</td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>8 HR ACL</td>
<td>1</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>15 MIN ACL</td>
<td>0.6</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>15 MIN ACL</td>
<td>3</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>8 HR ACL</td>
<td>0.2</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>TWA</td>
<td>0.2</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>TWA</td>
<td>1</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Substance</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>OEL Source</td>
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<tr>
<td>-----------</td>
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<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>TWA</td>
<td>0.2 mg/m³</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and fume. - as Cu</td>
<td>TWA</td>
<td>1 mg/m³</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (08 2015)</td>
</tr>
<tr>
<td>Silicon - Total dust.</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)</td>
</tr>
<tr>
<td>Silicon</td>
<td>8 HR ACL</td>
<td>10 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Silicon</td>
<td>15 MIN ACL</td>
<td>20 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<tr>
<td>Silicon - Total dust.</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>Canada, Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Molybdenum - Inhalable</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>Canada, British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td>Molybdenum - Respirable.</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>Canada, British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
</tr>
<tr>
<td>Molybdenum - Inhalable fraction. - as Mo</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
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<tr>
<td></td>
<td>8 HR ACL</td>
<td>10 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Molybdenum - Respirable fraction. - as Mo</td>
<td>8 HR ACL</td>
<td>3 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Molybdenum - Inhalable fraction. - as Mo</td>
<td>15 MIN ACL</td>
<td>20 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Molybdenum - Respirable fraction. - as Mo</td>
<td>15 MIN ACL</td>
<td>6 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Molybdenum - as Mo</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>Canada, Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
</tr>
<tr>
<td>Molybdenum - Respirable fraction. - as Mo</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
</tr>
<tr>
<td>Molybdenum - Inhalable fraction. - as Mo</td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
</tr>
<tr>
<td>Molybdenum - Respirable fraction. - as Mo</td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (06 2015)</td>
</tr>
<tr>
<td>Nickel</td>
<td>TWA</td>
<td>1.5 mg/m³</td>
<td>Canada, Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>0.05 mg/m³</td>
<td>Canada, British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (05 2013)</td>
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<tr>
<td>Nickel - Inhalable fraction.</td>
<td>TWA</td>
<td>1.5 mg/m³</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)</td>
</tr>
<tr>
<td>Nickel - Inhalable fraction. - as Ni</td>
<td>8 HR ACL</td>
<td>1.5 mg/m³</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
</tr>
<tr>
<td>Chemical Identity</td>
<td>Type</td>
<td>Exposure Limit Values</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------</td>
<td>------</td>
<td>-----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr)</td>
<td>VLE-PPT</td>
<td>0.5 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Manganese - as Mn</td>
<td>VLE-PPT</td>
<td>0.2 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Fume. - as Cu</td>
<td>VLE-PPT</td>
<td>0.2 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu) - Dust and mist. - as Cu</td>
<td>VLE-PPT</td>
<td>1 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Molybdenum - Respirable fraction. - as Mo</td>
<td>VLE-PPT</td>
<td>0.5 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Nickel - Inhalable fraction. - as Ni</td>
<td>VLE-PPT</td>
<td>1.5 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
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### Additional exposure limits under the conditions of use: US

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Type</th>
<th>Exposure Limit Values</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>TWA</td>
<td>5,000 ppm</td>
<td>US. ACGIH Threshold Limit Values (12 2010)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>30,000 ppm</td>
<td>US. ACGIH Threshold Limit Values (12 2010)</td>
</tr>
<tr>
<td></td>
<td>PEL</td>
<td>5,000 ppm 9,000 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>30,000 ppm 54,000 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td></td>
<td>REL</td>
<td>5,000 ppm 9,000 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>TWA</td>
<td>25 ppm</td>
<td>US. ACGIH Threshold Limit Values (12 2010)</td>
</tr>
<tr>
<td></td>
<td>PEL</td>
<td>50 ppm 55 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
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<tr>
<td></td>
<td>REL</td>
<td>35 ppm 40 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
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<tr>
<td></td>
<td>Ceil_Time</td>
<td>200 ppm 229 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>TWA</td>
<td>0.2 ppm</td>
<td>US. ACGIH Threshold Limit Values (02 2012)</td>
</tr>
<tr>
<td></td>
<td>Ceiling</td>
<td>5 ppm 9 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>1 ppm 1.8 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
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</table>
### Chemical Identity | Type | Exposure Limit Values | Source |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone</td>
<td>PEL</td>
<td>0.1 ppm 0.2 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>Ceil_Time</td>
<td>0.1 ppm 0.2 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>0.05 ppm</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>0.20 ppm</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>0.10 ppm</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
</tr>
<tr>
<td></td>
<td>TWA</td>
<td>0.08 ppm</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
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<tr>
<td>Manganese - Fume. - as Mn</td>
<td>Ceiling</td>
<td>5 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>REL</td>
<td>1 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>3 mg/m³</td>
<td>US. NIOSH: Pocket Guide to Chemical Hazards (2005)</td>
</tr>
<tr>
<td>Manganese - Inhalable fraction. - as Mn</td>
<td>TWA</td>
<td>0.1 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
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<tr>
<td>Manganese - Respirable fraction. - as Mn</td>
<td>TWA</td>
<td>0.02 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (03 2014)</td>
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<tr>
<td>Nickel - Inhalable fraction.</td>
<td>TWA</td>
<td>1.5 mg/m³</td>
<td>US. ACGIH Threshold Limit Values (12 2010)</td>
</tr>
<tr>
<td>Nickel - as Ni</td>
<td>PEL</td>
<td>1 mg/m³</td>
<td>US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000) (02 2006)</td>
</tr>
<tr>
<td></td>
<td>REL</td>
<td>0.015 mg/m³</td>
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</table>

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

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Type</th>
<th>Exposure Limit Values</th>
<th>Source</th>
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</thead>
<tbody>
<tr>
<td>Carbon dioxide</td>
<td>STEL</td>
<td>30,000 ppm 54,000 mg/m³</td>
<td>Canada, Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<td></td>
<td>TWA</td>
<td>5,000 ppm 9,000 mg/m³</td>
<td>Canada, Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>5,000 ppm</td>
<td>Canada, British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>15,000 ppm</td>
<td>Canada, British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>5,000 ppm</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)</td>
</tr>
<tr>
<td></td>
<td>STEL</td>
<td>30,000 ppm</td>
<td>Canada, Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2011)</td>
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<tr>
<td></td>
<td>STEL</td>
<td>30,000 ppm</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>5,000 ppm</td>
<td>Canada, Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
</tr>
<tr>
<td></td>
<td>8 HR ACL</td>
<td>5,000 ppm</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<tr>
<td></td>
<td>15 MINACL</td>
<td>30,000 ppm</td>
<td>Canada, Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>5,000 ppm 9,000 mg/m³</td>
<td>Canada, Quebec OELs. (Ministry of Labor)</td>
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<tr>
<td>Substance</td>
<td>Measurement</td>
<td>Concentration units</td>
<td>OEL Details</td>
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<td>--------------------</td>
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<td>------------------------------------------------------------------------------</td>
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<tr>
<td>Carbon monoxide</td>
<td>STEL</td>
<td>30,000 ppm</td>
<td>54,000 mg/m³. Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<td></td>
<td>TWA</td>
<td>25 ppm</td>
<td>29 mg/m³. Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<td></td>
<td>TWA</td>
<td>25 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<td>STEL</td>
<td>100 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<td>TWA</td>
<td>25 ppm</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)</td>
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<tr>
<td></td>
<td>8 HR ACL</td>
<td>25 ppm</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<td>190 ppm</td>
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<td>TWA</td>
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<td>40 mg/m³. Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<td></td>
<td>STEL</td>
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<td>230 mg/m³. Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<tr>
<td>Nitrogen dioxide</td>
<td>STEL</td>
<td>5 ppm</td>
<td>9.4 mg/m³. Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<td>3 ppm</td>
<td>5.6 mg/m³. Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<tr>
<td></td>
<td>CEILING</td>
<td>1 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>0.2 ppm</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2012)</td>
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<td></td>
<td>STEL</td>
<td>5 ppm</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
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<tr>
<td></td>
<td>TWA</td>
<td>3 ppm</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (11 2010)</td>
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<tr>
<td></td>
<td>8 HR ACL</td>
<td>3 ppm</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<td></td>
<td>15 MIN ACL</td>
<td>5 ppm</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<td></td>
<td>TWA</td>
<td>3 ppm</td>
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<td>Ozone</td>
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<tr>
<td></td>
<td>TWA</td>
<td>0.1 ppm</td>
<td>0.2 mg/m³. Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<td>Scenario</td>
<td>Limit</td>
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<td>-------</td>
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<td></td>
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<tr>
<td>TWA</td>
<td>0.05 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td>TWA</td>
<td>0.1 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td>TWA</td>
<td>0.2 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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</tr>
<tr>
<td>TWA</td>
<td>0.08 ppm</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
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<tr>
<td>TWA</td>
<td>0.1 ppm</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)</td>
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</tr>
<tr>
<td>STEL</td>
<td>0.3 ppm</td>
<td>0.6 mg/m3</td>
<td>Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents) (07 2010)</td>
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<tr>
<td>15 MIN ACL</td>
<td>0.15 ppm</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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<tr>
<td>8 HR ACL</td>
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<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
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</tr>
<tr>
<td>CEILING</td>
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<td>0.2 mg/m3</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<tr>
<td>TWA</td>
<td>0.20 ppm</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
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<tr>
<td>TWA</td>
<td>0.05 ppm</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
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</tr>
<tr>
<td>TWA</td>
<td>0.08 ppm</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
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</tr>
<tr>
<td>TWA</td>
<td>0.10 ppm</td>
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</tr>
<tr>
<td>Manganese - as Mn</td>
<td>TWA</td>
<td>0.2 mg/m3</td>
<td>Canada. Alberta OELs (Occupational Health &amp; Safety Code, Schedule 1, Table 2) (07 2009)</td>
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<tr>
<td>Manganese - as Mn</td>
<td>TWA</td>
<td>0.2 mg/m3</td>
<td>Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended) (07 2007)</td>
</tr>
<tr>
<td>8 HR ACL</td>
<td>0.2 mg/m3</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
<td></td>
</tr>
<tr>
<td>15 MIN ACL</td>
<td>0.6 mg/m3</td>
<td>Canada. Saskatchewan OELs (Occupational Health and Safety Regulations, 1996, Table 21) (05 2009)</td>
<td></td>
</tr>
<tr>
<td>Manganese - Fume. - as Mn</td>
<td>TWA</td>
<td>1 mg/m3</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<tr>
<td>Manganese - Dust. - as Mn</td>
<td>TWA</td>
<td>5 mg/m3</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<tr>
<td>Manganese - Fume. - as Mn</td>
<td>STEL</td>
<td>3 mg/m3</td>
<td>Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment) (12 2008)</td>
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<td>Manganese - Respirable</td>
<td>TWA</td>
<td>0.02 mg/m3</td>
<td>Canada. Manitoba OELs (Reg. 217/2006, The Workplace Safety And Health Act) (03 2014)</td>
</tr>
<tr>
<td>Chemical Identity</td>
<td>Type</td>
<td>Exposure Limit Values</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------</td>
<td>------</td>
<td>-----------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>VLE-CT</td>
<td>30,000 ppm</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
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<tr>
<td></td>
<td>VLE-PPT</td>
<td>5,000 ppm</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Carbon monoxide</td>
<td>VLE-PPT</td>
<td>25 ppm</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>VLE-PPT</td>
<td>0.2 ppm</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Ozone</td>
<td>VLE-P</td>
<td>0.1 ppm</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
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<td>Manganese - as Mn</td>
<td>VLE-PPT</td>
<td>0.2 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
<tr>
<td>Nickel - Inhalable fraction. - as Ni</td>
<td>VLE-PPT</td>
<td>1.5 mg/m³</td>
<td>Mexico. OELs. (NOM-010-STPS-2014 Chemical Pollutants at the Workplace; Assessment and Control) (04 2014)</td>
</tr>
</tbody>
</table>

**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 content of Manganese) is 0.4 mg/m³. This exposure guideline is calculated using the most conservative value of the ACGIH TLV or OSHA PEL for the stated substance. If your local applicable exposure limits are lower than the ACGIH TLV or OSHA PEL for any of the metallic substances listed in Section 2 or 3 of this SDS, you must take that into consideration before utilizing or applying this guideline.

**Eye/face 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.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appearance:</strong></td>
<td>Solid welding wire or rod.</td>
</tr>
<tr>
<td><strong>Physical state:</strong></td>
<td>Solid</td>
</tr>
<tr>
<td><strong>Form:</strong></td>
<td>Solid</td>
</tr>
<tr>
<td><strong>Color:</strong></td>
<td>No data available.</td>
</tr>
<tr>
<td><strong>Odor:</strong></td>
<td>No data available.</td>
</tr>
<tr>
<td><strong>Odor threshold:</strong></td>
<td>No data available.</td>
</tr>
<tr>
<td><strong>pH:</strong></td>
<td>No data available.</td>
</tr>
</tbody>
</table>
Melting point/freezing point:  No data available.
Initial boiling point and boiling range:  No data available.
Flash Point:  No data available.
Evaporation rate:  No data available.
Flammability (solid, gas):  No data available.
Upper/lower limit on flammability or explosive limits
Flammability limit - upper (%):  No data available.
Flammability limit - lower (%):  No data available.
Explosive limit - upper (%):  No data available.
Explosive limit - lower (%):  No data available.
Vapor pressure:  No data available.
Vapor density:  No data available.
Density:  No data available.
Relative density:  No data available.
Solubility(ies)
Solubility in water:  No data available.
Solubility (other):  No data available.
Partition coefficient (n-octanol/water):  No data available.
Auto-ignition temperature:  No data available.
Decomposition temperature:  No data available.
Viscosity:  No data available.

10. STABILITY AND REACTIVITY

Reactivity:  The product is non-reactive under normal conditions of use, storage and transport.

Chemical Stability:  Material is stable under normal conditions.

Possibility of hazardous reactions:  None under normal conditions.

Conditions to avoid:  Avoid heat or contamination.


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

Inhalation: 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.

Skin Contact: Arc rays can burn skin. Skin cancer has been reported.

Eye contact: Arc rays can injure eyes.

Ingestion: Health injuries from ingestion are not known or expected under normal use.

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation: 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)

Oral

Product: Not classified

Specified substance(s):
Iron
LD 50 (Rat): 98.6 g/kg
Copper and/or copper alloys and compounds (as Cu)
LD 50 (Rat): 481 mg/kg

Dermal

Product: Not classified

Inhalation

Product: Not classified

Repeated dose toxicity

Product: Not classified

Skin Corrosion/Irritation

Product: Not classified

Serious Eye Damage/Eye Irritation

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

Carcinogenicity
Product: Arc rays: Skin cancer has been reported.

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
Nickel Overall evaluation: 2B. Possibly carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:
Nickel Reasonably Anticipated to be a Human Carcinogen.

No carcinogetic 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 classified

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

Inhalation:
Specified substance(s):
Manganese
Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremor. This condition can be irreversible.

Nickel
Nickel and its compounds are on the IARC and NTP lists as posing respiratory cancer risk, and are skin sensitizers with symptoms ranging from slight itch to severe dermatitis.

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

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans:
Specified substance(s):
- Nickel: Overall evaluation: 2B. Possibly carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens:
Specified substance(s):
- Nickel: Reasonably Anticipated to be a Human Carcinogen.

Other effects:
Specified substance(s):
- Carbon dioxide: Asphyxia
- Carbon monoxide: Carboxyhemoglobinemia
- Nitrogen dioxide: Lower respiratory tract irritation
- Nickel: Dermatitis Pneumoconiosis

12. ECOLOGICAL INFORMATION

Ecotoxicity
Acute hazards to the aquatic environment:
Fish
- Product: Not classified
- Specified substance(s):
  - Copper and/or copper alloys and compounds (as Cu): LC 50 (Fathead minnow (Pimephales promelas), 96 h): 1.6 mg/l
  - Molybdenum: LC 50 (Rainbow trout, donaldson trout (Oncorhynchus mykiss), 96 h): 800 mg/l
  - Nickel: LC 50 (Fathead minnow (Pimephales promelas), 96 h): 2.916 mg/l

Aquatic Invertebrates
- Product: Not classified
- Specified substance(s):
  - Manganese: EC 50 (Water flea (Daphnia magna), 48 h): 40 mg/l
  - Copper and/or copper alloys and compounds (as Cu): EC 50 (Water flea (Daphnia magna), 48 h): 0.102 mg/l
  - Nickel: EC 50 (Water flea (Daphnia magna), 48 h): 1 mg/l

Chronic hazards to the aquatic environment:
Fish
- Product: Not classified

Aquatic Invertebrates
- Product: Not classified

Toxicity to Aquatic Plants
- Product: Not classified
- Specified substance(s):
  - Copper and/or copper alloys and compounds (as Cu): LC 50 (Green algae (Scenedesmus dimorphus), 3 d): 0.0623 mg/l
Persistence and Degradability

Biodegradation

Product: No data available.

Bioaccumulative potential

Bioconcentration Factor (BCF)

Product: No data available.

Specified substance(s):
- Copper and/or copper alloys and compounds (as Cu)
- Nickel

Blue-green algae (Anacystis nidulans), Bioconcentration Factor (BCF): 36.01 (Static)

Zebra mussel (Dreissena polymorpha), Bioconcentration Factor (BCF): 5,000 - 10,000 (Lotic) Bioconcentration factor calculated using dry weight tissue conc

Mobility in soil: No data available.

13. DISPOSAL CONSIDERATIONS

General information: 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.

Disposal instructions: 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.

Contaminated Packaging: 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.

14. TRANSPORT INFORMATION

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

IMDG
UN Number: NOT DG REGULATED
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):  

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Reportable quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr)</td>
<td>5000lbs.</td>
</tr>
<tr>
<td>Manganese</td>
<td>Included in the regulation but with no data values. See regulation for further details.</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu)</td>
<td>5000lbs.</td>
</tr>
<tr>
<td>Nickel</td>
<td>100lbs.</td>
</tr>
</tbody>
</table>

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  

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Reportable quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr)</td>
<td>5000 lbs.</td>
</tr>
<tr>
<td>Manganese</td>
<td>Included in the regulation but with no data values. See regulation for further details.</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu)</td>
<td>5000 lbs.</td>
</tr>
</tbody>
</table>
Nickel 100 lbs.

**SARA 311/312 Hazardous Chemical**

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Threshold Planning Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>10000 lbs</td>
</tr>
<tr>
<td>Chromium and chromium alloys or compounds (as Cr)</td>
<td>10000 lbs</td>
</tr>
<tr>
<td>Manganese</td>
<td>10000 lbs</td>
</tr>
<tr>
<td>Copper and/or copper alloys and compounds (as Cu)</td>
<td>10000 lbs</td>
</tr>
<tr>
<td>Silicon</td>
<td>10000 lbs</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>10000 lbs</td>
</tr>
<tr>
<td>Nickel</td>
<td>10000 lbs</td>
</tr>
</tbody>
</table>

**SARA 313 (TRI Reporting)**

<table>
<thead>
<tr>
<th>Chemical Identity</th>
<th>Reporting threshold for other users</th>
<th>Reporting threshold for manufacturing and processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>10000 lbs</td>
<td>25000 lbs</td>
</tr>
</tbody>
</table>

**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**
This product contains chemical(s) known to the State of California to cause cancer and/or to cause birth defects or other reproductive harm.

Nickel Carcinogenic.

**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**

Nickel

**US. Massachusetts RTK - Substance List**

**Chemical Identity**

Nickel

**US. Pennsylvania RTK - Hazardous Substances**

**Chemical Identity**

Nickel

**US. Rhode Island RTK**

No ingredient regulated by RI Right-to-Know Law present.

**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 AIICS: On or in compliance with the inventory
Canada DSL Inventory List: On or in compliance with the inventory
EINECS, ELINCS or NLP: On or in compliance with the inventory
Japan (ENCS) List: One or more components are not listed or are exempt from listing.
China Inv. Existing Chemical Substances: On or in compliance with the inventory
Korea Existing Chemicals Inv. (KECI): On or in compliance with the inventory
Canada NDSSL Inventory: One or more components are not listed or are exempt from listing.
Philippines PICCS: On or in compliance with the inventory
US TSCA Inventory: On or in compliance with the inventory
New Zealand Inventory of Chemicals: On or in compliance with the inventory
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. If local applicable limits for substances listed in Section 2 or 3 of this SDS are lower than the TLV or PEL this must be taken into consideration before utilizing or
applying this guideline. The MFEG™ never exceeds 5 mg/m³ 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 in accordance with recommended industrial hygiene practice.**

**Revision Date:** 09/19/2017

**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. 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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