

**SAFETY DATA SHEET**



**CROWN ALLOYS COMPANY**

**Section 1 – PRODUCT AND COMPANY IDENTIFICATION**

**PRODUCT NAME:** Build-Up and Hard Surfacing Covered Electrodes

**PRODUCT IDENTIFICATION:** ROYAL 235 | ROYAL 240

**SPECIFICATION:** N/A

**RECOMMENDED USE:** SMAW (Shielded Metal Arc Welding)

**SUPPLIER:** Crown Alloys Company  
 30105 Stephenson Hwy.  
 Madison Heights, MI. 48071

**TELEPHONE NUMBER:** (248) 588-3790

**EMERGENCY NUMBER:** Call CHEMTREC Day or Night 1-800-424-9300 / +1 703-527-3887

**WEBSITE:** [www.crownalloys.com](http://www.crownalloys.com)

**Section 2 – HAZARDS IDENTIFICATION**

**2.1 Classification of the mixture**

This product is placed on the market in solid form

**2.1.1 Classification in accordance with GHS-US**

Acute Tox. 4 (Oral)	H302	STOT SE 3	H336
Skin Irrit. 2	H315	Carc. 1B	H350
Skin Sens. 1	H317	STOT RE 1	H372
Eye Irrit. 2A	H319	Aquatic Acute 1	H400
STOT SE 3	H335	Aquatic Chronic 3	H412

**2.2 Label elements**

**GHS-US labelling**

**Hazard Pictograms (GHS-US):**



GHS07



GHS08



GHS09

**Signal word (GHS-US):**

Danger

**Hazard statements (GHS-US):**

- |  |   |
|--|---|
| H302 – Harmful if swallowed                | H336 – May cause drowsiness or dizziness                              |
| H317 – May cause an allergic skin reaction | H350 – May cause cancer   |
| H315 – Causes skin irritation              | H372 – Causes damage to organs through prolonged or repeated exposure |
| H319 – Causes serious eye irritation       | H400 – Very toxic to aquatic life                                     |
| H335 – May cause respiratory irritation    | H412 – Harmful to aquatic life with long lasting effects              |

**Precautionary statements (GHS-US):**

- |  |   |
|--|---|
| P201 – Obtain special instructions before use                                    | P403+P233 – Store in a well-ventilated place. Keep container tightly closed.  |
| P202 – Do not handle until all safety precautions have been read and understood  | P302+P352 – IF ON SKIN: Wash with plenty of soap and water  |
| P260 – Do not breathe dust/fume/gas/mist/vapors/spray                            | P308+P313 – IF EXPOSED OR CONCERNED: Get medical advice/attention   |
| P261 – Avoid breathing dust/fume/gas/mist/vapors/spray                           | P314 – Get medical advice and attention if you feel unwell  |
| P264 – Wash thoroughly after handling  | P321 – Specific treatment (see label)   |
| P270 – Do not eat, drink or smoke when using this product                        | P330 – If swallowed, rinse mouth  |
| P272 – Contaminated work clothing should not be allowed out of the workplace     | P333+P313 – If skin irritation or rash occurs: Get medical advice/attention   |
| P273 – Avoid release to the environment  | P362+P364 – Take off contaminated clothing and wash it before reuse   |
| P280 – Wear protective gloves/protective clothing/eye protection/face protection | P391 – Collect spillage   |
| P301+P312 – If swallowed: Call a poison center or physician if you feel unwell   | P405 – Store locked up  |
|  | P501- Dispose of contents/container in accordance with local/regional/national/international regulations  |
|  | P305+P351+P338 – If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. |
|  | P337+P313 – If eye irritation persists: Get medical advice/attention  |

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**2.3 Other hazards**

No additional information available

**2.4 Unknown acute toxicity (GHS-US)**

No data available

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

Electrical shock can kill.  
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 these alloys. Refer to Section 8.

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

The welding fumes produced from these welding alloys 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.	Chemical Identity	CAS-No.	Chemical Identity	CAS-No.
Carbon Dioxide	124-38-9	Ozone	10028-15-6	Nickel	7440-02-0
Carbon Monoxide	630-08-0	Manganese	7439-96-5	Chromium Oxide	1308-38-9
Nitrogen Dioxide	10102-44-0	Chromium (VI)	18540-29-9	Fluorides (as F)	16984-48-8

**Section 3 – COMPOSITION / INFORMATION ON INGREDIENTS**

**3.1 Substances**

Not applicable

Full text of H-phrases: See section 16

**3.2 Mixture**

**Reportable Hazardous Ingredients**

Chemical Identity	CAS-No.	Weight Percent (%)	GHS-US Classification
Carbon (C)	7440-44-0	1.00 – 7.00	Not classified
Chromium and chromium alloys or compounds (as Cr)	7440-47-3	10.0 – 60.0	Comb. Dust
Copper (Cu)	7440-50-8	0.10 max.	Comb. Dust Aquatic Acute 1, H400 Aquatic Chronic 3, H412
Iron (Fe)	7439-89-6	30.0 – 70.0	Acute Tox. 4 (Oral), H302
Manganese (Mn)	7439-96-5	0.10 – 30.0	Comb. Dust
Molybdenum (Mo)	7439-98-7	0.12 max.	Not classified
Nickel (Ni)	7440-02-0	0.10 – 5.00	Skin Sens. 1, H317 Carc. 1B, H350 STOT RE 1, H372
Silicon (Si)	7440-21-3	1.50 max.	Not classified

Other components which may be present: **Flux**

Barium carbonate	513-77-9	1.50 max.	Harmful if swallowed, R22
Calcium carbonate, Limestone (CaCO <sub>3</sub> )	1317-65-3	1.00 – 5.00	Not classified
Calcium fluoride (Fluorspar) (CaF <sub>2</sub> )	7789-75-5	0.50 – 5.00	Not classified
Feldspar	68476-25-5	5.00 max.	Not classified
Graphite	7782-42-5	1.50 max.	Not classified
Potassium silicate (K <sub>2</sub> SiO <sub>3</sub> )	1312-76-1	5.00 max.	Acute Tox. 4 (Oral), H302
Potassium oxalate	6487-48-5	5.00 max.	Not classified
Silica (quartz) (SiO <sub>2</sub> )	14808-60-7	5.00 max.	Carc. 1A, H350 STOT RE 1, H372
Sodium silicate (Na <sub>2</sub> Si <sub>6</sub> O <sub>9</sub> )	1344-09-8	1.00 – 5.00	Acute Tox. 4 (Oral), H302
Titanium dioxide (TiO <sub>2</sub> )	13463-67-7	10.0 max.	Carc. 2, H351

**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. These alloys may contain additional non-hazardous ingredients or may form additional compounds under the condition of use. Refer to Sections 2 & 8 for more information.

**Section 4 – FIRST AID MEASURES**

**4.1 Description of first aid measures**

**Ingestion:** Unlikely due to the form of the product. 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. If symptoms develop, seek medical attention at once.

**Inhalation:** Remove to fresh air. If not breathing, give artificial respiration. Seek medical assistance immediately.

**Skin Contact:** Flush with water for at least 15 minutes. For reddened or blistered skin, or thermal burns, obtain medical assistance.

**Eye Contact:** Dust or fume from these alloys should be flushed from the eyes with clean, tepid water until transported to a medical facility. Do not rub eyes or keep eyes tightly closed. Obtain immediate medical assistance.  
Arc rays can injure eyes. If exposed, move victim to a dark room, remove contact lenses and cover eyes with a padded dressing and rest. Obtain medical assistance if symptoms persist.

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

#### Symptoms/injuries after inhalation:

No adverse effects are expected from welding consumables until they are welded.

Hexavalent chromium compounds, nickel metal and compounds and respirable crystalline silica are listed in the National Toxicology Program (NTP) Annual Report on Carcinogens, and are found to be a human carcinogen in the International Agency for Research on Cancer (IARC) Monographs, and are listed by OSHA/ACGIH as potential carcinogens.

Short-term (acute) overexposure to the gases, fumes, and dusts may include irritation of the eyes, lungs, nose, and throat. Some toxic gases associated with welding may cause pulmonary edema, asphyxiation, and death.

Acute overexposure may include signs and symptoms such as watery eyes, nose and throat irritation, headache, dizziness, difficulty in breathing, frequent coughing, or chest pain. The presence of chromium/chromate in fume can cause irritation of nasal membranes and skin. The presence of nickel compounds in fume can cause metallic taste, nausea, tightness of chest, fever, and allergic reaction. Excessive inhalation or ingestion of manganese can produce manganese poisoning. Overexposure to manganese compounds may affect the central nervous system, symptoms of which are languor, sleepiness, muscular weakness, emotional disturbances, and spastic gait resembling Parkinsonism. These symptoms can become progressive and permanent if not treated. Excessive inhalation of fumes may cause "Metal Fume Fever" with Flu-like symptoms such as chills, fever, body aches, vomiting, sweating, etc.

#### Symptoms/injuries after skin contact:

Dusts may cause irritation.

#### Symptoms/injuries after eye contact:

Causes eye irritation.

#### Symptoms/injuries after ingestion:

Not an anticipated route of exposure during normal product handling. May be harmful if ingested.

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

No additional information available

## Section 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.

### 5.1 Extinguishing media

#### Suitable extinguishing media:

Use extinguishing media appropriate for surrounding fire.

#### Unsuitable extinguishing media:

None

### 5.2 Special hazards arising from the substance

#### Fire hazard:

Not flammable.

#### Explosion hazard:

None known.

### 5.3 Special protective equipment and precautions for firefighters

#### Special firefighting procedures:

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

#### Special protective equipment for firefighters:

Firefighters should wear full protective gear.

## Section 6 – ACCIDENTAL RELEASE MEASURES

### 6.1 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.

### 6.2 Environmental precautions

Avoid release to the environment

### 6.3 Methods and material for containment and cleaning up

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. Attempt to reclaim the product if possible.

## Section 7 – HANDLING AND STORAGE

### 7.1 Precautions for safe handling

Avoid inhaling welding fumes. Keep formation of airborne dusts to a minimum. Provide appropriate exhaust ventilation at places where dust is formed. Read and understand the manufacturer's instruction and the precautionary label on the product. 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).

### 7.2 Conditions for safe storage, including any incompatibilities

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

### 7.3 Specific end use(s)

For welding consumables and related products

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**Section 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION**

**8.1 Control parameters**

Chemical Identity (CAS-No.)	ACGIH TLV (TWA)	OSHA PEL (TWA)	NIOSH REL	NIOSH STEL
<b>Carbon</b> (7440-44-0)	2.0 mg/m <sup>3</sup>	2.5 mg/m <sup>3</sup>	N/A	N/A
<b>Chromium</b> (7440-47-3)	0.5 mg/m <sup>3</sup> [metal compound as Cr] 0.05 mg/m <sup>3</sup> [Cr(VI) inorganic compounds as Cr, water soluble] 0.01 mg/m <sup>3</sup> [Cr(VI) inorganic compounds as Cr, water insoluble]	1.0 mg/m <sup>3</sup> [metal compound as Cr] 0.005 mg(5 µg)/m <sup>3</sup> [Cr(VI) inorganic compounds as Cr(VI), water soluble] 0.005 mg(5 µg)/m <sup>3</sup> [Cr(VI) inorganic compounds as Cr(VI), insoluble]	0.5 mg/m <sup>3</sup>	N/A
<b>Copper</b> (7440-50-8)	0.2 mg/m <sup>3</sup> (fume, as Cu) 1.0 mg/m <sup>3</sup> (dust and mists, as Cu)	0.1 mg/m <sup>3</sup> (fume, as Cu) 1.0 mg/m <sup>3</sup> (dust and mist, as Cu)	1 mg/m <sup>3</sup>	N/A
<b>Iron</b> (7439-89-6)	5.0 mg/m <sup>3</sup> (as Fe <sub>2</sub> O <sub>3</sub> ) respirable fraction	10.0 mg/m <sup>3</sup> (fume, as Fe <sub>2</sub> O <sub>3</sub> )	5.0 mg/m <sup>3</sup> (dust & fume as Fe)	N/A
<b>Manganese</b> (7439-96-5)	0.02 mg/m <sup>3</sup> (elemental and inorganic compounds, as Mn – respirable fraction) 0.1 mg/m <sup>3</sup> (elemental and inorganic compounds, as Mn – inhalable fraction)	5.0 mg/m <sup>3</sup> (fume, as Mn) Ceiling	1 mg/m <sup>3</sup>	3 mg/m <sup>3</sup>
<b>Molybdenum</b> (7439-98-7)	0.5 mg/m <sup>3</sup> (respirable fraction, as Mo) 10.0 mg/m <sup>3</sup> (inhalable fraction, as Mo)	5.0 mg/m <sup>3</sup> (total dust, as Mo)	N/A	N/A
<b>Nickel</b> (7440-02-0)	1.5 mg/m <sup>3</sup> as metal (inhalable fraction) 0.2 mg/m <sup>3</sup>	1.0 mg/m <sup>3</sup> (metal and insoluble compounds as Ni)	0.015 mg/m <sup>3</sup>	N/A
<b>Silicon</b> (7440-21-3)	Withdrawn	15.0 mg/m <sup>3</sup> (total dust) 5.0 mg/m <sup>3</sup> (respirable fraction)	5.0 mg/m <sup>3</sup> (respirable) 10.0 mg/m <sup>3</sup> (total)	N/A
<b>Barium carbonate</b> (513-77-9)	0.5 mg/m <sup>3</sup> (as Ba)	0.5 mg/m <sup>3</sup> (as Ba)	N/A	N/A
<b>Calcium carbonate, (Limestone)</b> (1317-65-3)	10.0 mg/m <sup>3</sup>	5.0 mg/m <sup>3</sup> (respirable fraction) 15.0 mg/m <sup>3</sup> (total dust)	5.0 mg/m <sup>3</sup> (respirable) 10.0 mg/m <sup>3</sup> (total)	N/A
<b>Calcium fluoride</b> (7789-75-5)	2.5 mg/m <sup>3</sup> (as F)	2.5 mg/m <sup>3</sup> (as F) 2.5 mg/m <sup>3</sup> (as F) (dust)	N/A	N/A
<b>Cellulose</b> (9004-34-6)	10.0 mg/m <sup>3</sup>	5.0 mg/m <sup>3</sup>	N/A	N/A
<b>Feldspar</b> (68476-25-5)	2.0 mg/m <sup>3</sup>	10.0 mg/m <sup>3</sup>	N/A	N/A
<b>Graphite</b> (7782-42-5)	2.0 mg/m <sup>3</sup> (all forms except graphite fibers)	5.0 mg/m <sup>3</sup> (synthetic) 15.0 mppcf (millions of particles per cubic foot of air)	N/A	N/A
<b>Potassium silicate</b> (1312-76-1)	10.0 mg/m <sup>3</sup>	None Established	N/A	N/A
<b>Potassium oxalate</b> (6487-48-5)	5.0 mg/m <sup>3</sup>	None Established	N/A	N/A
<b>Silica (quartz)</b> (14808-60-7)	0.025 mg/m <sup>3</sup> (respirable fraction)	2.4 mppcf (millions of particles per cubic foot of air) [respirable] 0.1 mg/m <sup>3</sup> 0.3 mg/m <sup>3</sup> (total dust)	0.05 mg/m <sup>3</sup> (respirable dust)	N/A
<b>Sodium silicate</b> (1344-09-8)	10.0 mg/m <sup>3</sup>	N/A	N/A	N/A
<b>Titanium dioxide</b> (13463-67-7)	10.0 mg/m <sup>3</sup>	15.0 mg/m <sup>3</sup> (total dust)	N/A	N/A

**8.2 Exposure controls**

**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.

**Appropriate Engineering Controls:**

Use enough ventilation, local exhaust at the arc, or both to keep the fumes and gases from the worker's breathing zone & the general area. Maintain exposures below acceptable exposure levels (see Section 8.1). Use industrial hygiene air monitoring to ensure that your use of these products does not create exposures that exceed the recommended exposure limits. Always use exhaust ventilation in user operations such as high temperature cutting, grinding, welding and brazing. Train the welder to keep his head out of the fume plume. Confined spaces require adequate ventilation and/or air supplied respirators. Read and understand the manufacturer's instructions and the precautionary label on the product. See American National Standard Z49.1, Safety in Welding, Cutting, and Allied Processes, published by the American Welding Society, 8669 Doral Blvd. Suite 130, Doral, FL 33166 and OSHA Publication 2206 (29CFR1910), US Government Printing Office, Washington, D.C. 20402 for more details on many of the following.

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**8.2 Exposure controls (continued)**

- Eye/face protection:** Wear helmet or use face shield with filter lens shade number 12 or darker for open arc processes. No specific lens shade recommendation for submerged arc processes. Shield others by providing screens and flash goggles.
- Skin/Hand Protection:** Wear protective gloves. Suitable gloves can be recommended by the glove supplier.
- 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. Use respirable fume respirator or air supplied respirator when welding in confined space or where local exhaust or ventilation does not keep exposure below TLV's (see Section 8.1). Use only NIOSH approved respirators in accordance with 29 CFR 1910.134 – Respiratory Protection. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).
- 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. Cosmetics should not be applied in areas where exposures exist! 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).

**Section 9 – PHYSICAL AND CHEMICAL PROPERTIES**

<b>Appearance</b>	Solid steel rod covered with an extruded flux
<b>Physical state</b>	Solid
<b>Form</b>	Solid
<b>Color</b>	Metallic
<b>Odor</b>	No data available
<b>Odor threshold</b>	No data available
<b>pH</b>	Not applicable
<b>Melting point/freezing point</b>	No data available
<b>Flammability (solid, gas)</b>	No data available
<b>Flash Point</b>	Not applicable
<b>Evaporation rate</b>	Not applicable
<b>Initial boiling point and boiling range</b>	No data available

<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>	Not applicable
<b>Vapor density</b>	Not applicable
<b>Relative density</b>	No data available
<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>	Not applicable

**Section 10 – STABILITY AND REACTIVITY**

**10.1 Reactivity**

This product is non-reactive under normal conditions of use, storage and transport.

**10.2 Chemical stability**

This product is stable under normal conditions.

**10.3 Possibility of hazardous reactions**

Will not occur.

**10.4 Conditions to avoid**

Uncontrolled exposure to extreme temperatures and incompatible materials.

**10.5 Incompatible materials**

Strong acids, strong oxidizers, strong bases, mineral acids, some halogenated compounds, phosphorus and mercury.

**10.6 Hazardous decomposition products**

Welding/brazing fumes and gases can't be classified simply. The composition and quantity of both are dependent upon the metal being welded/brazed and the rods used. Coatings on the metal being welded/brazed (such as paint, plating, or galvanizing), the number of welders, the volume of the work area, the quality and the amount of ventilation, the position of the welder's head with respect to the gas plume, the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing activities), the process and procedures, as well as the welding/brazing consumables.





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When these hard facing electrodes are 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, coatings, etc., as noted above. Gaseous reaction products may include carbon monoxide and carbon dioxide. Ozone and nitrogen oxides may be formed by the radiation from an arc, in addition to the shielding gases like argon and helium, whenever they are employed. Reasonably expected fume constituents of these hard facing electrodes would include: Complex oxides of iron, manganese, calcium, silicon, copper, chromium, nickel, molybdenum, carbon dioxide, carbon monoxide, ozone and nitrogen oxides. Fluorides will also be present. The fume limit for chromium, nickel, calcium fluoride, silica (quartz) and/or manganese may be reached before the general welding fume limit of 5 mg/m<sup>3</sup> is reached. One recommended way to determine the composition and quantity of fumes and gases to which workers are exposed is to take an air sample inside the welder's helmet if worn or in the worker's breathing zone. See ANSI/AWS F1.1 "Method for Sampling Airborne Particles Generated by Welding and Allied Processes" and "Characterization of Arc Welding Fume" available from the American Welding Society, 8669 Doral Blvd. Suite 130, Doral, FL 33166

**A SIGNIFICANT AMOUNT OF THE CHROMIUM IN THE FUMES CAN BE HEXAVALENT CHROMIUM , ALSO KNOWN AS Cr(VI), WHICH HAS A VERY LOW EXPOSURE LIMIT OF 0.005 mg/m<sup>3</sup> (5 µg/m<sup>3</sup>).**

Monitor fume levels and Cr(VI) level. Train workers about the hazards of Cr(VI). **Read and comply with OSHA's permissible exposure limits for hexavalent chromium Cr(VI), Fed. Reg. 71 – 10099 (specifically 29 CFR 1910.1026, 29 CFR 1915.1026, and 29 CFR 1926.1126).** For Cr(VI), OSHA requires: "The employer shall perform initial monitoring to determine the 8-hour TWA exposure for each employee on the basis of a sufficient number of personal breathing zone air samples to accurately characterize full shift exposure on each shift, for each job classification, in each work area". Specialized equipment is required for monitoring Cr(VI) concentration in the workplace. OSHA Analytical Method Number ID-215 for area and breathing zone sampling and OSHA Analytical Method Number W4001 for wipe samples are listed on the OSHA website – [www.osha.gov](http://www.osha.gov) – as methods for measuring Cr(VI). This standard is complex and the employer should contact an occupational health professional for doing the Cr(VI) monitoring and all other fume monitoring.

**EU RoHS (European Union Restriction of Hazardous Substances):** Some of these hard facing electrodes contain Chromium. During welding these alloys will produce Cr(VI) (hexavalent chromium), however, the weld deposit does not contain Cr(VI) as it will all be in the zero valent state or as Cr(III) as an oxide. **FINISHED PRODUCTS MANUFACTURED USING THESE HARD FACING ELECTRODES WILL NOT CONTAIN ANY Cr(VI).**

## Section 11 – TOXICOLOGICAL INFORMATION

### Information on likely routes of exposure

- Ingestion:** Health injuries from ingestion are not known or expected under normal use.
- 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 this section.
- Skin Contact:** Arc rays can burn skin. Skin cancer has been reported.
- Eye contact:** Arc rays can injure eyes.

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

- Inhalation:** Short-term (acute) overexposure to welding fumes 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 welding fumes can lead to siderosis (iron deposits in lung), central nervous system effects, bronchitis and other pulmonary effects. Respiratory exposure to the crystalline silica (quartz) present in these welding electrodes is not anticipated during normal use. Respiratory overexposure to airborne crystalline silica is known to cause silicosis, a form of disabling pulmonary fibrosis which can be progressive and may lead to death. Crystalline silica is on the IARC and NTP lists as posing a cancer risk to humans.

### Information on toxicological effects

**Acute toxicity** (list all possible routes of exposure): Harmful if swallowed

<b>Specified substance: HEXAVALENT CHROMIUM</b> LD50 (oral, rat) = 52 mg/kg LC50 (inhalation, rat) = 167 mg/m <sup>3</sup> /4 hr LD50 (dermal, rabbit) = 57 mg/kg	<b>Specified substance: SILICON</b> ATE (oral) = 3160.0 mg/kg LD50 (oral, rat) = 3160 mg/kg LC50 (inhalation, rat) > 2.08 mg/l (highest attainable concentration)	<b>Specified substance: MOLYBDENUM</b> LD50 (oral, rat) = 4461 mg/kg LC50 (inhalation, rat) = 5.1 mg/l/4 hr LD50 (dermal, rabbit) > 2000 mg/kg
<b>Specified substance: NICKEL</b> LD50 (oral, rat) > 9000 mg/kg LC50 (inhalation, rat) > 10.2 mg/l/1 hr	<b>Specified substance: TITANIUM DIOXIDE</b> LD50 (oral, rat) >10000 mg/kg LC50 (inhalation, rat) > 6.82 mg/l/4 hr	<b>Specified substance: IRON</b> LD50 (oral, rat) = 98.6 g/kg ATE (oral) = 984.00 mg/kg
<b>Specified substance: CALCIUM FLUORIDE</b> LD50 (oral, rat) = 4250 mg/kg LC50 (inhalation, rat) > 5070 mg/m <sup>3</sup> /4 hr	<b>Specified substance: POTASSIUM SILICATE</b> LD50 (oral, rat) = 1300 mg/kg ATE (oral) = 1300.00 mg/kg bodyweight	<b>Specified substance: SODIUM SILICATE</b> LD50 (oral, rat) = 1153 mg/kg ATE (oral) = 1153.00 mg/kg
<b>Specified substance: MANGANESE</b> LD50 (oral, rat) = 9000 mg/kg ATE (oral) = 9000000.0 mg/kg LC50 (inhalation, rat) > 5.14 mg/l/4 hr	<b>Specified substance: CALCIUM CARBONATE</b> LD50 (oral, rat) > 2000 mg/kg LC50 (inhalation, rat) > 3 mg/l/4 hr LD50 (dermal, rat) > 2000 mg/kg	<b>Specified substance: SILICA, CRYSTALLINE</b> LD50 (oral, rat) = 500 mg/kg ATE (oral) = 500.00 mg/kg
<b>Specified substance: COPPER</b>	LD50 (oral, rat) = 481 mg/kg	LC50 (inhalation, rat) > 5.11 mg/l/4 hr

- Repeated dose toxicity (product):** Not classified
- Skin corrosion/irritation (product):** Not classified
- Serious eye damage/irritation (product):** Not classified
- Respiratory or skin sensitization (product):** May cause an allergic skin reaction
- Germ cell mutagenicity (product):** Not classified



# CROWN ALLOYS COMPANY

## SAFETY DATA SHEET

**Carcinogenicity (product):** May cause cancer

<b>Chromium (7440-47-3)</b>	
International Agency for Research on Cancer (IARC) Monographs	3 (Not classifiable as to its carcinogenicity to humans)
<b>Titanium dioxide (13463-67-7)</b>	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)
<b>Silica (quartz) (14808-60-7)</b>	
International Agency for Research on Cancer (IARC) Monographs	1 (Carcinogenic to humans)
National Toxicology Program (NTP) Status	Known to be Human Carcinogen
<b>Nickel (7440-02-0)</b>	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)
National Toxicology Program (NTP) Status	Reasonably anticipated to be a Human Carcinogen

**Reproductive toxicity (product):** Not classified  
**Specific target organ toxicity - single exposure (product):** Not classified  
**Specific target organ toxicity - repeated exposure (product):** Causes damage to organs through prolonged or repeated exposure  
**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:**

<p><b>Specified substance: CHROMIUM (VI)</b>  <b>Inhalation:</b>          Chromates may cause ulceration, perforation of the nasal septum, and severe irritation of the bronchial tubes and lungs. Liver damage and allergic reactions, including skin rash, have been reported. Asthma has been reported in some sensitized individuals. Skin contact may result in irritation, ulceration, sensitization, and contact dermatitis. Chromates contain the hexavalent form of chromium [Chromium (VI)]. Hexavalent chromium and its compounds are on the IARC and NTP lists as posing a cancer risk to humans.</p>	<p><b>Specified substance: MANGANESE</b>  <b>Inhalation:</b>          Overexposure to manganese fumes may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremors. This condition can be irreversible.  <b>Specified substance: NICKEL</b>  <b>Inhalation:</b>          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.</p>
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**Additional toxicological information under the conditions of use:**

**Acute toxicity**

<p><b>Specified substance: CHROMIUM (VI)</b>          LD50 (oral, rat) = 27 – 59 mg/kg          LC50 (inhalation, rat) = 33 – 70 mg/m<sup>3</sup>/4h  <b>Specified substance: FLUORIDES (as F)</b>          LD50 (oral, rat) = 4,250 mg/kg</p>	<p><b>Specified substance: CARBON DIOXIDE</b>          LCLo (inhalation, human) = 90000 ppm/5 min.  <b>Specified substance: CARBON MONOXIDE</b>          LC50 (inhalation, rat) = 1300 mg/l /4h</p>	<p><b>Specified substance: NITROGEN DIOXIDE</b>          LC50 (inhalation, rat) = 88 ppm/4h  <b>Specified substance: OZONE</b>          LCLo (inhalation, human) = 50 ppm/30 min.</p>
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**Carcinogenicity:**

<b>Specified substance: Chromium (VI) or Hexavalent Chromium</b>	
International Agency for Research on Cancer (IARC) Monographs	1 (Carcinogenic to humans)
National Toxicology Program (NTP) Status	Known to be human carcinogen
US OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)	Cancer
<b>Specified substance: Chromium Oxide</b>	
International Agency for Research on Cancer (IARC) Monographs	3 (Not classifiable as to its carcinogenicity to humans)
<b>Specified substance: Nickel</b>	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)
National Toxicology Program (NTP) Status	Reasonably anticipated to be a Human Carcinogen
<b>Silica, Crystalline [Quartz] (14808-60-7)</b>	
International Agency for Research on Cancer (IARC) Monographs	1 (Carcinogenic to humans)
National Toxicology Program (NTP) Status	2 (Known To Be Human Carcinogen)
<b>Titanium Dioxide (13463-67-7)</b>	
International Agency for Research on Cancer (IARC) Monographs	2B (Possibly carcinogenic to humans)

## Section 12 – ECOLOGICAL INFORMATION

**Eco-toxicity**

**Acute hazards to the aquatic environment:**

**Fish**

<p><b>Specified substance: COPPER and compounds (as Cu)</b>          LC50 (Fathead minnow (Pimephales promelas), 96 h): 0.0068 – 0.0156 mg/l</p>	<p>LC50 (Fathead minnow (Pimephales promelas), 96 h): 1.6 mg/l          LC50 (Fathead minnow (Pimephales promelas) [static], 96 h): &lt;0.3 mg/l</p>
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## SAFETY DATA SHEET

### Acute hazards to the aquatic environment:

#### Fish (continued)

<b>Specified substance: SODIUM SILICATE</b> LC50 (Western mosquitofish ( <i>Gambusia affinis</i> ), 96 h): 1,800 mg/l LC50 ( <i>Lepomis macrochirus</i> ), 96 h): 301 - 478 mg/l LC50 ( <i>Brachydanio rerio</i> ) [semi-static], 96 h): 3185 mg/l	<b>Specified substance: NICKEL</b> LC50 (Fathead minnow ( <i>Pimephales promelas</i> ), 96 h): 2.916 mg/l LC50 ( <i>Brachydanio rerio</i> ), 96 h): >100 mg/l LC50 ( <i>Cyprinus carpio</i> ) [semi-static], 96 h): 1.3 mg/l
<b>Specified substance: POTASSIUM SILICATE</b> LC50 ( <i>Brachydanio rerio</i> ) [semi-static], 96 h): 3185 mg/l LC50 ( <i>Lepomis macrochirus</i> ), 96 h): 301 - 478 mg/l	<b>Specified substance: IRON and/or iron alloys (as Fe)</b> LC50 ( <i>Cyprinus carpio</i> ) [semi-static], 96 h): 0.56 mg/l
<b>Specified substance: CALCIUM CARBONATE</b> LC50 (Rainbow trout ( <i>Oncorhynchus mykiss</i> ), 96 h): > 100/kg	<b>Specified substance: MOLYBDENUM</b> LC50 (Rainbow trout ( <i>Oncorhynchus mykiss</i> ), 96 h): 800 mg/l

#### Aquatic Invertebrates

<b>Specified substance: COPPER and compounds (as Cu)</b> EC50 (Water flea ( <i>Daphnia magna</i> ), 48 h): 0.102 mg/l EC50 ( <i>Pseudokirchneriella subcapitata</i> ) [static], 72 h): 0.0426 – 0.0535 mg/l EC50 ( <i>Daphnia Magna</i> ) [Static], 48 h): 0.03 mg/l EC50 ( <i>Pseudokirchneriella subcapitata</i> ) [static], 96 h): 0.031 – 0.054 mg/l	<b>Specified substance: NICKEL</b> EC50 (Water flea ( <i>Daphnia magna</i> ), 48 h): 1 mg/l EC50 ( <i>Pseudokirchneriella subcapitata</i> ), 72 h): 0.18 mg/l EC50 ( <i>Pseudokirchneriella subcapitata</i> ) [static], 96 h): 0.174 – 0.311 mg/l EC50 ( <i>Daphnia magna</i> ), 48 h): >100 mg/l
<b>Specified substance: SODIUM SILICATE</b> EC50 (Water flea ( <i>Ceriodaphnia dubia</i> ), 48 h): 22.94 – 49.01 mg/l	<b>Specified substance: MANGANESE</b> EC50 (Water flea ( <i>Daphnia magna</i> ), 48 h): 40 mg/l
<b>Specified substance: CALCIUM CARBONATE</b> EC50 (Water flea ( <i>Daphnia magna</i> ), 48 h): > 100/kg	

### Chronic hazards to the aquatic environment:

<b>Fish (product):</b>	Not classified
<b>Aquatic Invertebrates (product):</b>	Not classified
<b>Toxicity to Aquatic Plants (product):</b>	Not classified

**Specified substance: COPPER and/or copper alloys and compounds (as Cu) - LC50** (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

<b>Specified substance: NICKEL</b> Zebra mussel ( <i>Dreissena polymorpha</i> ), Bioconcentration Factor (BCF): 5,000 - 10,000 (Lotic) Bioconcentration factor calculated using dry weight tissue conc	<b>Specified substance: COPPER and compounds (as Cu)</b> Blue-green algae ( <i>Anacystis nidulans</i> ), Bioconcentration Factor (BCF): 36.01 (Static)
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**Mobility in Soil:** No data available

**Other Adverse Effects:** Very toxic to aquatic organisms

## Section 13 – DISPOSAL CONSIDERATIONS

**Waste disposal recommendations:** Prevent waste from contaminating surrounding environment. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with international/federal/state/local regulations. However, alloy wastes are normally collected to recover metal values.

## Section 14 – TRANSPORT INFORMATION

In accordance with DOT / ADR / RID / ADNR / IMDG / ICAO / IATA

### 14.1 UN number

Not a dangerous good in sense of transport regulations

### 14.2 UN proper shipping name

Not applicable

## Section 15 – REGULATORY INFORMATION

### 15.1 US Federal regulations

<b>Chromium (7440-47-3)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 313 (Specific toxic chemical listings) SARA Section 313 - Emission Reporting: <b>1.0 %</b>	<b>Manganese (7439-96-5)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 313 (Specific toxic chemical listings) SARA Section 313 - Emission Reporting: <b>1.0 %</b>
<b>Nickel (7440-02-0)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 313 (Specific toxic chemical listings) SARA Section 313 - Emission Reporting: <b>0.1 %</b>	<b>Copper (7440-50-8)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on SARA Section 313 (Specific toxic chemical listings) SARA Section 313 - Emission Reporting: <b>1.0 %</b>





**SAFETY DATA SHEET**

**15.1 US Federal regulations (continued)**

<b>Molybdenum (7439-98-7)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory	<b>Silicon (7440-21-3)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory
<b>Calcium fluoride (CaF<sub>2</sub>) (7789-75-5)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory	<b>Titanium dioxide (13463-67-7)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory
<b>Potassium silicate (1312-76-1)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory	<b>Sodium silicate (1344-09-8)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory
<b>Silica, crystalline (14808-60-7)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory	<b>Calcium carbonate (Limestone) (1317-65-3)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory
<b>Iron (7439-89-6)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory	<b>Graphite (7782-42-5)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory
<b>Carbon (7440-44-0)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory	<b>Barium carbonate (513-77-9)</b> Listed on the United States TSCA (Toxic Substances Control Act) inventory

**15.2 US State regulations**

<b>Nickel (7440-02-0)</b>				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
<b>Yes</b>				
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List		U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
<b>Titanium dioxide (13463-67-7)</b>				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
<b>Yes</b>				
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List		U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
<b>Silica, crystalline (14808-60-7)</b>				
U.S. - California - Proposition 65 - Carcinogens List	U.S. - California - Proposition 65 - Developmental Toxicity	U.S. - California - Proposition 65 - Reproductive Toxicity - Female	U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No significance risk level (NSRL)
<b>Yes</b>				
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List		U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
<b>Chromium (7440-47-3)</b>		<b>Manganese (7439-96-5)</b>		
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
<b>Silicon (7440-21-3)</b>		<b>Molybdenum (7439-98-7)</b>		
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		
<b>Calcium carbonate (Limestone) (1317-65-3)</b>		<b>Graphite (7782-42-5)</b>		
U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		U.S. - Massachusetts - Right To Know List U.S. - Minnesota - Hazardous Substance List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List		



**SAFETY DATA SHEET**

**Section 16 – OTHER INFORMATION**

**SUPERSEDES LAST REVISION:** 11/18/2015 (SDS)

HMIS RATING (Hazardous Materials Information System)			
Health (blue) - 2	Flammability (red) - 0	Reactivity (yellow) - 0	Protective Equipment - X (See Sections 4, 8 & 10)

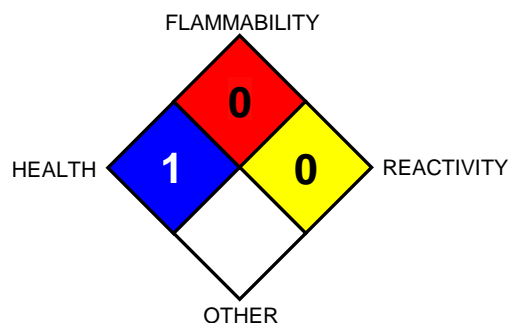
**Health Hazard:** 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; one time overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal).

**Flammability Hazard:** 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]).

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

**Caution:** HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDS's under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used only in conjunction with a fully implemented HMIS® program by workers who have received appropriate HMIS® training. HMIS® is a registered trade and service mark of the NPCA.

**NFPA RATING**



**NATIONAL FIRE PROTECTION ASSOCIATION:**

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

**Flammability Hazard:** Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

**Reactivity Hazard:** Refer to definitions for "HMIS RATING (Hazardous Materials Information System)"

**DEFINITIONS OF TERMS**

- ACGIH - American Conference of Governmental Industrial Hygienists
- CAS No. - Chemical Abstracts Service Number
- EPA - Environmental Protection Agency
- GHS - Globally Harmonized System
- IARC - International Agency for Research on Cancer
- LC50 - Lethal Concentration (50 percent kill)
- LCLO - Lowest published lethal concentration
- LD50 - Lethal dose (50 percent kill)
- LDLO - Lowest published lethal dose
- NIOSH - National Institute of Occupational Safety and Health

- NTP - National Toxicology Program
- OSHA - U.S. Occupational Safety and Health Administration
- PEL - Permissible Exposure Limit
- SARA - Superfund Amendments and Reauthorization Act
- STEL - Short Term Exposure Limit
- TCLo - the lowest concentration to cause a symptom
- TDLo - the lowest dose to cause a symptom
- TLV - Threshold Limit Value
- TSCA - Toxic Substances Control Act
- TWA - Time Weighted Average

**Full text of H-phrases (from Section 2)**

<b>Acute Tox. 4 (Oral)</b>	Acute toxicity (oral), Category 4
<b>Aquatic Acute 1</b>	Hazardous to the aquatic environment — Acute Hazard, Category 1
<b>Aquatic Chronic 2</b>	Hazardous to the aquatic environment — Chronic Hazard, Category 2
<b>Aquatic Chronic 3</b>	Hazardous to the aquatic environment — Chronic Hazard, Category 3
<b>Carc. 1A</b>	Carcinogenicity, Category 1A
<b>Carc. 1B</b>	Carcinogenicity, Category 1B
<b>Carc. 2</b>	Carcinogenicity, Category 2
<b>Skin Irrit. 2</b>	Skin corrosion/irritation, Category 2
<b>Skin Sens. 1</b>	Sensitisation — Skin, Category 1
<b>STOT RE 1</b>	Specific target organ toxicity — Repeated exposure, Category 1
<b>STOT SE 3</b>	May cause respiratory irritation
<b>STOT SE 3</b>	May cause drowsiness or dizziness
<b>H302</b>	Harmful if swallowed
<b>H315</b>	Causes skin irritation

<b>H317</b>	May cause an allergic skin reaction
<b>H319</b>	Causes serious eye irritation
<b>H332</b>	Harmful if inhaled
<b>H334</b>	May cause allergy or asthma symptoms or breathing difficulties if inhaled
<b>H335</b>	May cause respiratory irritation
<b>H336</b>	May cause drowsiness or dizziness
<b>H350</b>	May cause cancer
<b>H351</b>	Suspected of causing cancer
<b>H372</b>	Causes damage to organs through prolonged or repeated exposure
<b>H373</b>	May cause damage to organs through prolonged or repeated exposure
<b>H400</b>	Very toxic to aquatic life
<b>H411</b>	Toxic to aquatic life with long lasting effects

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