CROWN ALLOYS
COMPANY

MATERIAL SAFETY DATA SHEET

Section 1 – COMPANY AND MATERIAL IDENTIFICATION

PRODUCT TYPE: Stainless steel bare wire for gas tungsten arc welding (GTAW) and gas metal arc welding (GMAW).

TRADE NAME: CROWN ER XXX

SPECIFICATION: AWS A5.9

CLASSIFICATION: **ER 308, ER 308L, ER 308LSi, ER 309, ER 309L, ER 309LSi, ER 310, ER 312, ER 316, ER 316L, ER 316LSi, ER 317L, ER 320, ER 320LR, ER 330, ER 347, ER 409, ER 409Nb, ER 410, ER 420, ER 630(17-4-PH)**

VENDOR: Crown Alloys Company

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DATE: January 30, 2014

Section 2 – HAZARDOUS INGREDIENTS

HMIS RATING (Hazardous Materials Information System)			
Health (blue) - 2	**Flammability (red) - 0**	**Reactivity (yellow) - 0**	**Protective Equipment - X** (See Section 7)

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 MSDS'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.

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Section 2 – HAZARDOUS INGREDIENTS (continued)

IMPORTANT! This section covers the material from which the above products are manufactured. The following are the occupational exposure limits for the components (solids) of the products as manufactured AND the fume constituents produced during welding of those components (solids).
The fume constituents of the typical **gases** produced during welding are covered in Section 5.

Ingredient Name	Symbol or Formula	CAS No.	OSHA – TWA PEL, mg/m^3	(ACGIH – TWA)[4] TLV, mg/m^3	IDLH[1] mg/m^3	Wt.%
Chromium√	Cr	7440-47-3	1 (as metal) 0.005 mg(**5 μg**)/m^3 [Cr(VI) inorganic compounds as Cr(VI), water soluble] 0.0025 action level 0.1 ceiling limit (as CrO_3) 0.5 Chromium (III) Compounds (as Cr)	0.5 (as metal) 0.05 [Cr(VI) inorganic compounds as Cr, water soluble] 0.01 [Cr(VI) inorganic compounds as Cr, water insoluble] 0.5 Chromium (III) Compounds (as Cr)	250	10.5-32.0
Cobalt	Co	7440-48-4	0.1(for metal dust and Co fume)	0.02(for metal dust and Co fume)	N/E	<0.10
Copper	Cu	7440-50-8	0.1(fume), 1.0 (dust/mist)	0.2(fume), 1.0 (dust/mist)	N/E	4.0 max.
Iron√	Fe	7439-89-6	10.0 (Fe_2O_3 dust & fume as Fe)	5.0 (Fe_2O_3 dust & fume as Fe)	2500	Balance
Manganese√	Mn	7439-96-5	5.0 Ceiling (elemental and inorganic compounds, as Mn) 5.0 (fume, as Mn)	0.02 (elemental and inorganic compounds, as Mn – respirable fraction) 0.1 (inhalable) 0.2 (fume)	500	2.5 max.
Molybdenum	Mo	7439-98-7	5.0 (soluble) 15.0 (as insoluble compounds, total dust as Mo)	5.0 (soluble) 3.0 (respirable fraction) 10.0 (insoluble & metal compounds, as Mo - inhalable)	5000	4.00 max.
Nickel√	Ni	7440-02-0	1.0 (metal and insoluble compounds as Ni) 0.1 (as Ni soluble)	1.5 as metal (inhalable fraction) 0.1 (as Ni soluble) 0.2 (nickel oxide as Ni – inhalable)	10	5.0 max.[2] 8.0–36.0[3]
Niobium	Nb	7440-03-1	no limits set	no limits set	N/E	1.0 max.
Silicon	Si	7440-21-3	10.0 (total dust) 5.0 (respirable fraction) 10 ÷ %silica+2 (respirable fraction) 30 ÷ %silica+2 (total dust)	0.025 (silica – respirable fraction)	N/E	1.0 max.
Titanium	Ti	7440-32-6	5.0 (TiO_2 – respirable fraction)	10.0 (TiO_2 – as oxide dust)	N/E	1.5 max.

[1] Immediately Dangerous to Life and Health – This level represents a concentration from which one can escape within 30 minutes without suffering escape-preventing or permanent injury.
[2] 400 series stainless steel. [3] 300 series stainless steel. N/E – Not Established
NIOSH classifies welding fumes as carcinogens. **√Substance identified by other sources as a suspected or confirmed human carcinogen.**
[4] The ACGIH has an established exposure limit for Welding Fumes, Not Otherwise Classified. That Threshhold Limit Value is 5 mg/m^3.

Section 3 – PHYSICAL and CHEMICAL CHARACTERISTICS

APPEARANCE AND COLOR: These products consist of solid chrome-nickel welding wire of various diameters and are odorless. As shipped, these products are non-flammable, non-explosive, non-reactive and non-hazardous.

The following information is for elemental iron, a main component of these products:
SPECIFIC GRAVITY @20^{O}C (water = 1): 7.86 g/cc **FREEZING/MELTING POINT:** 2795^{O}F (1535^{O}C)
SOLUBILITY IN WATER; Insoluble **BOILING POINT @ 24 mm Hg:** 5432^{O}F (3000^{O}C)

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Section 4 – FIRE and EXPLOSION HAZARD DATA

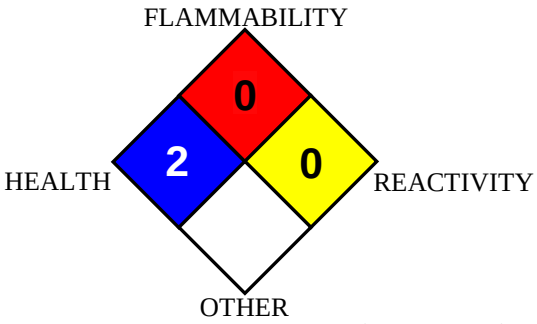
NATIONAL FIRE PROTECTION ASSOCIATION:

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)"

NFPA RATING



FLAMMABLE PROPERTIES: Non-flammable as *shipped*. Brazing flame, welding arc and sparks can ignite combustibles and flammables. Refer to American National Standard Z49.1 *"Safety in Welding and Cutting"* and *"Safe Practices"* Code: SP, published by the American Welding Society for fire prevention during the use of welding, brazing and allied procedures.

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): Not Applicable Upper (UEL): Not Applicable

FLASH POINT: Not Flammable **AUTOIGNITION TEMPERATURE:** Not Flammable

FIRE EXTINGUISHING MATERIALS: Water Spray: YES / Carbon Dioxide: YES / Halon: YES / Foam: YES / Dry Chemical: YES Other: Any "ABC" Class

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, these products may generate irritating fumes containing iron compounds, metal oxides and a variety of metal compounds. The molten material can present a significant thermal hazard to firefighters.

Section 5 – STABILITY AND REACTIVITY DATA

STABILITY: Stable **HAZARDOUS POLYMERIZATION:** Will not occur.

CONDITIONS TO AVOID: Uncontrolled exposure to extreme temperatures and incompatible materials.

DECOMPOSITION PRODUCTS: Thermal decomposition products can include iron fumes, a variety of iron compounds, nickel compounds, carbon monoxide, carbon dioxide and a variety of metal oxides.

MATERIALS WITH WHICH THESE STAINLESS STEEL WIRES/RODS IS INCOMPATIBLE: Strong acids, strong oxidizers, mineral acids, some halogenated compounds, phosphorous and mercury.

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.

When these stainless steel wires/rods are consumed, the fume and gas decomposition products generated are different in percent and form from the ingredients listed in Section 2. Decomposition products of normal operation include those originating from the volatilization, reaction, or oxidation of the materials shown in Section 2, 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.

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^3 (5 µg/m^3).

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 – 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): These stainless steel welding wires/rods 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 STAINLESS STEEL WIRES/RODS WILL NOT CONTAIN ANY Cr(VI).

The fume limit for manganese, nickel and/or chromium may be reached before the general limit for welding fumes (TLV 5 mg/m^3) is reached.

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Section 5 – STABILITY AND REACTIVITY DATA (continued)

Reasonably expected decomposition products from normal use of these wires/rods includes a complex of the oxides of the materials listed in Section 2, as well as the typical GASES produced during the GTAW and GMAW processes. Below are the gases and their corresponding occupational exposure limits.

Fume Constituent		CAS No.	OSHA – TWA PEL	ACGIH – TWA TLV	ACGIH STEL
Name	Symbol or Formula				
Carbon Dioxide	CO_2	124-38-9	5,000 ppm	5,000 ppm	30,000 ppm
Carbon Monoxide	CO	630-08-0	50 ppm	25 ppm	
Dinitrogen Tetroxide	N_2O_4	10544-72-6	N/E	N/E	
Hydrogen Fluoride	HF	7664-39-3	3 ppm	0.5 ppm	2 ppm (ceiling)
Nitric Oxide	NO	10102-43-9	25 ppm	25 ppm	
Nitrogen Dioxide	NO_2	10102-44-0	5 ppm (ceiling limit)	3 ppm	5 ppm
Ozone	O_3	10028-15-6	0.1 ppm	0.1 ppm (for light work) 0.08 ppm (for moderate work) 0.05 ppm (for heavy work)	
Phosgene*	$COCl_2$	75-44-5	0.1 ppm	0.1 ppm	
Phosphine**	PH_3	7803-51-2	0.3 ppm	0.3 ppm	1 ppm

* May result from contact with chlorinated hydrocarbon vapors.
** May result from welding on phosphate coated steels.

Section 6 – HEALTH HAZARD DATA

Medical conditions aggravated by exposure to this product: Skin, respiratory, pancreas and liver disorders may be aggravated by prolonged overexposures to the dusts or fumes generated by these products. Persons with pre-existing impaired lung functions (asthma-like conditions). Persons with a pacemaker should not go near welding and cutting operations until they have consulted their doctor and obtained information from the manufacturer of the device.

- **EYES:** Contact with the rod form of these products can be physically damaging to the eye (i.e., foreign object). Fumes generated during welding operations can be irritating to the eyes. Chronic exposures could cause conjunctivitis. Ultraviolet radiation from welding can cause flash burns. Contact with the molten metal will burn the contaminated eyes.
  - Due to the presence of **nickel**, prolonged exposure could cause conjunctivitis (inflammation of the mucous membranes of the eyes).
  - Eyes may be burned by **chromium (VI)** compounds.
  - **Copper metal** as a foreign body can provoke an inflammatory reaction resulting in pus formation in the conjunctiva, cornea or sclera.
  - Prolonged eye contact with **iron metal dust** could cause rust brown colored spots and if left for several years, permanent damage could result.
  - Prolonged eye contact with **cobalt** may cause conjunctivitis.
- **SKIN:** Contact of the rod form of these products with the skin is not anticipated to be irritating. Fumes generated during welding operations can be irritating to the skin. Symptoms of skin *overexposure* may include irritation and redness. Prolonged or repeated skin *overexposure* may lead to allergic contact dermatitis. Contact with molten metal will burn contaminated skin. Ultraviolet radiation and infrared heat rays can burn skin. Skin absorption is not known to be a significant route of *overexposure* for any component of these products.
  - Long term exposure to **chromium** and **trivalent chromium dust** can cause scaling, redness, itchiness and a burning sensation on the skin.
  - **Chromium (VI)** salt dust can form ulcers on skin.
- **INGESTION:**
  - Repeated or prolonged ingestion exposures to > 50-100 mg of **iron** per day can result in deposition of **iron** in the body tissues, which can cause disease.
  - Swallowing **chromium (VI)** salts can cause severe injury or death
  - High dietary intake of **molybdenum** may produce a gout-like disease and high blood uric acid.
  - Excessive ingestion of **cobalt** may lead to flu-like symptoms such as chills, fever, body aches, vomiting, sweating, etc.
  - Excessive ingestion of **manganese** can produce manganese poisoning.
- **INHALATION:** Excessive inhalation of user generated fumes from high temperature cutting or welding of these alloys may, depending on the specific features of the process used, pose a long term health hazard. The IARC has concluded that welding fumes are possibly carcinogenic to humans. Inhalation of large amounts of particulates generated by this product during metal processing operations may result in pneumoconiosis (a disease of the lungs). Repeated *overexposures* to the dusts or fumes generated by these alloys during welding operations may have adverse effects on the lungs with possible pulmonary edema and emphysema. Some of the other health effects are listed on the next page.
- **IARC (International Agency for Research on Cancer) CLASSIFICATIONS: Chromium VI compounds** and **nickel compounds** are classified as IARC Group 1 and NTP Group K carcinogens. **Chromium VI**, **nickel compounds** and **welding fumes** must be considered as possible carcinogens under OSHA (29 CFR 1910.1200).

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Section 6 – HEALTH HAZARD DATA (continued)

❖ **INHALATION (continued):**

- *Chronic exposure* to excessive levels of **carbon** may lead to benign pneumoconiosis.
- **Hexavalent chromium (Chrome VI)** can cause asthma, kidney damage, primary irritant dermatitis, sensitization dermatitis, skin ulceration, and pulmonary edema (fluid in the lungs). *Chronic* inhalation or *overexposure* has been associated with lung, nasal, gastrointestinal cancer. **Hexavalent chromium** is listed as carcinogenic to humans by IARC (Group 1). **Chromium** and some of its compounds are listed as carcinogenic by the NTP. **Hexavalent chromium** compounds may be generated during welding operations with alloys containing **chromium.** Fumes from welding **chromium-containing** stainless steel or certain chromium-containing rods can trigger eczematous eruptions on the palms of the hands of **chromium**-sensitized individuals. *Chronic overexposure* to **chromium** can cause ulceration and perforation of the nasal septum. Studies have shown that **chromate** production workers exposed to **hexavalent chromium** compounds have an excess of lung cancers.
- Asthmatic symptoms and pulmonary fibrosis occurring in the tungsten carbide industry may be related to the inhalation of **metallic cobalt dust**. Evidence of polycythemia and altered thyroid, kidney and liver function have also been found.
- *Overexposure* to **copper fume** may exist when welding, flame cutting, etc. *Overexposure* to **copper dust/mists** can cause irritation of the eyes, skin, and upper respiratory tract. *Chronic overexposure* may result in blood disorders (anemia), and skin and hair discoloration. *Overexposure* to **copper fume** can result in respiratory tract irritation, nausea, fever, chills, shortness of breath and malaise (metal fume fever).
- Inhalation of dusts and fumes of **iron** can cause metal fume fever. Symptoms of metal fume fever can be delayed 24-48 hours. Inhalation of excessive **iron oxide fumes** or dusts can lead to irritation of the respiratory tract. Prolonged inhalation of **iron oxide** for periods of 6 to 10 years is known to cause siderosis which appears to be a benign pneumoconiosis.
- *Chronic exposure* to high levels of **manganese dust or fumes** can cause nervous system disorders, pneumonitis (inflammation of lung tissue), and may cause fibrosis and reproductive disorders in males. It can also lead to neurological problems such as apathy, drowsiness, weakness, spastic gait, paralysis and other neurological problems resembling Parkinsonism. Excessive inhalation of fumes may cause "Metal Fume Fever" with its flu like symptoms, such as chills, fever, body aches, vomiting, sweating, etc. *Chronic overexposure* to **manganese compounds** above safe exposure limits can cause irreversible damage to the central nervous system, including the brain, symptoms of which may include slurred speech, languor, sleepiness, muscular weakness, emotional disturbances and spastic gait. Employees who are *overexposed* to **manganese compounds** should be seen by a physician for early detection of neurologic problems.
- Inhalation of **molybdenum fumes** has caused kidney damage, respiratory irritation and liver damage in animals. Prolonged *overexposure* may result in loss of appetite, loss of muscle coordination, weight loss, difficulty breathing and anemia.
- The U.S. National Toxicology Program (NTP) 10th Report on Carcinogens has listed "**metallic nickel**" as "reasonably anticipated to be a human carcinogen" and "**nickel compounds**" as "known human carcinogens". The International Agency for Research on Cancer (IARC) concluded that **nickel compounds** were carcinogenic to humans and that **metallic nickel** is possibly carcinogenic to humans. Studies of **nickel** refinery workers indicated a higher incidence of lung and nasal cancers. **Nickel** can cause pulmonary asthma in hypersensitive individuals. *Chronic overexposure* to **nickel fumes** may also cause pulmonary fibrosis and edema.
- **Niobium** could cause irritation to the respiratory tract upon *acute exposure*.
- **Oxides of nitrogen** can cause irritation of the eyes, skin (when moist), and respiratory tract. Exposure to *high* levels of **nitrogen oxides** can cause delayed pulmonary edema (fluid in the lungs) which may be fatal. **Nitric oxide** can cause formation of met hemoglobin, which decreases the blood's ability to carry oxygen. *Chronic overexposure* can cause pulmonary fibrosis (scarring of the lungs).
- Welding processes generate fumes and an intense ultraviolet radiation that results in the formation of **ozone** and **oxides of nitrogen**. Exposure to *low* levels of **ozone** can cause irritation of the eyes, nose and throat. Inhalation can cause chest tightness, headache, shortness of breath, cough, wheeze and narrowing of airways. Symptoms disappear when removed from exposure.
- Exposure to *high* levels of **ozone** may cause acute respiratory distress with shortness of breath, pulmonary changes, hemorrhage and pulmonary edema. Symptoms of pulmonary edema may be delayed for one or more hours. Exposure of test animals and human tissue to high concentrations has shown chromosomal changes, reproductive effects, blood changes, and death from lung congestion.
- High concentrations of **silicon dust** will cause some irritation to the nose and throat. Inhalation of **crystalline silica** over a long period can cause silicosis. **Crystalline silica** is listed as carcinogenic to humans by IARC (Group 1)*.
- Inhalation of **titanium dioxide** dust or fume could produce lung fibrosis and chronic bronchitis.
- Shielding gases such as **argon, helium** and **carbon dioxide** are asphyxiants and adequate ventilation and/or respirators must be provided.

Section 7 – PRECAUTIONS for SAFE HANDLING & USE - APPLICABLE CONTROL MEASURES

VENTILATION AND ENGINEERING CONTROLS: Maintain exposures below the acceptable exposure levels (see Section 2). 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.

RESPIRATORY PROTECTION: 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 2). 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).

FOR MAXIMUM SAFETY:

BE CERTIFIED FOR AND WEAR A RESPIRATOR AT ALL TIMES WHEN WELDING OR BRAZING!

EYE PROTECTION: Ensure eyewash/safety shower stations are available near areas where these products are used. Wear safety glasses, goggles or face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting").

PROTECTIVE CLOTHING: Wear head, hand, and body protection which help to prevent injury from radiation, sparks, and electrical shock. See ANSI Z49.1. As a minimum this includes welder's gloves, protective face shield, dark substantial clothing, and may include arm protectors, aprons, hats, and shoulder protection.

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting these products ON YOU or IN YOU. Wash hands after handling these products. Do not eat or drink while handling these products.

WASTE DISPOSAL METHOD: Prevent waste from contaminating surrounding environment. Discard any product, residue, disposable container or liner in an environmentally acceptable manner, in full compliance with federal, state and local regulations. However, alloy wastes are normally collected to recover metal values.

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Section 8 – FIRST AID MEASURES

- **EYE EXPOSURE:** Flush eyes with plenty of water or saline for at least 15 minutes. Consult a physician.
- **SKIN EXPOSURE:** Wash thoroughly with soap and water. If molten material contaminates the skin, immediately begin decontamination with cold, running water. Minimum flushing is for 15 minutes. Consult a physician if irritation persists.
- **INHALATION EXPOSURE:** Remove to fresh air. Check for clear airway, breathing and presence of pulse. Provide CPR for persons without pulse or respirations. Consult a physician immediately.
- **INGESTION EXPOSURE:** Ingestion is not a likely route of exposure for these rods. If swallowed CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING, unless directed by medical personnel. Have victim rinse mouth with water, if conscious. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure.

Section 9 – TOXICOLOGICAL INFORMATION

Below are the LD_{50} and the LC_{50} values available for some of the fumes and gases given off during welding:

CARBON MONOXIDE: (Cas No. 630-08-0) LC_{50} (inhalation, mouse) = 2444 ppm/4H **Cr (VI) OXIDE:** (Cas No. 1333-82-0) LD_{50} (oral, rat) = 80 mg/kg **COPPER OXIDE:** (CAS No. 1317-39-1) LD_{50} (oral, rat) = 470 mg/kg	**IRON:** TDLo (oral, child) = 77 mg/kg;BAH gastrointestinal tract, blood effects **IRON OXIDE:** (CAS No. 1309-37-1) LD_{50} (intraperitoneal, rat) = 5500 mg/kg **MANGANESE:** TCLo (inhalation, man) =2300µg/m^3 BRN, central nervous system effects	**MOLYBDENUM OXIDE:** (CAS No.18868-43-4) LD_{50} (oral, rat) = 125 mg/kg **NICKEL OXIDE:** (CAS No. 1313-99-1) LD_{50} (subcutaneous, mouse) = 50 mg/kg **OZONE:** (CAS No. 10028-15-6) LC_{50} (inhalation, cat) = 34.5 ppm/3H

- **SUSPECTED CANCER AGENT:** The components of these products are listed as follows:
  - **IRON OXIDE:** IARC Group 3 (Not Classifiable as to Carcinogenicity to Humans), ACGIH-TLV-A4 (Not Classifiable as a Human Carcinogen).
  - **MANGANESE:** EPA-D (Not Classifiable as to Human Carcinogenicity)
  - **CARBON:** IARC Group 3 (Not Classifiable as to Carcinogenicity to Humans). NIOSH-X (Carcinogen defined with no further categorization).
  - **NICKEL:** Nickel compounds are listed on the NTP and are listed on IARC Group 1(The agent is carcinogenic to humans). Nickel metal is possibly carcinogenic to humans as defined by IARC Group 2B(The agent is possibly carcinogenic to humans).
  - **CHROMIUM:** Hexavalent chromium is listed on IARC Group 1(The agent is carcinogenic to humans). Chromium and some of its compounds are listed as carcinogenic by the NTP.

Section 10 – REGULATORY INFORMATION

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

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Chromium	No	Yes	Yes
Manganese	No	No	Yes
Vanadium (fume or dust)	No	No	Yes

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for the components of these products. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs (4,540 kg) therefore applies, per 40 CFR 370.20.

CALIFORNIA PROPOSITION 65: 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 25249.5 et seq.)

Section 11 – DEFINITIONS of TERMS

CAS No. - Chemical Abstracts Service Number
PEL - Permissible Exposure Level
TLV - Threshold Limit Value
TWA - Time Weighted Average
STEL - Short Term Exposure Limit
NIOSH – National Institute of Occupational Safety and Health
OSHA – U.S. Occupational Safety and Health Administration
TDLo – the lowest dose to cause a symptom
TCLo – the lowest concentration to cause a symptom
SARA – Superfund Amendments and Reauthorization Act
ACGIH – American Conference of Governmental Industrial Hygienists
mppcf – Millions of Particles Per Cubic Foot
IARC – International Agency for Research on Cancer
TDo, LDLo, and **LDo,** or **TC, TCo, LCLo,** and **LCo** – the lowest dose (or concentration) to cause lethal or toxic effects.
LD_{50} & LC_{50} – These values are the amount of a substance given to the stated species that causes 50% of that species to die.

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