

# CIGWELD CROMALLOY 409TI

Chemwatch Material Safety Data Sheet  
Issue Date: 11-Dec-2006  
NC317ECP

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## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

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### PRODUCT NAME

CIGWELD CROMALLOY 409TI

### SYNONYMS

"Product Code: 723043"

### PRODUCT USE

Gas shielded, titanium stabilised metal cored wire for the joining and repair of 409 and 3Cr12/5Cr12 ferritic corrosion resistant steels.

### SUPPLIER

Company: CIGWELD Pty Ltd  
Address:  
71 Gower Street  
Preston  
VIC 3072  
AUS  
Telephone: (03) 9474 7400  
Telephone: 1300 654 674  
Emergency Tel: (03) 9474 7400

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## Section 2 - HAZARDS IDENTIFICATION

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### STATEMENT OF HAZARDOUS NATURE

**HAZARDOUS SUBSTANCE. NON-DANGEROUS GOODS. According to the Criteria of NOHSC, and the ADG Code.**

### POISONS SCHEDULE

None

### RISK

Limited evidence of a carcinogenic effect.

### SAFETY

Wear suitable protective clothing.  
Use only in well ventilated areas.  
Keep container in a well ventilated place.  
To clean the floor and all objects contaminated by this material, use water and detergent.  
Keep away from food, drink and animal feeding stuffs.  
Take off immediately all contaminated clothing.  
If swallowed, IMMEDIATELY contact Doctor or Poisons Information Centre (show this container or label).

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## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

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| NAME  | CAS RN     | %   |
|---|------------|-----|
| tubular wire which, in use, generates welding fumes | Not avail. | >60 |
| which consists of iron oxide fume                   | 1309-37-1  |     |

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## Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

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|                |           |
|----------------|-----------|
| chromium fume  | 7440-47-3 |
| manganese fume | 7439-96-5 |
| titanium fume  |           |

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## Section 4 - FIRST AID MEASURES

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### SWALLOWED

Not normally a hazard due to the physical form of product. The material is a physical irritant to the gastro-intestinal tract.

### EYE

- Particulate bodies from welding spatter may be removed carefully.
- DO NOT attempt to remove particles attached to or embedded in eye.
- Lay victim down, on stretcher if available and pad BOTH eyes, make sure dressing does not press on the injured eye by placing thick pads under dressing, above and below the eye.
- Seek urgent medical assistance, or transport to hospital.
- For "arc eye", i.e. welding flash or UV light burns to the eye:
- Place eye pads or light clean dressings over both eyes.
- Seek medical assistance.

### SKIN

If skin or hair contact occurs:

- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

### INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prosthesis such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor.

### NOTES TO PHYSICIAN

Copper, magnesium, aluminium, antimony, iron, manganese, nickel, zinc (and their compounds) in welding, brazing, galvanising or smelting operations all give rise to thermally produced particulates of smaller dimension than may be produced if the metals are divided mechanically. Where insufficient ventilation or respiratory protection is available these particulates may produce "metal fume fever" in workers from an acute or long term exposure.

- Onset occurs in 4-6 hours generally on the evening following exposure. Tolerance develops in workers but may be lost over the weekend. (Monday Morning Fever)
- Pulmonary function tests may indicate reduced lung volumes, small airway obstruction and decreased carbon monoxide diffusing capacity but these abnormalities resolve after several months.
- Although mildly elevated urinary levels of heavy metal may occur they do not correlate with clinical effects.
- The general approach to treatment is recognition of the disease, supportive care and prevention of exposure.
- Seriously symptomatic patients should receive chest x-rays, have arterial blood gases determined and be observed for the development of tracheobronchitis and pulmonary edema. [Ellenhorn and Barceloux: Medical Toxicology].

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## Section 5 - FIRE FIGHTING MEASURES

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### EXTINGUISHING MEDIA

- There is no restriction on the type of extinguisher which may be used.

### FIRE FIGHTING

- Alert Fire Brigade and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or water courses.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

### FIRE/EXPLOSION HAZARD

- Non combustible.
- Not considered to be a significant fire risk, however containers may burn.
- In a fire may decompose on heating and produce toxic / corrosive fumes.

### FIRE INCOMPATIBILITY

Welding electrodes should not be allowed to come into contact with strong acids or other substances which are corrosive to metals.

Welding arc and metal sparks can ignite combustibles.

### HAZCHEM: None

### Personal Protective Equipment

- Breathing apparatus.
- Gas tight chemical resistant suit.
- Limit exposure duration to 1 BA set30 mins.

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## Section 6 - ACCIDENTAL RELEASE MEASURES

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### EMERGENCY PROCEDURES

#### MINOR SPILLS

- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Wear impervious gloves and safety glasses.
- Use dry clean up procedures and avoid generating dust.
- Place spilled material in clean, dry, sealable, labelled container.

#### MAJOR SPILLS

- Minor hazard.
- Clear area of personnel.
- Alert Fire Brigade and tell them location and nature of hazard.
- Control personal contact by using protective equipment if risk of overexposure exists.
- Prevent, by any means available, spillage from entering drains or water courses.
- Contain spill/secure load if safe to do so.
- Bundle/collect recoverable product and label for recycling.
- Collect remaining product and place in appropriate containers for disposal.
- Clean up/sweep up area. Water may be required.
- If contamination of drains or waterways occurs, advise emergency services.

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## Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Protective Equipment advice is contained in Section 8 of the MSDS.

## Section 7 - HANDLING AND STORAGE

### PROCEDURE FOR HANDLING

- Limit all unnecessary personal contact.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

### SUITABLE CONTAINER

- Packaging as recommended by manufacturer.
- Check that containers are clearly labelled.
- Multi-wall paper container NOTE: Bags should be stacked, blocked, interlocked, and limited in height so that they are stable and secure against sliding or collapse.

### STORAGE INCOMPATIBILITY

Segregate from strong acids.

### STORAGE REQUIREMENTS

- Keep dry.
- Store under cover.
- Protect containers against physical damage.
- Observe manufacturer's storing and handling recommendations.

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

| Source                       | Material  | TWA<br>ppm | TWA<br>mg/m <sup>3</sup> | STEL<br>ppm | STEL<br>mg/m <sup>3</sup> | Peak<br>ppm | Peak<br>mg/m <sup>3</sup> | TWA<br>F/CC |
|------------------------------|---|------------|--------------------------|-------------|---------------------------|-------------|---------------------------|-------------|
| Australia Exposure Standards | iron oxide fume<br>(Iron oxide fume<br>(Fe <sub>2</sub> O <sub>3</sub> ) (as Fe)) |            | 5                        |             |                           |             |                           |             |
| Australia Exposure Standards | iron oxide fume<br>(Inspirable dust<br>(Not specified))                           |            | 10                       |             |                           |             |                           |             |
| Australia Exposure Standards | chromium fume<br>(Chromium (metal))   |            | 0.5                      |             |                           |             |                           |             |
| Australia Exposure Standards | chromium fume<br>(Chromium (III)<br>compounds (as Cr))                            |            | 0.5                      |             |                           |             |                           |             |
| Australia Exposure Standards | manganese fume<br>(Manganese, fume<br>(as Mn))                                    |            | 1                        |             | 3                         |             |                           |             |

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### Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

| Source                       | Material   | TWA<br>ppm | TWA<br>mg/m <sup>3</sup> | STEL<br>ppm | STEL<br>mg/m <sup>3</sup> | Peak<br>ppm | Peak<br>mg/m <sup>3</sup> | TWA<br>F/CC |
|------------------------------|--|------------|--------------------------|-------------|---------------------------|-------------|---------------------------|-------------|
| Australia Exposure Standards | manganese fume (Manganese, dust & compounds (as Mn)) |            | 1                        |             |                           |             |                           |             |

The following materials had no OELs on our record under the following CAS or Chemwatch (CW) numbers

- CIGWELD Cromalloy 409Ti CW:46881
- welding fumes: No data available for CW:35201
- manganese fume: No data available for CAS:7439-96-5

### EMERGENCY EXPOSURE LIMITS

| Material        | Revised IDLH Value<br>(mg/m <sup>3</sup> ) | Revised IDLH Value<br>(ppm) |
|-----------------|--|-----------------------------|
| iron oxide fume | 2, 500                                     |                             |
| chromium fume   | 250  |                             |
| manganese fume  | 500  |                             |

### ODOUR SAFETY FACTOR (OSF)

Not available. Refer to individual constituents.

### INGREDIENT DATA

#### WELDING FUMES:

In addition to complying with any individual exposure standards for specific contaminants, where current manual welding processes are used, the fume concentration inside the welder's helmet should not exceed 5 mg/m<sup>3</sup>, when collected in accordance with the appropriate standard (AS 3640, for example).

ES\* TWA: 5 mg/m<sup>3</sup>

TLV\* TWA: 5 mg/m<sup>3</sup>, B2 (a substance of variable composition)

OES\* TWA: 5 mg/m<sup>3</sup>

Most welding, even with primitive ventilation, does not produce exposures inside the welding helmet above 5 mg/m<sup>3</sup>. That which does should be controlled (ACGIH). Inspirable dust concentrations in a workers breathing zone shall be collected and measured in accordance with AS 3640, for example. Metal content can be analytically determined by OSHA Method ID25 (ICP-AES) after total digestion of filters and dissolution of captured metals. Sampling of the Respirable Dust fraction requires cyclone separator devices (elutriators) and procedures to comply with AS 2985 (for example).

For each of the following

IRON OXIDE FUME:

CHROMIUM FUME:

MANGANESE FUME:

Not available

### PERSONAL PROTECTION

#### EYE

Welding helmet with suitable filter. Welding hand shield with suitable filter.

- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure,

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## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

For most open welding/brazing operations, goggles, even with appropriate filters, will not afford sufficient facial protection for operators. Where possible use welding helmets or handshields corresponding to AS 1336 and AS 1338 which provide the maximum possible facial protection from flying particles and fragments. [WRIA-WTIA Technical Note 7].

### HANDS/FEET

Welding Gloves  
Safety footwear.

### OTHER

Overalls.

- Eyewash unit.

Aprons, sleeves, shoulder covers, leggings or spats of pliable flame resistant leather or other suitable materials may also be required in positions where these areas of the body will encounter hot metal.

### RESPIRATOR

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

| Breathing Zone Level<br>ppm (volume) | Maximum Protection<br>Factor | Half- face Respirator | Full- Face Respirator |
|--------------------------------------|------------------------------|-----------------------|-----------------------|
| 1000                                 | 10                           | - AUS P               | -                     |
| 1000                                 | 50                           | -                     | - AUS P               |
| 5000                                 | 50                           | Airline *             | -                     |
| 5000                                 | 100                          | -                     | - 2 P                 |
| 10000                                | 100                          | -                     | - 3 P                 |
|                                      | 100+                         |                       | Airline**             |

\* - Continuous Flow

\*\* - Continuous-flow or positive pressure demand.

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

For further information consult site specific CHEMWATCH data (if available), or your Occupational Health and Safety Advisor.

### ENGINEERING CONTROLS

Special ventilation requirements apply for processes which result in the generation of barium, chromium, lead, or nickel fume and in those processes which generate ozone. The use of mechanical ventilation by local exhaust systems is required as a minimum in all circumstances (including outdoor work). (In confined spaces always check that oxygen has not been depleted by excessive rusting of steel or snowflake corrosion of aluminium) Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 metre/sec.

If risk of inhalation or overexposure exists, wear SAA approved respirator or work in fume hood.

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## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

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### APPEARANCE

Steel tubular wire containing a powder.

### PHYSICAL PROPERTIES

Does not mix with water.

Sinks in water.

Molecular Weight: Not applicable

Melting Range (°C): 1500

Solubility in water (g/L): Immiscible

pH (1% solution): Not applicable.

Volatile Component (%vol): Not applicable

Relative Vapour Density (air=1): Not applicable

Lower Explosive Limit (%): Not applicable

Autoignition Temp (°C): Not applicable

State: Manufactured

Boiling Range (°C): Not applicable

Specific Gravity (water=1): 6.3

pH (as supplied): Not applicable

Vapour Pressure (kPa): Not applicable

Evaporation Rate: Not applicable

Flash Point (°C): Not applicable

Upper Explosive Limit (%): Not applicable

Decomposition Temp (°C): Not available.

Viscosity: Not Applicable

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## Section 10 - CHEMICAL STABILITY AND REACTIVITY INFORMATION

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### CONDITIONS CONTRIBUTING TO INSTABILITY

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerisation will not occur.

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## Section 11 - TOXICOLOGICAL INFORMATION

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### POTENTIAL HEALTH EFFECTS

#### ACUTE HEALTH EFFECTS

##### SWALLOWED

Not normally a hazard due to physical form of product.

##### EYE

Fumes from welding/brazing operations may be irritating to the eyes.

Arc rays can injure eyes.

##### SKIN

Chrome fume, as the chrome VI oxide, is corrosive to the skin and may aggravate pre-existing skin conditions such as dermatitis and eczema. As a potential skin sensitiser, the fume may cause dermatoses to appear suddenly and without warning. Absorption of chrome VI compounds through the skin can cause systemic poisoning affecting the kidneys and liver.

Arc rays can burn skin.

##### INHALED

Chrome fume is irritating to the respiratory tract and lungs. Toxic effects result from over-exposure. Asthmatic conditions may result as a consequence of the sensitising action of chrome VI compounds.

Manganese fume is toxic and produces nervous system effects characterised by tiredness. Acute poisoning is rare although acute inflammation of the lungs may occur. A chemical pneumonia may also result from frequent exposure. Inhalation of freshly formed metal

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## Section 11 - TOXICOLOGICAL INFORMATION

oxide particles sized below 1.5 microns and generally between 0.02 to 0.05 microns may result in "metal fume fever". Symptoms may be delayed for up to 12 hours and begin with the sudden onset of thirst, and a sweet, metallic or foul taste in the mouth. Other symptoms include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalised feeling of malaise. Mild to severe headache, nausea, occasional vomiting, fever or chills, exaggerated mental activity, profuse sweating, diarrhoea, excessive urination and prostration may also occur. Tolerance to the fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours following removal from exposure.

Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.

### CHRONIC HEALTH EFFECTS

Principal route of exposure is inhalation of welding fumes from electrodes and workpiece. Reaction products arising from electrode core and flux appear as welding fume depending on welding conditions, relative volatilities of metal oxides and any coatings on the workpiece. Studies of lung cancer among welders indicate that they may experience a 30-40% increased risk compared to the general population. Since smoking and exposure to other cancer-causing agents, such as asbestos fibre, may influence these results, it is not clear whether welding, in fact, represents a significant lung cancer risk. Whilst mild steel welding represents little risk, the stainless steel welder, exposed to chromium and nickel fume, may be at risk and it is this factor which may account for the overall increase in lung cancer incidence among welders. Cold isolated electrodes are relatively harmless.

Welding fume with high levels of ferrous materials may lead to particle deposition in the lungs (siderosis) after long exposure. This clears up when exposure stops. Chronic exposure to iron dusts may lead to eye disorders.

Exposure to fume containing high concentrations of water-soluble chromium (VI) during the welding of stainless steels in confined spaces has been reported to result in chronic chrome intoxication, dermatitis and asthma. Certain insoluble chromium (VI) compounds have been named as carcinogens (by the ACGIH) in other work environments. Chromium may also appear in welding fumes as Cr<sub>2</sub>O<sub>3</sub> or double oxides with iron. These chromium (III) compounds are generally biologically inert.

Other welding process exposures can arise from radiant energy UV flash burns, thermal burns or electric shock

The welding arc emits ultraviolet radiation at wavelengths that have the potential to produce skin tumours in animals and in over-exposed individuals, however, no confirmatory studies of this effect in welders have been reported.

### TOXICITY AND IRRITATION

Not available. Refer to individual constituents.

unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances

#### WELDING FUMES:

Not available. Refer to individual constituents.

WARNING: This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.

#### IRON OXIDE FUME:

The substance is classified by IARC as Group 3:

NOT classifiable as to its carcinogenicity to humans.

Evidence of carcinogenicity may be inadequate or limited in animal testing.

No oral toxicity data.

Substance has been investigated as a tumorigen;

found to be an equivocal tumorigenic agent by RTECS criteria.

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## Section 11 - TOXICOLOGICAL INFORMATION

### CHROMIUM FUME:

The substance is classified by IARC as Group 3:  
NOT classifiable as to its carcinogenicity to humans.  
Evidence of carcinogenicity may be inadequate or limited in animal testing.  
Not available.

### MANGANESE FUME:

#### TOXICITY

Inhalation (man) TCl<sub>o</sub>: 2.3 mg/m<sup>3</sup>

Oral (rat) LD50: 9000 mg/kg

The substance has been investigated as a tumorigen;  
found to be an equivocal tumorigenic agent by RTECS.

#### IRRITATION

Skin (rabbit) 500mg/24H Mild

Eye (rabbit) 500mg/24H Mild

| MATERIAL        | CARCINOGEN | REPROTOXIN | SENSITISER | SKIN |
|-----------------|------------|------------|------------|------|
| iron oxide fume | IARC:      |            |            |      |
| chromium fume   | IARC:      |            |            |      |
| manganese fume  |            | ILOM ILOEI |            |      |

### CARCINOGEN

IARC: International Agency for Research on Cancer (IARC) Carcinogens: iron oxide fume  
Category:

### CARCINOGEN

IARC: International Agency for Research on Cancer (IARC) Carcinogens: chromium fume  
Category:

### REPROTOXIN

ILOM: ILO Agents toxic to the male reproductive system: manganese fume

### REPROTOXIN

ILOEI: ILO Chemicals in the electronics industry that have toxic effects on reproduction: manganese fume

## Section 12 - ECOLOGICAL INFORMATION

No data for CIGWELD Cromalloy 409Ti.

## Section 13 - DISPOSAL CONSIDERATIONS

- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Management Authority for disposal.
- Bury residue in an authorised landfill.
- Recycle containers if possible, or dispose of in an authorised landfill.

## Section 14 - TRANSPORTATION INFORMATION

HAZCHEM: None

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS:UN, IATA,  
IMDG

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## Section 15 - REGULATORY INFORMATION

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**POISONS SCHEDULE: None**

### REGULATIONS

welding fumes (CAS No:Not avail):  
No regulations applicable

iron oxide fume (CAS: 1309-37-1) is found on the following regulatory lists;

- Australia Exposure Standards
- Australia High Volume Industrial Chemical List (HVICL)
- Australia Inventory of Chemical Substances (AICS)
- Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 2
- Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 4
- Australia Standard for the Uniform Scheduling of Drugs and Poisons (SUSDP) - Schedule 6
- International Agency for Research on Cancer (IARC) Carcinogens
- International Council of Chemical Associations (ICCA) - High Production Volume List
- OECD Representative List of High Production Volume (HPV) Chemicals

chromium fume (CAS: 7440-47-3) is found on the following regulatory lists;

- Australia - Australia New Zealand Food Standards Code - Processing Aids - Permitted catalysts
- Australia - Australian Capital Territory - Environment Protection Regulation: Ambient environmental standards (AQUA/1 to 6 - inorganic chemicals)
- Australia - Australian Capital Territory Environment Protection Regulation Agricultural Uses (IRRIG) - Physical and chemical quality
- Australia - Australian Capital Territory Environment Protection Regulation Agricultural uses (STOCK) - Physical and chemical quality
- Australia - Australian Capital Territory Environment Protection Regulation Pollutants entering waterways - Agricultural uses (Irrig)
- Australia - Australian Capital Territory Environment Protection Regulation Pollutants entering waterways - Agricultural uses (Stock)
- Australia - Australian Capital Territory Environment Protection Regulation Pollutants entering waterways - Domestic water quality
- Australia - Australian Capital Territory Environment Protection Regulation Pollutants entering waterways - Ecosystem maintenance
- Australia - Western Australia Hazardous Substances Prohibited for Specified Uses or Methods of Handling
- Australia Exposure Standards
- Australia Inventory of Chemical Substances (AICS)
- Australia National Pollutant Inventory
- International Agency for Research on Cancer (IARC) Carcinogens
- OECD Representative List of High Production Volume (HPV) Chemicals
- WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water

manganese fume (CAS: 7439-96-5) is found on the following regulatory lists;

- Australia - Australian Capital Territory - Environment Protection Regulation: Ambient environmental standards (Domestic water supply - inorganic chemicals)
- Australia - Australian Capital Territory Environment Protection Regulation Agricultural Uses (IRRIG) - Physical and chemical quality
- Australia - Australian Capital Territory Environment Protection Regulation Pollutants entering waterways - Agricultural uses (Irrig)
- Australia - Australian Capital Territory Environment Protection Regulation

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Section 15 - REGULATORY INFORMATION

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Pollutants entering waterways - Domestic water quality

Australia Exposure Standards

Australia Inventory of Chemical Substances (AICS)

Australia National Pollutant Inventory

OECD Representative List of High Production Volume (HPV) Chemicals

WHO Guidelines for Drinking-water Quality - Guideline values for chemicals that are of health significance in drinking-water

No data available for welding fumes as CAS: Not avail.

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## Section 16 - OTHER INFORMATION

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