

Safety Data Sheet (SDS)

Established Date: 01/Apr./2009

Revised Date: 01/Jun./2022

1. Identification of the Substance and of the Company

Product Identifier:

Tool Steel (include the coated or surface treated Tool Steel)

Supplier Information:

Company Name: **OSG USA, INC.**
Address: **620 Stetson Avenue
Saint Charles, IL 60174**
Contact Department: **Engineering**
Phone Number: **800-837-2223**
FAX Number: **800-837-3334**
Emergency Phone Number: **800-837-2223**

Recommended Use of the Tool Steel:

Cutting and drilling tools for metallic materials

Restrictions on Use of the Tool Steel:

Do not use for other than the specified purpose

Attention to the Phase/State of the Tool Steel:

- Tool Steel as solid state like cutting tools is chemically stable and safe at explosive, flammable, combustible, pyrophoric, water-reactive, and oxidizability under normal environment.
- Tool Steel is safe for use as the cutting tools (grinding, machining, rolling for metals) under normal condition.
- This SDS informs about the dust, fume or vapor which occur from Tool Steel producing process such as raw material powder handling and grinding.

2. Hazard Identification

The GHS Classification

Some data (such as the burning rate test data, etc.) for the dust, fume or vapor which occur from Tool Steel producing process are unavailable. Therefore, they are not be classified by GHS.

In here, GHS classification of the each metallic ingredients (cobalt, nickel, chromium and manganese) for composing the Tool Steel can be disclosed. In addition, other hazards and harmful effects (for health, environment, physical and chemical) which are not listed are unclassifiable or non-applicable by GHS.

GHS classification for the hazards of cobalt alone in below,
(When cobalt is included as ingredients of Tool Steel.)

Health Hazard	• Acute toxicity (oral)	Category4
	• Acute toxicity (inhaled: dust, mist)	Category1
	• Serious eye damage / eye irritation	Category2B
	• Respiratory sensitization	Category1A
	• Skin sensitization	Category1A
	• Carcinogenicity	Category2

	<ul style="list-style-type: none"> •Reproductive toxicity •Specific target organ toxicity (Single exposure) •Specific target organ toxicity (Repeated exposure) 	<p>Category1B</p> <p>Category1 (Respiratory)</p> <p>Category1 (Respiratory, Heart, Thyroid, Blood)</p>
Environmental Hazard:	<ul style="list-style-type: none"> •Hazardous to the aquatic environment – prolonged (Chronic hazard) •Hazardous to the aquatic environment – repeated (Acute hazard) 	<p>Category1</p> <p>Category1</p>

GHS classification for the hazards of nickel alone in below,
(When nickel is included as ingredients of Tool Steel.)

Health Hazard	<ul style="list-style-type: none"> •Respiratory sensitization •Skin sensitization •Carcinogenicity •Specific target organ toxicity (Single exposure) •Specific target organ toxicity (Repeated exposure) 	<p>Category1</p> <p>Category1</p> <p>Category2</p> <p>Category1 (Respiratory tract irritation)</p> <p>Category1 (Respiratory)</p>
Environmental Hazard:	<ul style="list-style-type: none"> •Hazardous to the aquatic environment – prolonged (Chronic hazard) 	<p>Category4</p>

GHS classification for the hazards of chromium alone in below,
(When chromium is included as ingredients of Tool Steel.)

Health Hazard	<ul style="list-style-type: none"> •Serious eye damage •Respiratory sensitization •Skin sensitization •Germ cell mutagenicity •Specific target organ toxicity (Single exposure) •Specific target organ toxicity (Repeated exposure) 	<p>Category2B</p> <p>Category1</p> <p>Category1</p> <p>Category2</p> <p>Category2 (Respiratory tract irritation)</p> <p>Category3 (Respiratory)</p>
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GHS classification for the hazards of manganese alone in below,
(When manganese is included as ingredients of Tool Steel.)

Health Hazard	<ul style="list-style-type: none"> •Skin corrosion, irritation •Serious eye damage •Reproductive toxicity •Specific target organ toxicity (Single exposure) 	<p>Category3</p> <p>Category2B</p> <p>Category1B</p> <p>Category1 (Respiratory)</p>
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	<ul style="list-style-type: none"> • Specific target organ toxicity (Repeated exposure) 	Category1 (Nervous system , Respiratory)
Environmental Hazard:	<ul style="list-style-type: none"> • Hazardous to the aquatic environment – prolonged (Chronic hazard) 	Category4

GHS Label Elements

GHS label elements of the each metallic ingredients (cobalt, nickel, manganese and chromium) for composing the Tool Steel can be disclosed in below.

	Cobalt	Nickel	Chromium	Manganese
Hazard Pictograms :				
Signal Words :	Danger			
Hazard Statements :	<ul style="list-style-type: none"> • Risk of causing allergies, asthma or breathing difficulties if inhaled. • Risk of causing an allergic skin reaction. • May cause cancer. • May cause adverse effects on fertility or the unborn child. • Risk of respiratory irritation. • Cause of respiratory failure due to long-term or repetitive exposure. • May be harmful to aquatic life due to long lasting effects 	<ul style="list-style-type: none"> • Risk of causing allergies, asthma or breathing difficulties if inhaled. • Risk of causing an allergic skin reaction. • May cause cancer. • Respiratory and kidney disorders • Cause of respiratory failure due to long-term or repetitive exposure. • May be harmful to aquatic life due to long lasting effects 	<ul style="list-style-type: none"> • Risk of causing allergies, asthma or breathing difficulties if inhaled. • Risk of causing an allergic skin reaction. • Suspected of causing genetic disease • Failure to systemic toxicity • Risk of respiratory irritation. 	<ul style="list-style-type: none"> • Mild skin irritation • Eye irritation. • Respiratory disorders. • May cause adverse effects on fertility or the unborn child. • Cause of respiratory failure due to long-term or repetitive exposure. • May be harmful to aquatic life due to long lasting effects

Precautionary Statements :	<p>【Prevention】</p> <ul style="list-style-type: none"> • Obtain safety instructions* before use. • Do not handle until all safety precautions have been read and understood. • Use appropriate personal protection and ventilation system keeping away from exposure. • Wear suitable protective gloves. • When insufficient ventilation, wear respirator as required. • Do not breathe dust, fume or vapor. • Do not eat, drink or smoke in handling area. • Wash skin thoroughly after handling. • Do not release into the environment. <p>【Responses】</p> <ul style="list-style-type: none"> • If inhaled, move to fresh air and take a rest with posture easy to breathe. • If respiratory symptoms occurs, contact a doctor. • When feeling ill, get medical advice/attention. • Take off contaminated clothing and wash before reuse. • If on skin, rinse away immediately with a large amount of water and soap. • If skin irritation occurs, contact a doctor and get medical advice/attention. • If exposed or concerned, get medical advice/attention. • If dust is in eyes, immediately wash away with clean water (remove the contact lenses if possible). If irritation persists, get medical advice/attention. • If a large amount of dust is swallowed, get medical advice/attention after ingesting plenty of water to dilute. <p>【Storage】</p> <ul style="list-style-type: none"> • Avoid sudden changes of temperature and high humidity for storage. <p>【Disposal】</p> <ul style="list-style-type: none"> • Dispose of contents/container to an approved waste disposal plant under the laws.
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*For safety instructions, refer to the Japan Cutting & Wear-resistant Tool Association website (<http://www.jta-tool.jp/>) .

3. Composition/Information on Ingredients

- Distinction between substance and mixture: Mixture (alloy)
- Chemical name or general name: Tool Steel
 - Tool Steel may be coated or surface treated with the following substances.
 - Coating materials : CrN, TiAlN, TiC, TiCN, TiN, AlCrN, Ti,SiN
 - Surface treatment : Steam treatment (Fe₃O₄), Nitriding treatment (Fe₄N, Fe₂N)
- Ingredients and concentration or concentration range (composition) of the Tool Steel.

Ingredient	Chemical Formula	CAS No	Official Number of Law for PRTR	Official Number of Industrial Safety and Health Law	Composition mass%
Iron	Fe	7439-89-6	N/A	N/A	N/A
Silicon	Si	7440-21-3	N/A	N/A	0-2.2
Manganese	Mn	7439-96-5	Class1:412	Appendix9-550	0-1.2
Chromium	Cr	7440-47-3	Class1:87	Appendix9-142	0.2-1.3
Molybdenum	Mo	7439-98-7	Class1:453	Appendix9-603	0.3-6
Tungsten	W	7440-33-7	N/A	Appendix 9-337	0-4.5
Vanadium	V	7440-62-2	N/A	N/A	0.05-2.5
Cobalt	Co	7440-48-4	Class1:132	Appendix 9-172	0-4.5
Nickel	Ni	7440-02-0	Class1:308	Appendix 9-418	0-1.8

*For the details regarding the content of the designated chemical material such as cobalt, nickel, chromium, manganese and molybdenum (effective digit: 2), please contact to the above supplier.

*Even if the cemented carbide do not contain cobalt, nickel, chromium, manganese as an active ingredient may include cobalt, nickel, chromium, manganese as an impurity.

4. First-Aid Measures

If Inhaled

- If the high concentration of dust is inhaled or respiratory symptoms (coughs, gasping, shortness of breath, etc.) are experienced, move to fresh air and take a rest with posture easy to breathe. If breathing difficulties occur, administer oxygen inhalation. If breathing has stopped, immediately administer artificial respiration and get medical advice/attention.
- If irritation or rash persists, get medical advice and attention.

If on Skin

- If dust is contacted with skin, take off contaminated clothing and rinse the affected area with soapy water thoroughly. If irritation or rash persists, get medical advice/attention.

If in Eyes

- If dust is in eyes, immediately wash away with clean water (remove the contact lenses if possible). If irritation persists, get medical advice/attention.

If Swallowed

- If a large amount of dust is swallowed, get medical advice/attention after ingesting plenty of water to dilute.

5. Fire-Fighting Measures

Suitable Extinguishing Media and Unsuitable Extinguishing Media

- To extinguish the fire of dust, use dry sand, expanded vermiculite, dilatable perlite, ABC type (general, oil, electric fire) powder extinguishers or water (no water allowed for the dust containing cut powders of light metal such as magnesium and aluminum).

Special Protective Equipment and Emergency Procedures for Fire-Fighters

- In fighting a fire, wear a protective clothing, dust-proof respirator or respiratory protective equipment.

6. Accidental Release Measures

Personal Precautions, Protective Equipment, and Emergency Procedures

- It is recommended that someone who cleans dust should wear clothing and respiratory protective equipment to minimize exposure.

Environmental Precautions

- Dispose of dust as industrial wastes and prevent release in water systems.

Containment and Cleanup Methods and Equipment

- If there is dust which occur from Tool Steel producing process, isolate the area and remove with a cleaner equipped with a filter which can take up fine particles very efficiently. If appropriate removing methods are not available, sweep with water sprayers or wet mops.

7. Handling and Storage

Handling

■ Technical Measures

- If the disperse of dust containing cobalt or nickel or manganese is concerned, provide local exhaust ventilation and use personal protective equipment to minimize exposure to human body.

■ Precautions for Safe Handling

- Obtain safety instructions before use.
- Do not handle until all safety precautions have been read and understood.

■ Contact Avoidance

- Take measures described in “Exposure Controls/Personal Protection.”
- Do not breathe dust, fume or vapor.
- Do not eat, drink or smoke in handling area.

■ Hygiene Measures

- Wash skin thoroughly after handling.
- Do not release into the environment.

Storage

■ Conditions for Safe Storage

- Avoid sudden changes of temperature and high humidity for storage.
- If storing fine powder, dust, and swarf generated by cutting or polishing, cover them with a cover to prevent dispersal.

■ Materials for Safe Container

- Use materials meeting the specific gravity of Tool Steel

8. Exposure Controls/Personal Protection

Exposure Prevention

·Permissible concentration in working environment (reference value)

Ingredient	Chemical Formula	OSHA* PEL* mg/m ³	ACGIH* TLV* mg/m ³	Japan Society for Occupational Health Exposure Limit* mg/m ³
Iron	Fe	N/A	N/A	N/A
Silicon	Si	15	10	N/A
Manganese	Mn	5	0.2	0.3
Chromium	Cr	0.5	0.5	0.5
Molybdenum	Mo	15	10	N/A
Tungsten	W	5	5	N/A
Vanadium	V	N/A	N/A	N/A
Cobalt	Co	0.1	0.02	0.05
Nickel	Ni	1.0	1.5	1.0

*OSHA : Occupational Safety & Health Administration U.S. Department

*PEL : Permissible Exposure Limit

- *ACGIH : American Conference of Governmental Industrial Hygienists Inc.
- *TLV : Threshold Limit Value
- * Exposure Limit: If processing such as polishing and cutting that generates dust, for ingredients with not indicated value, refer to the exposure limit of the Japan Society for Occupational Health
- *N/A : Not Applicable

·Facility measures

Provide local exhaust ventilation so that dusts in the air may not exceed the exposure limits in the above table. It is to be noted that management concentration of the cobalt (and its inorganic compounds) and manganese (and its inorganic compounds) are to be 0.02mg/m³ and 0.2mg/m³ respectively in accordance with the working environment assessment standard by Japanese Minister of Health, Labour and Welfare under the paragraph (2), Article 65-2 of the Industrial Safety and Health Act in Japan.

In addition, cobalt (and its inorganic compounds) and manganese (and its inorganic compounds) in the storage or handling, and that to take the necessary action conforming to the Ordinance on Prevention of Hazards due to Specified Chemical Substance.

Protection Measures

- Respiratory Protection: Dust-proof respirators and respiratory protective equipment are recommended.
- Hand Protection: Protective gloves for dust are recommended.
- Eye/Face Protection: Eye and face protections for dust are recommended.
- Skin/Body Protection: Avoid direct skin contact.
Clean up deposited dust on clothing, rags, etc. by washing or absorbing with suitable filters but not by whisking off.
Change the contaminated clothing into clean one.

Hygiene Measure

Wash skin thoroughly after handling.

9. Physical and Chemical Properties

- Physical State: Solid state
- Color : Shiny silver color
(in case of the coated or surface treated Tool Steel, the appearance color is often different.)
- Odor: Odorless
- Melting/Freezing Point: 1200 – 1400 °C
- Boiling or Initial Boiling Point and Boiling Range: No data available

Flammability, Explosion Limits, Flammability Limit, Flash Point, Spontaneous Ignition Temperature, Resolution Temperature:	No data available
pH:	No data available
Kinematic Viscosity:	No data available
Solubility:	Insoluble
Vapor Pressure:	No data available
Density and/or Relative Density:	7 – 9
Relative Gas Density:	No data available
Particle Properties:	No data available

10. Stability and Reactivity

A grain of dust which occur from Tool Steel producing process is very fine and under the specific conditions in which the dusts are mixed with grinding oil with low flash point, it is possible to become pyrophoric. If dusts under very flammable conditions are dispersed in the air, it is possible to explode.

The each metallic ingredients (cobalt, nickel, chromium and manganese) for composing the Tool Steel has the following information about stability and reactivity under specific conditions.

Stability and reactivity of cobalt alone in below,
(When cobalt is included as ingredients of Tool Steel.)

Reactivity, chemical stability:	Stable to heat and contact with water Ignite spontaneously in air
Hazardous reactions:	It reacts with strong oxidizing agents It reacts violently with oxygen, and it poses a risk of fire or explosion It reacts violently with acid to generate hydrogen
Conditions to avoid:	Contact with incompatible materials
Incompatible materials:	Strong oxidizing agents, acid
Hazardous decomposition products:	By combustion, cobalt oxide and fumes of cobalt oxide may occur

Stability and reactivity of nickel alone in below,
(When nickel is included as ingredients of Tool Steel.)

Reactivity, chemical stability:	It is considered stable in storage and handling in accordance with the laws and regulations
Hazardous reactions:	Metallic nickel is usually stabilized against oxidation by the oxide film, fresh metal surfaces without oxide film is rapidly oxidized by air. Thus, fresh metallic nickel powder, there is a risk of ignition in air.
Conditions to avoid:	No data available

Hazardous decomposition products: No data available

Stability and reactivity of chromium alone in below,
(When chromium is included as ingredients of Tool Steel.)

Reactivity, chemical stability:	Stable under normal handling conditions
Hazardous reactions:	Reacts violently with strong oxidizing agents such as hydrogen peroxide, it poses a risk of fire or explosion. It reacts with dilute hydrochloric acid and dilute sulfuric acid.
Conditions to avoid:	The alkali or alkaline carbonate is Incompatible. When mixed with air in powder or granular form, there is a possibility of dust explosion.
Incompatible materials:	Strong oxidizing agents, dilute hydrochloric acid, dilute sulfuric acid, alkali, alkali carbonate
Hazardous decomposition products:	During combustion, there can be irritating or toxic fumes and gases.

Stability and reactivity of manganese alone in below,
(When manganese is included as ingredients of Tool Steel.)

Reactivity, chemical stability:	Stable under normal handling conditions.
Hazardous reactions:	Toxic fumes occur when heated. Reacts violently with nonmetals (chlorine, fluorine, oxygen, etc.) at high temperature, causing fire and explosion hazard. Reacts violently with hydrogen peroxide, bromine pentafluoride, nitrogen dioxide and aluminum dust, causing fire and explosion hazard. It reacts with boron, carbon, silicon, phosphorus, sulfur, oxidant. It reacts explosively with nitric acid and ammonium nitrate.
Conditions to avoid:	In the case of powder, it reacts with water or steam to generate hydrogen. When mixed with air in powder or granular form, there is a possibility of dust explosion.
Incompatible materials:	High temperature heating, mixing and contact with incompatible hazardous substances. Strong oxidants, strong acids, hydrogen peroxide, bromine pentafluoride, nitrogen dioxide, nonmetals, aluminum dust, etc.
Hazardous decomposition products:	Upon heating, irritating, corrosive, toxic gases and fumes are generated.

11. Toxicological Information

Acute Toxicity:	No data available on Tool Steel
Skin Corrosion/Irritation:	No data available on Tool Steel

Serious Eye Damage/Eye Irritation:	No data available on Tool Steel
Respiratory or Skin Sensitization:	No data available on Tool Steel
Germ Cell Mutagenicity:	No data available on Tool Steel
Carcinogenicity:	Group 2A on IARC, as cobalt powder coexisting with tungsten carbide powder. Suspected to be carcinogenic in humans (Ref.1)
Reproductive Toxicity:	No data available on Tool Steel
Specific Target Organ Toxicity/Systemic Toxicity: (Single Exposure)	No data available on Tool Steel
Specific Target Organ Toxicity/Systemic Toxicity: (Repeated Exposure)	No data available on Tool Steel
Aspiration Hazard:	No data available on Tool Steel

12. Ecological Information

Ecotoxicity, Persistence, Degradability, Bioaccumulation, Mobility in soil, Hazardous to the ozone layer

- Not reported on Tool Steel

13. Disposal Considerations

Safe and environmentally desirable disposal or recycle method

- The main ingredients such as tungsten or cobalt or nickel are rare metal. It is desirable to collect and recycle them.
- For disposal, conform to the applicable laws regarding industrial wastes such as 'Waste Disposal and Public Cleansing Law' and relevant local by laws.

14. Transport Information

International Regulations

UN Number:	Not applicable
Proper Shipping Name	Not applicable
UN Hazard Class:	Not applicable
Packing Group	Not applicable
Marine Pollutant:	Not applicable

*When transporting a powder of metallic ingredients (cobalt, nickel, manganese) for composing the Tool Steel, there is a possibility that it is necessary to take appropriate action in accordance with the relevant provisions established by IMO (International Maritime Organization), ICAO (International Civil Aviation Organization), IATA (International Air Transport Association).

Domestic Regulations

Land Regulatory Information	In accordance with the Fire Service Act/ the Road Act
Marine Transportation Information:	In accordance with the Ship Safety Act/ the Act on Port Regulations
Marine Pollutant:	Not applicable
Aviation transportation information :	In accordance with the Civil Aeronautics Act

*When transporting a powder of metallic ingredients (cobalt, nickel, manganese) for

composing the Tool Steel, there is a possibility that it is necessary to take appropriate action in accordance with the relevant provisions of Ship Safety Law and the Aviation Law.

Special Safety Measures for Transportation and Transportation Method

When transporting the dust which occur from Tool Steel producing process, make sure that there is no damage or corrosion or leakage of the container, to ensure implementation of the prevention of collapse of cargo.

15. Regulatory Information

Name and Information of Applicable Regulatory

- Law for Pollutant Release and Transfer Register (PRTR)
 - Manganese: “Class 1 designated chemical substances”, Cabinet OrderNo.412
 - Chromium: “Class 1 designated chemical substances”, Cabinet OrderNo.87
 - Molybdenum: “Class 1 designated chemical substances”, Cabinet OrderNo.453
 - Cobalt: “Class 1 designated chemical substances”, Cabinet Order No.132
 - Nickel: “Class 1 designated chemical substances”, Cabinet OrderNo.308

- Industrial Safety and Health Law, Ordinance on Prevention of Hazards due to Specified Chemical Substances
 - Manganese: The substances are defined in the Article 57-2 of the Act, and the manganese is listed by No.550 in Appended Table9 in the Article 18-2 of the Enforcement Order as “Dangerous or Harmful Substances to be notified their names, etc.”
Article 2, Paragraph 1, Items 2 and 5 of Ordinance on Prevention of Hazards due to Specified Chemical Substance, Specified chemical substance class 2, Management class 2.
When the content of cobalt and cobalt oxide is less than 1%, the Ordinance on Prevention of Hazards due to Specified Chemical Substance is not covered.
 - Chromium: The substances are defined in the Article 57-2 of the Act, and the chromium is listed by No.142 in Appended Table9 in the Article 18-2 of the Enforcement Order as “Dangerous or Harmful Substances to be notified their names, etc.”
 - Molybdenum: The substances are defined in the Article 57-2 of the Act, and the molybdenum is listed by No.603 in Appended Table9 in the Article 18-2 of the Enforcement Order as “Dangerous or Harmful Substances to be notified their names, etc.”
 - Tungsten: The substances are defined in the Article 57-2 of the Act, and the tungsten is listed by No.337 in Appended Table9 in the Article 18-2 of the Enforcement Order as “Dangerous or Harmful Substances to be notified their names, etc.”
 - Cobalt: The substances are defined in the Article 57-2 of the Act, and the cobalt is listed by No.172 in Appended Table9 in the Article 18-2 of the Enforcement Order as “Dangerous or Harmful Substances to be notified their names, etc.”
Article 2, Paragraph 1, Items 2 and 5 of Ordinance on Prevention of Hazards due to Specified Chemical Substance, Specified chemical substance class 2, Management class 2.
When the content of cobalt and cobalt oxide is less than 1%, the Ordinance on Prevention of Hazards due to Specified Chemical Substance is not covered.
 - Nickel: The substances are defined in the Article 57-2 of the Act, and the nickel is listed by No.418 in Appended Table9 in the Article 18-2 of the

Enforcement Order as “Dangerous or Harmful Substances to be notified their names, etc.”

16. Other Information

Other Hazardous Information

The following attention should be paid for dust which occur from Tool Steel producing process.

- If a large amount of dust containing cobalt is inhaled, blood, heart, thyroid gland, and spleen disorders may result. (Ref.2)
- It is reported that repeated or prolonged contact with cobalt, nickel, or chromium may affect skin, respiratory organs, heart, etc. (Ref.3 - 6)
- Contact with molybdenum stimulates skin and eyes. Also, inhalation and swallowing of molybdenum may be harmful. (Ref.7)
- For carcinogenicity of metallic ingredients of Tool Steel has the following knowledge.

Cobalt metal	ACGIH	A3: Confirmed animal carcinogen with unknown relevance to humans.
	IARC	2B: Possibly carcinogenic to humans.
Nickel metal	Japan Society for Occupational Health	2B: The substance has been determined to be possibly carcinogenic to humans (with relatively insufficient evidence).
	ACGIH	A5: Not suspected as a human carcinogen.
	IARC	2B: Possibly carcinogenic to humans.
Chromium metal	Japan Society for Occupational Health	2B: The substance has been determined to be possibly carcinogenic to humans (with relatively insufficient evidence).
	IARC	3: Not classifiable as to its carcinogenicity to humans.

*ACGIH : American Conference of Governmental Industrial Hygienists Inc.

*IARC : International Agency for Research on Cancer

Disclaimer

The contents of this SDS are based on material and information available as of today and may be revised due to knowledge newly obtained. The values of concentration, physical/chemical properties are not guaranteed. In addition, the precautions described herein apply only to normal uses, and thus safety cannot be guaranteed.

Reference URL

- Ministry of Economy, Trade and Industry : <http://www.meti.go.jp/>
- Ministry of the Environment : <http://www.env.go.jp/>
- Ministry of Health, Labour and Welfare : <http://www.mhlw.go.jp/>
- Japan Industrial Safety and Health Assoc. : <http://www.jaish.gr.jp/>
- International Agency for Research on Cancer : <http://monographs.iarc.fr/>
- International Chemical Safety Card : <http://www.nihs.go.jp/ICSC/>
- National Institute of Technology and Evaluation : <http://www.safe.nite.go.jp/ghs/list.html>

Reference Documents

- (1) IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol.86 (2006).

- (2) Food & Drug Research Laboratories, study No.8005B (4.11.84).
- (3) T. Shirakawa et al., Chest. 95, 29 (1989).
- (4) International Chemical Safety Cards (cobalt, chromium, nickel).
- (5) The Guide to Chemical Hazards (edited by Japan Industrial Safety & Health Association)
- (6) A. O. Bech et al., Brit. J. Ind., 19, 239 (1962).
- (7) Chemical safety management data book, (The Chemical Daily Co., Ltd.)

Revision History

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