

PALLADIUM (-102, -104, -105, -106, -108, -110) POWDER

Chemwatch: 45193
 Version No: 5.1.1.1
 Safety Data Sheet according to OSHA HazCom Standard (2012) requirements

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 S.GHS.USA.EN

SECTION 1 IDENTIFICATION

Product Identifier

Product name	PALLADIUM POWDER
Chemical Name	palladium
Synonyms	Pd
Proper shipping name	Metal powder, flammable, n.o.s.
Chemical formula	Pd
Other means of identification	Not Available
CAS number	7440-05-3

Relevant identified uses of the substance

	Medical and research applications
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Details of the manufacturer

Registered company name	Oak Ridge National Laboratory
Address	P.O. Box 2008, Oak Ridge, Tennessee 37831-6158
Telephone	(865) 574-6984
Fax	(865) 574-6986
Website	http://isotopes.gov/
Email	isotopes@ornl.gov

Emergency telephone number

Association / Organization	Oak Ridge National Laboratory
Emergency telephone numbers	(865) 574-6606
Other emergency telephone numbers	CHEMTREC: 1-800-424-9300

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	3	3
Toxicity	2	2
Body Contact	2	2
Reactivity	2	2
Chronic	2	2

0 = Minimum
 1 = Low
 2 = Moderate
 3 = High
 4 = Extreme



Flammable Solid Category 1, Skin Corrosion/Irritation Category 2, Eye Irritation Category 2A, Skin Sensitizer Category 1, Carcinogen Category 2, STOT - SE (Resp. Irr.) Category 3, Acute Aquatic Hazard Category 3

Label elements



Hazard statement(s)

H228	Flammable solid
H315	Causes skin irritation
H319	Causes serious eye irritation
H317	May cause an allergic skin reaction
H351	Suspected of causing cancer
H335	May cause respiratory irritation
H402	Harmful to aquatic life

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statement(s) Response

P308+P313	IF exposed or concerned: Get medical advice/attention.
P370+P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P302+P352	IF ON SKIN: Wash with plenty of water and soap
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary statement(s) Storage

P405	Store locked up.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.

Precautionary statement(s) Disposal

	Dispose of contents/container to authorized chemical landfill or if organic to high temperature incineration
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SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS**Substances**

CAS No	%[weight]	Name
7440-05-3	100	palladium

Mixtures See section above for composition of Substances

SECTION 4 FIRST AID MEASURES**Description of first aid measures**

Eye Contact	<p>If this product comes in contact with the eyes:</p> <ul style="list-style-type: none"> ■ Wash out immediately with fresh running water. ■ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ■ Seek medical attention without delay; if pain persists or recurs seek medical attention. ■ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel. ■ 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. <p>For THERMAL burns:</p> <ul style="list-style-type: none"> ■ Do NOT remove contact lens ■ 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.
Skin Contact	<p>If skin contact occurs:</p> <ul style="list-style-type: none"> ■ Immediately remove all contaminated clothing, including footwear. ■ Flush skin and hair with running water (and soap if available). ■ Seek medical attention in event of irritation. <p>In case of burns:</p> <ul style="list-style-type: none"> ■ Immediately apply cold water to burn either by immersion or wrapping with saturated clean cloth. ■ DO NOT remove or cut away clothing over burned areas. Do not pull away clothing which has adhered to the skin as this can cause further injury. ■ DO NOT break blister or remove solidified material. ■ Quickly cover wound with dressing or clean cloth to help prevent infection and to ease pain. ■ For large burns, sheets, towels or pillow slips are ideal; leave holes for eyes, nose and mouth. ■ DO NOT apply ointments, oils, butter, etc. to a burn under any circumstances. ■ Water may be given in small quantities if the person is conscious. ■ Alcohol is not to be given under any circumstances. ■ Reassure. ■ Treat for shock by keeping the person warm and in a lying position. ■ Seek medical aid and advise medical personnel in advance of the cause and extent of the injury and the estimated time of arrival of the patient.

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Inhalation	<p>If fumes or combustion products are inhaled remove from contaminated area. Lay patient down. Keep warm and rested.</p> <ul style="list-style-type: none"> ■ Prostheses 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, without delay.
Ingestion	<ul style="list-style-type: none"> ■ If swallowed do NOT induce vomiting. ■ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. ■ Observe the patient carefully. ■ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. ■ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink. ■ Seek medical advice.

Indication of any immediate medical attention and special treatment needed

Copper, magnesium, aluminum, antimony, iron, manganese, nickel, zinc (and their compounds) in welding, brazing, galvanizing 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]

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

	<p>Metal dust fires need to be smothered with sand, inert dry powders. DO NOT USE WATER, CO2 or FOAM.</p> <ul style="list-style-type: none"> ■ Use DRY sand, graphite powder, dry sodium chloride based extinguishers, G-1 or Met L-X to smother fire. ■ Confining or smothering material is preferable to applying water as chemical reaction may produce flammable and explosive hydrogen gas.
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Special hazards arising from the substrate or mixture

	<ul style="list-style-type: none"> ■ Reacts with acids producing flammable / explosive hydrogen (H2) gas ■ None known.
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Advice for firefighters

Fire Fighting	<ul style="list-style-type: none"> ■ Alert Fire Brigade and tell them location and nature of hazard. ■ Wear breathing apparatus plus protective gloves. ■ Prevent, by any means available, spillage from entering drains or water course. ■ Fight fire from a safe distance, with adequate cover.
Fire/Explosion Hazard	<ul style="list-style-type: none"> ■ DO NOT disturb burning dust. Explosion may result if dust is stirred into a cloud, by providing oxygen to a large surface of hot metal. ■ DO NOT use water or foam as generation of explosive hydrogen may result. <p>With the exception of the metals that burn in contact with air or water (for example, sodium), masses of combustible metals do not represent unusual fire risks because they have the ability to conduct heat away from hot spots so efficiently that the heat of combustion cannot be maintained - this means that it will require a lot of heat to ignite a mass of combustible metal.</p>

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Minor Spills	<ul style="list-style-type: none"> ■ Remove all ignition sources. ■ DO NOT touch or walk through spilled material. ■ Clean up all spills immediately. ■ Avoid contact with skin and eyes.
Major Spills	<ul style="list-style-type: none"> ■ Clear area of personnel and move upwind. ■ Alert Fire Brigade and tell them location and nature of hazard. ■ DO NOT touch or walk through spilled material. ■ Control personal contact with the substance, by using protective equipment.

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

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	<ul style="list-style-type: none"> ■ Avoid all personal contact, including inhalation. ■ Wear protective clothing when risk of overexposure occurs. ■ Use in a well-ventilated area. ■ Prevent concentration in hollows and sumps.
Other information	<ul style="list-style-type: none"> ■ Store under an inert gas, e.g. argon or nitrogen. <p>FOR MINOR QUANTITIES:</p> <ul style="list-style-type: none"> ■ Store in an indoor fireproof cabinet or in a room of noncombustible construction. ■ Provide adequate portable fire-extinguishers in or near the storage area. <p>FOR PACKAGE STORAGE:</p> <ul style="list-style-type: none"> ■ Store in original containers in approved flame-proof area.

Conditions for safe storage, including any incompatibilities

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Suitable container	<p>CARE: Packing of high density product in light weight metal or plastic packages may result in container collapse with product release</p> <ul style="list-style-type: none"> ■ Heavy gauge metal packages / Heavy gauge metal drums <p>For low viscosity materials and solids:</p> <ul style="list-style-type: none"> ■ Drums and jerricans must be of the non-removable head type. <p>Where a can is to be used as an inner package, the can must have a screwed enclosure.</p> <p>For materials with a viscosity of at least 2680 cSt. (23 deg. C):</p> <ul style="list-style-type: none"> ■ Removable head packaging and ■ cans with friction closures may be used.
Storage incompatibility	<ul style="list-style-type: none"> ■ Several platinum compounds, including trimethylplatinum derivatives are explosively unstable. ■ Some compounds of the other platinum group metals are also of limited stability ■ WARNING: Avoid or control reaction with peroxides. All <i>transition metal</i> peroxides should be considered as potentially explosive. For example transition metal complexes of alkyl hydroperoxides may decompose explosively.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
US OSHA Permissible Exposure Levels (PELs) - Table Z3	palladium	Inert or Nuisance Dust	5 mg/m3 / 15 mg/m3 / 15 mppcf / 50 mppcf	Not Available	Not Available	Respirable fraction; All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1. / Total dust; All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name are covered by this limit, which is the same as the Particulates Not Otherwise Regulated (PNOR) limit in Table Z-1.

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
palladium	Palladium	0.093 mg/m3	1 mg/m3	6.1 mg/m3

Ingredient	Original IDLH	Revised IDLH
palladium	Not Available	Not Available

Exposure controls

Appropriate engineering controls	<p>For large scale or continuous use:</p> <ul style="list-style-type: none"> ■ Spark-free, earthed ventilation system, venting directly to the outside and separate from usual ventilation systems ■ Provide dust collectors with explosion vents <p>Metal dusts must be collected at the source of generation as they are potentially explosive.</p> <ul style="list-style-type: none"> ■ Avoid ignition sources. ■ Good housekeeping practices must be maintained. ■ Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions.
Personal protection	
Eye and face protection	<p>Safety glasses with side shields. Chemical goggles.</p> <p>Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task.</p>
Skin protection	See Hand protection below
Hands/feet protection	<p>NOTE:</p> <ul style="list-style-type: none"> ■ The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact. ■ Contaminated leather items, such as shoes, belts and watch-bands should be removed and destroyed. <p>The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer.</p>
Body protection	See Other protection below
Other protection	<ul style="list-style-type: none"> ■ Overalls. ■ Eyewash unit. ■ Barrier cream. ■ Skin cleansing cream.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the: **Forsberg Clothing Performance Index™**.

The effect(s) of the following substance(s) are taken into account in the computer generated selection:

Respiratory protection

Required Minimum Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
up to 10 x ES	P1 Air-line*	-	PAPR-P1 -

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Material	CPI
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* CPI - Chemwatch Performance Index

A: Best Selection

B: Satisfactory; may degrade after 4 hours continuous immersion

C: Poor to Dangerous Choice for other than short term immersion

NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -

* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

up to 50 x ES	Air-line**	P2	PAPR-P2
up to 100 x ES	-	P3	-
		Air-line*	-
100+ x ES	-	Air-line**	PAPR-P3

* - Negative pressure demand ** - Continuous flow

A(All classes) = Organic vapors, B AUS or B1 = Acid gasses, B2 = Acid gas or hydrogen cyanide(HCN), B3 = Acid gas or hydrogen cyanide(HCN), E = Sulfur dioxide(SO2), G = Agricultural chemicals, K = Ammonia(NH3), Hg = Mercury, NO = Oxides of nitrogen, MB = Methyl bromide, AX = Low boiling point organic compounds(below 65 degC)

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

	Silver-white metal		
Physical state	Solid	Relative density (Water = 1)	12.0
Odor	Not Available	Partition coefficient n-octanol / water	Not Available
Odor threshold	Not Available	Auto-ignition temperature (°C)	Not Available
pH (as supplied)	Not Applicable	Decomposition temperature	Not Applicable
Melting point / freezing point (°C)	1554	Viscosity (cSt)	Not Applicable
Initial boiling point and boiling range (°C)	2800	Molecular weight (g/mol)	106.42
Flash point (°C)	Not Available	Taste	Not Available
Evaporation rate	Not Applicable	Explosive properties	Not Available
Flammability	Not Available	Oxidizing properties	Not Available
Upper Explosive Limit (%)	Not Available	Surface Tension (dyn/cm or mN/m)	Not Applicable
Lower Explosive Limit (%)	Not Available	Volatile Component (%vol)	Negligible
Vapor pressure (kPa)	Negligible	Gas group	Not Available
Solubility in water (g/L)	Immiscible	pH as a solution(1%)	Not Applicable
Vapor density (Air = 1)	Not Applicable	VOC g/L	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	<ul style="list-style-type: none"> ■ Unstable in the presence of incompatible materials. ■ Product is considered stable. ■ Hazardous polymerization will not occur.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual. 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.
Ingestion	Accidental ingestion of the material may be damaging to the health of the individual. Not normally a hazard due to the physical form of product. The material is a physical irritant to the gastro-intestinal tract. Colloidal palladium is reported to increase body temperature, produce discoloration and tissue death at the site of injection, decrease body-weight and cause some destruction of blood cells. Platinoids are poorly absorbed from the gut, skin and other routes not directly in the blood stream.
Skin Contact	This material can cause inflammation of the skin on contact in some persons. The material may accentuate any pre-existing dermatitis condition. Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions. Open cuts, abraded or irritated skin should not be exposed to this material. Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
Eye	This material can cause eye irritation and damage in some persons. Contact with the eye by metal dusts may cause mechanical abrasion or foreign body penetration of the eyeball.

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Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment. Skin contact with the material is more likely to cause a sensitization reaction in some persons compared to the general population. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

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Not Available

Not Available

palladium

Not Available

Not Available

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Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS.

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No significant acute toxicological data identified in literature search.

Acute Toxicity	<input type="checkbox"/>	Carcinogenicity	<input checked="" type="checkbox"/>
Skin Irritation/Corrosion	<input checked="" type="checkbox"/>	Reproductivity	<input type="checkbox"/>
Serious Eye Damage/Irritation	<input checked="" type="checkbox"/>	STOT - Single Exposure	<input checked="" type="checkbox"/>
Respiratory or Skin sensitization	<input checked="" type="checkbox"/>	STOT - Repeated Exposure	<input type="checkbox"/>
Mutagenicity	<input type="checkbox"/>	Aspiration Hazard	<input type="checkbox"/>

Legend: - Data required to make classification available
 - Data available but does not fill the criteria for classification
 - Data Not Available to make classification

CMR STATUS

CARCINOGEN	palladium	US Environmental Defense Scorecard Suspected Carcinogens	P65-MC
RESPIRATORY	palladium	US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs) - Respiratory	X

SECTION 12 ECOLOGICAL INFORMATION

Toxicity Harmful to aquatic organisms. For Metal:

Atmospheric Fate - Metal-containing inorganic substances generally have negligible vapor pressure and are not expected to partition to air.

Environmental Fate: Environmental processes, such as oxidation, the presence of acids or bases and microbiological processes, may transform insoluble metals to more soluble ionic forms.

Environmental processes may enhance bioavailability and may also be important in changing solubilities.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
	No Data available for all ingredients	No Data available for all ingredients

Bioaccumulative potential

Ingredient	Bioaccumulation
	No Data available for all ingredients

Mobility in soil

Ingredient	Mobility
	No Data available for all ingredients

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

- Containers may still present a chemical hazard/ danger when empty.
 - Return to supplier for reuse/ recycling if possible.
- Otherwise:
- If container cannot be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorized landfill.
 - Where possible retain label warnings and SDS and observe all notices pertaining to the product.

SECTION 14 TRANSPORT INFORMATION

Labels Required

	
Marine Pollutant	NO

Land transport (DOT)

UN number	3089
Packing group	II
UN proper shipping name	Metal powder, flammable, n.o.s
Environmental hazard	No relevant data
Transport hazard class(es)	Class : 4.1
Special precautions for user	Special provisions : IB8, IP2, IP4, T3, TP33

Air transport (ICAO-IATA / DGR)

UN number	3089
Packing group	II
UN proper shipping name	Metal powder, flammable, n.o.s.
Environmental hazard	No relevant data
Transport hazard class(es)	ICAO/IATA Class : 4.1 ICAO / IATA Subrisk : Not Applicable ERG Code : 3L
Special precautions for user	Special provisions : A3 Cargo Only Packing Instructions : 448 Cargo Only Maximum Qty / Pack : 50 kg Passenger and Cargo Packing Instructions : 445 Passenger and Cargo Maximum Qty / Pack : 15 kg Passenger and Cargo Limited Quantity Packing Instructions : Y441 Passenger and Cargo Limited Maximum Qty / Pack : 5 kg

Sea transport (IMDG-Code / GGVSee)

UN number	3089
Packing group	II
UN proper shipping name	METAL POWDER, FLAMMABLE, N.O.S.
Environmental hazard	No relevant data
Transport hazard class(es)	IMDG Class : 4.1 IMDG Subrisk : Not Applicable
Special precautions for user	EMS Number : F-G , S-G Special provisions : Not Applicable Limited Quantities : 1 kg

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

	"US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants","US - Hawaii Air Contaminant Limits","US - California Permissible Exposure Limits for Chemical Contaminants","US - Michigan Exposure Limits for Air Contaminants","US - Oregon Permissible Exposure Limits (Z-1)","International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs","US OSHA Permissible Exposure Levels (PELs) - Table Z3","US - Washington Permissible exposure limits of air contaminants","US - California OEHHA/ARB - Chronic Reference Exposure Levels and Target Organs (CRELs)","US Toxic Substances Control Act (TSCA) - Chemical Substance Inventory","US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants"
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SECTION 16 OTHER INFORMATION

Other information

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

A list of reference resources used to assist the committee may be found at:

www.chemwatch.net/references

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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