Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
1,4-Naphthoquinone

STATEMENT OF HAZARDOUS NATURE

NFPA

SUPPLIER
Company: Santa Cruz Biotechnology, Inc.
Address: 2145 Delaware Ave
Santa Cruz, CA 95060
Telephone: 800.457.3801 or 831.457.3800
Emergency Tel: CHEMWATCH: From within the US and Canada: 877-715-9305
Emergency Tel: From outside the US and Canada: +800 2436 2255 (1-800-CHEMCALL) or call +613 9573 3112

PRODUCT USE
Polymerisation regulator for rubber and polyester resins, synthesis of dyes and pharmaceuticals, fungicide, algicide.

SYNONYMS
C10-H6-O2, "1, 4-dihydro-1, 4-diketonaphthalene", "1, 4-naphthalenedione", alpha-naphthoquinone, "1, 4-naptha-quinone", "RCRA Waste No.: U166", "USAF CY-10"

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flammability</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Toxicity</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Body Contact</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Reactivity</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chronic</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>

CANADIAN WHMIS SYMBOLS
Transition metal ions may also play an important role in lipid peroxidation after free radical-induced membrane phospholipids, such as peroxidation results in impairment of cellular and/or subcellular membranes which may produce cell death. Lipids containing several double bonds (such as polyunsaturated fatty acids and cholesterol) are also subject to damage. In the case of membrane phospholipids, such "peroxidation" results in impairment of cellular and/or subcellular membranes which may produce cell death. Transition metal ions may also play an important role in lipid peroxidation after free radical-induced change of valency - \( \text{Fe}^{3+}/\text{Fe}^{2+} \), copper...
and mercury ions, as well as vanadate and chromate ions seem to initiate this process and may even exacerbate it by producing secondary radicals when the phospholipid is modified.

### Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>NAME</th>
<th>CAS RN</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-naphthoquinone</td>
<td>130-15-4</td>
<td>&gt;98</td>
</tr>
</tbody>
</table>

### Section 4 - FIRST AID MEASURES

**SWALLOWED**
- Give a slurry of activated charcoal in water to drink. NEVER GIVE AN UNCONSCIOUS PATIENT WATER TO DRINK.
- At least 3 tablespoons in a glass of water should be given.
- Although induction of vomiting may be recommended (IN CONSCIOUS PERSONS ONLY), such a first aid measure is dissuaded because of the risk of aspiration of stomach contents. (i) It is better to take the patient to a doctor who can decide on the necessity and method of emptying the stomach. (ii) Special circumstances may however exist; these include non-availability of charcoal and the ready availability of the doctor.

**NOTE:** If vomiting is induced, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. **NOTE:** Wear protective gloves when inducing vomiting.
- REFER FOR MEDICAL ATTENTION WITHOUT DELAY.
- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS. (ICSC20305/20307).

**EYE**
- If this product comes in contact with the eyes:
  - Immediately hold eyelids apart and flush the eye continuously with 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.
  - Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
  - Transport to hospital or doctor without delay.
  - Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

**SKIN**
- If skin or hair contact occurs:
  - Quickly but gently, wipe material off skin with a dry, clean cloth.
  - Immediately remove all contaminated clothing, including footwear.
  - Wash skin and hair with running water. Continue flushing with water until advised to stop by the Poisons Information Center.
  - Transport to hospital, or doctor.

**INHALED**
- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- 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.

**NOTES TO PHYSICIAN**
- Treat symptomatically.
  - for poisons (where specific treatment regime is absent):

  **BASIC TREATMENT**
  - Establish a patent airway with suction where necessary.
  - Watch for signs of respiratory insufficiency and assist ventilation as necessary.
  - Administer oxygen by non-rebreather mask at 10 to 15 l/min.
  - Monitor and treat, where necessary, for pulmonary edema.
  - Monitor and treat, where necessary, for shock.
  - Anticipate seizures.
  - DO NOT use emetics. Where ingestion is suspected rinse mouth and give up to 200 ml water (5 ml/kg recommended) for dilution where patient is able to swallow, has a strong gag reflex and does not drool.

  **ADVANCED TREATMENT**

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3 of 13
- Consider orotracheal or nasotracheal intubation for airway control in unconscious patient or where respiratory arrest has occurred.
- Positive-pressure ventilation using a bag-valve mask might be of use.
- Monitor and treat, where necessary, for arrhythmias.
- Start an IV D5W TKO. If signs of hypovolemia are present use lactated Ringers solution. Fluid overload might create complications.
- Drug therapy should be considered for pulmonary edema.
- Hypotension with signs of hypovolemia requires the cautious administration of fluids. Fluid overload might create complications.
- Treat seizures with diazepam.
- Proparacaine hydrochloride should be used to assist eye irrigation.

BRONSTEIN, A.C. and CURRANCE, P.L.
EMERGENCY CARE FOR HAZARDOUS MATERIALS EXPOSURE: 2nd Ed. 1994.

### Section 5 - FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vapour Pressure (mmHG)</td>
<td>Negligible</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available</td>
</tr>
<tr>
<td>Specific Gravity (water=1)</td>
<td>1.422</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not available</td>
</tr>
</tbody>
</table>

**EXTINGUISHING MEDIA**

- Foam.
- Dry chemical powder.
- BCF (where regulations permit).
- Carbon dioxide.
- Water spray or fog - Large fires only.

**FIRE FIGHTING**

- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- 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.

**GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS**

- Combustible solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.
- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Combustion products include: carbon monoxide (CO), carbon dioxide (CO2), other pyrolysis products typical of burning organic material. May emit poisonous fumes.

**FIRE INCOMPATIBILITY**

- Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

**PERSONAL PROTECTION**

Glasses:
Chemical goggles.
Gloves:
Respirator:
Particulate

### Section 6 - ACCIDENTAL RELEASE MEASURES

**MINOR SPILLS**

- Clean up waste regularly and abnormal spills immediately.
- Avoid breathing dust and contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up. NOTE: Vacuum cleaner must be fitted with an exhaust micro filter (HEPA type) (consider explosion-proof
machines designed to be grounded during storage and use).
- Dampen with water to prevent dusting before sweeping.
- Place in suitable containers for disposal.

**MAJOR SPILLS**
- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

**PROTECTIVE ACTIONS FOR SPILL**

From IERG (Canada/Australia)

<table>
<thead>
<tr>
<th>Isolation Distance</th>
<th>25 meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downwind Protection Distance</td>
<td>250 meters</td>
</tr>
</tbody>
</table>

**FOOTNOTES**

1. **PROTECTIVE ACTION ZONE** is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
2. **PROTECTIVE ACTIONS** should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
3. **INITIAL ISOLATION ZONE** is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.
4. **SMALL SPILLS** involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". **LARGE SPILLS** involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.
6. IERG information is derived from CANUTEC - Transport Canada.

**ACUTE EXPOSURE GUIDELINE LEVELS** (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
DO NOT allow material to contact humans, exposed food or food utensils.
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.
Launder contaminated clothing before re-use.
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.
Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.
DO NOT cut, drill, grind or weld such containers.
In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

- Lined metal can, Lined metal pail/drum
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.
For low viscosity materials
- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.
For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):
- Removable head packaging;
- Cans with friction closures and
- Low pressure tubes and cartridges may be used.
- Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages *.
- In addition, where inner packagings are glass and contain liquids of packing group I and II there must be sufficient inert absorbent to absorb any spillage *.
- Unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic. All inner and sole packagings for substances that have been assigned to Packaging Groups I or II on the basis of inhalation toxicity criteria, must be hermetically sealed.

STORAGE REQUIREMENTS

- Store in original containers.
- Keep containers securely sealed.
- Store in a cool, dry, well-ventilated area.
- Store away from incompatible materials and foodstuff containers.
- Protect containers against physical damage and check regularly for leaks.
- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

| X | X | + | X | X | + |

X: Must not be stored together
O: May be stored together with specific precautions
+: May be stored together

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION
<table>
<thead>
<tr>
<th>Source</th>
<th>Material</th>
<th>TWA mg/m³</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>US - Oregon Permissible Exposure Limits (Z-3)</td>
<td>1,4-naphthoquinone (Inert or Nuisance Dust: Total dust)</td>
<td>10</td>
<td>(d)</td>
</tr>
<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z3</td>
<td>1,4-naphthoquinone (Inert or Nuisance Dust: (d) Respirable fraction)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US OSHA Permissible Exposure Levels (PELs) - Table Z3</td>
<td>1,4-naphthoquinone (Inert or Nuisance Dust: (d) Total dust)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>US - Hawaii Air Contaminant Limits</td>
<td>1,4-naphthoquinone (Particulates not otherwise regulated - Total dust)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>US - Hawaii Air Contaminant Limits</td>
<td>1,4-naphthoquinone (Particulates not otherwise regulated - Respirable fraction)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Oregon Permissible Exposure Limits (Z-3)</td>
<td>1,4-naphthoquinone (Inert or Nuisance Dust: Respirable fraction)</td>
<td>5</td>
<td>(d)</td>
</tr>
<tr>
<td>US ACGIH Threshold Limit Values (TLV)</td>
<td>1,4-naphthoquinone (Particles (Insoluble or Poorly Soluble) [NOS] Inhalable particles)</td>
<td>10</td>
<td>See Appendix B current TLV/BEI Book</td>
</tr>
<tr>
<td>US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants</td>
<td>1,4-naphthoquinone (Particulates not otherwise regulated Respirable fraction)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants</td>
<td>1,4-naphthoquinone (Particulates not otherwise regulated (PNOR)(f)- Respirable fraction)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>US - Michigan Exposure Limits for Air Contaminants</td>
<td>1,4-naphthoquinone (Particulates not otherwise regulated, Respirable dust)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Canada - Prince Edward Island Occupational Exposure Limits</td>
<td>1,4-naphthoquinone (Particles (Insoluble or Poorly Soluble) [NOS] Inhalable particles)</td>
<td>10</td>
<td>See Appendix B current TLV/BEI Book</td>
</tr>
</tbody>
</table>

**MATERIAL DATA**

1,4-NAPHTHOQUINONE:

- It is the goal of the ACGIH (and other Agencies) to recommend TLVs (or their equivalent) for all substances for which there is evidence of health effects at airborne concentrations encountered in the workplace.
- At this time no TLV has been established, even though this material may produce adverse health effects (as evidenced in animal experiments or clinical experience). Airborne concentrations must be maintained as low as is practically possible and occupational exposure must be kept to a minimum.
- NOTE: The ACGIH occupational exposure standard for Particles Not Otherwise Specified (P.N.O.S) does NOT apply.

Sensory irritants are chemicals that produce temporary and undesirable side-effects on the eyes, nose or throat. Historically occupational exposure standards for these irritants have been based on observation of workers' responses to various airborne concentrations. Present day expectations require that nearly every individual should be protected against even minor sensory irritation and exposure standards are established using uncertainty factors or safety factors of 5 to 10 or more. On occasion animal no-observable-effect-levels (NOEL) are used to determine these limits where human results are unavailable. An additional approach, typically used by the TLV committee (USA) in determining respiratory standards for this group of chemicals, has been to assign ceiling values (TLV C) to rapidly acting irritants and to assign short-term exposure limits (TLV STELs) when the weight of evidence from irritation, bioaccumulation and other endpoints combine to warrant such a limit. In contrast the MAK Commission (Germany) uses a five-category system based on intensive odour, local irritation, and elimination half-life. However this system is being replaced to be consistent with the European Union (EU) Scientific Committee for Occupational Exposure Limits (SCOEL); this is more closely allied to that of the USA.

OSHA (USA) concluded that exposure to sensory irritants can:

- cause inflammation
- cause increased susceptibility to other irritants and infectious agents
- lead to permanent injury or dysfunction
- permit greater absorption of hazardous substances and
- acclimate the worker to the irritant warning properties of these substances thus increasing the risk of overexposure.

OEL-Russia: STEL 0.1 mg/m³ (skin)

**PERSONAL PROTECTION**

Consult your EHS staff for recommendations

**EYE**

- Safety glasses with side shields.
• Chemical goggles.
• Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. DO NOT wear contact lenses.

HANDS/FEET
• Wear chemical protective gloves, eg. PVC.
• Wear safety footwear or safety gumboots, eg. Rubber.
NOTE: 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.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:
• frequency and duration of contact,
• chemical resistance of glove material,
• glove thickness and
• dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).
• When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
• When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.

Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OVERALLS
• Overalls.
• Eyewash unit.
• Barrier cream.
• Skin cleansing cream.

RESPIRATOR
• Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
• The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker’s exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
• Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.

Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
• Use approved positive flow mask if significant quantities of dust becomes airborne.
• Try to avoid creating dust conditions.

RESPIRATOR

<table>
<thead>
<tr>
<th>Protection Factor</th>
<th>Half-Face Respirator</th>
<th>Full-Face Respirator</th>
<th>Powered Air Respirator</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 x PEL</td>
<td>P1</td>
<td>-</td>
<td>PAPR-P1</td>
</tr>
<tr>
<td></td>
<td>Air-line*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>50 x PEL</td>
<td>Air-line**</td>
<td>P2</td>
<td>PAPR-P2</td>
</tr>
<tr>
<td>100 x PEL</td>
<td>-</td>
<td>P3</td>
<td>-</td>
</tr>
<tr>
<td>100+ x PEL</td>
<td>-</td>
<td>Air-line*</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Air-line**</td>
<td>P3</td>
<td>PAPR-P3</td>
</tr>
</tbody>
</table>

* - Negative pressure demand ** - Continuous flow

Explanation of Respirator Codes:
Class 1 low to medium absorption capacity filters.
Class 2 medium absorption capacity filters.
Class 3 high absorption capacity filters.
PAPR Powered Air Purifying Respirator (positive pressure) cartridge.
Type A for use against certain organic gases and vapors.
Type AX for use against low boiling point organic compounds (less than 65ºC).
Types B for use against certain inorganic gases and other acid gases and vapors.
Type E for use against sulfur dioxide and other acid gases and vapors.
Type K for use against ammonia and organic ammonia derivatives
Class P1 intended for use against mechanically generated particulates of sizes most commonly encountered in industry, e.g. asbestos, silica.
Class P2 intended for use against both mechanically and thermally generated particulates, e.g. metal fume.
Class P3 intended for use against all particulates containing highly toxic materials, e.g. beryllium.
The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker’s exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).

Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.

Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.

Use approved positive flow mask if significant quantities of dust becomes airborne.
Try to avoid creating dust conditions.

ENGINEERING CONTROLS
• Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a
certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in the air could occur, respiratory protection should be considered. Such protection might consist of:
  (a): particle dust respirators, if necessary, combined with an absorption cartridge;
  (b): filter respirators with absorption cartridge or canister of the right type;
  (c): fresh-air hoods or masks
- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to efficiently remove the contaminant.

<table>
<thead>
<tr>
<th>Type of Contaminant</th>
<th>Air Speed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>direct spray, spray painting in shallow booths, drum filling, conveyor loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)</td>
<td>1-2.5 m/s (200-500 f/min.)</td>
</tr>
<tr>
<td>grinding, abrasive blasting, tumbling, high speed wheel generated dusts (released at high initial velocity into zone of very high rapid air motion).</td>
<td>2.5-10 m/s (500-2000 f/min.)</td>
</tr>
</tbody>
</table>

Within each range the appropriate value depends on:

- Lower end of the range
- Upper end of the range

**PHYSICAL AND CHEMICAL PROPERTIES**

**PHYSICAL PROPERTIES**

Solid.
Does not mix with water.
Sinks in water.

<table>
<thead>
<tr>
<th>State</th>
<th>Divided solid</th>
<th>Molecular Weight</th>
<th>158.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting Range (°F)</td>
<td>249.8- 251.6</td>
<td>Viscosity</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>Not available</td>
<td>Solubility in water (g/L)</td>
<td>Immiscible</td>
</tr>
<tr>
<td>Flash Point (°F)</td>
<td>Not available</td>
<td>pH (1% solution)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Decomposition Temp (°F)</td>
<td>Not Available</td>
<td>pH (as supplied)</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Autoignition Temp (°F)</td>
<td>Not available</td>
<td>Vapour Pressure (mmHG)</td>
<td>Negligible</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available</td>
<td>Specific Gravity (water=1)</td>
<td>1.422</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not available</td>
<td>Relative Vapor Density (air=1)</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Volatile Component (%vol)</td>
<td>Negligible</td>
<td>Evaporation Rate</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

**APPEARANCE**

Yellow crystalline powder with benzoquinone odour; does not mix with water. Soluble in hot alcohol, ether, benzene, chloroform, carbon disulfide, acetic acid. Also soluble in solutions of alkali hydroxides giving reddish-brown colour.

log Kow 1.71-1.78

**CONDITIONS CONTRIBUTING TO INSTABILITY**

- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.
STORAGE INCOMPATIBILITY

Avoid storage with reducing agents.

For incompatible materials - refer to Section 7 - Handling and Storage.

Section 11 - TOXICOLOGICAL INFORMATION

1,4-NAPHTHOQUINONE

TOXICITY AND IRRITATION

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

<table>
<thead>
<tr>
<th></th>
<th>IRRITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxicity</td>
<td></td>
</tr>
<tr>
<td>Oral (rat) LD50: 190 mg/kg</td>
<td>Nil Reported</td>
</tr>
<tr>
<td>Subcutaneous (rat) LD50: 202 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke's edema. The pathogenesis of contact eczema involves a cell-mediated (T lymphocytes) immune reaction of the delayed type. Other allergic skin reactions, e.g. contact urticaria, involve antibody-mediated immune reactions. The significance of the contact allergen is not simply determined by its sensitization potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitizing substance which is widely distributed can be a more important allergen than one with stronger sensitizing potential with which few individuals come into contact. From a clinical point of view, substances are noteworthy if they produce an allergic test reaction in more than 1% of the persons tested.

Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compounds. 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. RADS (or asthma) following an irritating inhalation is an infrequent disorder with rates related to the concentration of and duration of exposure to the irritating substance. Industrial bronchitis, on the other hand, is a disorder that occurs as result of exposure due to high concentrations of irritating substance (often particulate in nature) and is completely reversible after exposure ceases. The disorder is characterised by dyspnea, cough and mucus production.

Biologically active naphthoquinones readily pass through the cellular membranes where their electrophilicity enables them to conjugate with other compounds. This reaction has been implicated in the toxicity of quinones. Nucleophilic targets include thiol groups which results in inhibition of enzymes such as parvulin-like peptidyl-prolyl cis/trans isomerases, glutathione-S-transferase and cardiac sarcoplasmic reticulum Ca2+ ATPase.

The toxicity of quinone compounds has been extensively studied and is generally accepted to be a function of (a) the capacity of quinones to produce oxygen free radicals and (b) the electrophilicity of quinones, which enables them to form adducts to cellular macromolecules. In vitro experiments designed to examine the relative rates of enzymatic single-electron reduction demonstrated that naphthoquinones, especially juglone, undergo rapid single-electron reduction.

Unsubstituted naphthoquinones generally do not show mutagenicity in the Salmonella mutation assay in the presence or absence of S-9 metabolic activation. However, substituted naphthoquinones containing one or more hydroxyl groups and/or methoxy groups have been shown to be mutagenic in S. typhimurium in the presence of S-9.

Somnolence, dyspnea, tumors, maternal effects recorded.

Active as anti-cancer agent.

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

1,4-NAPHTHOQUINONE:

<table>
<thead>
<tr>
<th>Marine Pollutant:</th>
<th>Marine Pollutant</th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish LC50 (96h) (mg/l):</td>
<td>0.3- 0.6 (4)</td>
<td></td>
</tr>
<tr>
<td>Algae IC50 (72hr.) (mg/l):</td>
<td>0.3- 0.6</td>
<td></td>
</tr>
<tr>
<td>log Pow (Verschueren 1983):</td>
<td>1.71/1.78</td>
<td></td>
</tr>
</tbody>
</table>

Very toxic to aquatic organisms.

Do NOT allow product to come in contact with surface waters or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or disposing of equipment wash-waters.

Wastes resulting from use of the product must be disposed of on site or at approved waste sites.

DO NOT discharge into sewer or waterways.

log Kow: 1.71-1.78

BOD 5 if unstated: 0.81

ThOD: 2.1

Fish LC50 (96 h): 3.5 mg/L

Degradation Biological: sig

Ecotoxicity

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Persistence: Water/Soil</th>
<th>Persistence: Air</th>
<th>Bioaccumulation</th>
<th>Mobility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-naphthoquinone</td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
<td></td>
</tr>
</tbody>
</table>
### Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions
B. Component Waste Numbers

When 1,4-naphthoquinone is present as a solid waste as a discarded commercial chemical product, off-specification species, as a container residue, or a spill residue, use EPA waste number U166 (waste code T).

Disposal Instructions
All waste must be handled in accordance with local, state and federal regulations.

1. Puncture containers to prevent re-use and bury at an authorized landfill.

Legislation addressing waste disposal requirements may differ by country, state and/or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:
- **Reduction**
- **Reuse**
- **Recycling**
- **Disposal** (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.
- **Recycle wherever possible.**
- **Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.**
- **Dispose of by: Burial in a licensed land-fill or Incineration in a licensed apparatus (after admixture with suitable combustible material)**
- **Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.**

### Section 14 - TRANSPORTATION INFORMATION

DOT:

<table>
<thead>
<tr>
<th>Symbols:</th>
<th>G</th>
<th>Hazard class or Division:</th>
<th>6.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification Numbers:</td>
<td>UN2811</td>
<td>PG:</td>
<td>I</td>
</tr>
<tr>
<td>Label Codes:</td>
<td>6.1</td>
<td>Special provisions:</td>
<td>IB7, T6, TP33</td>
</tr>
<tr>
<td>Packaging: Exceptions:</td>
<td>None</td>
<td>Packaging: Non-bulk:</td>
<td>211</td>
</tr>
<tr>
<td>Packaging: Exceptions:</td>
<td>None</td>
<td>Quantity limitations: Passenger aircraft/rail:</td>
<td>5 kg</td>
</tr>
<tr>
<td>Quantity Limitations: Cargo aircraft only:</td>
<td>50 kg</td>
<td>Vessel stowage: Location:</td>
<td>B</td>
</tr>
<tr>
<td>Vessel stowage: Other:</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hazardous materials descriptions and proper shipping names:
Section 15 - REGULATORY INFORMATION

REGULATIONS

1,4-naphthoquinone (CAS: 130-15-4) is found on the following regulatory lists:

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

■ Cumulative effects may result following exposure*.
* (limited evidence).

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■ Classification of the mixture 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 (M)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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