**1,4-Benzquinone**

**sc-202873**

**Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

**PRODUCT NAME**
1,4-Benzquinone

**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**
- Intermediate. In the manufacture of hydroquinone, in the production of dyes and fungicides, oxidising agent, photographic chemical. Intermediate

**SYNONYMS**
C6-H4-O2, benzo-chinon, "1, 4-benzoquine", "1, 4-benzoquine", "1, 4-benzoquine", "1, 4-benzoquine", p-benzoquinone, p-benzoquinone, chinon, p-chinon, p-chinon, chinone, cyclohexadienedione, "1, 4-cyclohexadienedione", "1, 4-cyclohexadienedione", "2, 5-cyclohexadiene-1, 4-dione", "2, 5-cyclohexadiene-1, 4-dione", "1, 4-cyclohexadiene dioxide", "1, 4-cyclohexadiene dioxide", "1, 4-dioosibenzene", "1, 4-dioosibenzene", "1, 4-dioxybenzene", "1, 4-dioxybenzene", "1, 4-dioxy-benzol", "1, 4-dioxy-benzol", quinone, p-quinone, p-quinone

**Section 2 - HAZARDS IDENTIFICATION**

**EMERGENCY OVERVIEW**

**RISK**
Toxic by inhalation and if swallowed.
Irritating to eyes, respiratory system and skin.
Very toxic to aquatic organisms.

**POTENTIAL HEALTH EFFECTS**

**ACUTE HEALTH EFFECTS**
SWALLOWED
- Toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 40 gram may be fatal or may produce serious damage to the health of the individual.
- The substance and/or its metabolites may bind to hemoglobin inhibiting normal uptake of oxygen. This condition, known as "methemoglobinemia", is a form of oxygen starvation (anoxia).

Symptoms include cyanosis (a bluish discoloration skin and mucous membranes) and breathing difficulties. Symptoms may not be evident until several hours after exposure.

At about 15% concentration of blood methemoglobin there is observable cyanosis of the lips, nose and earlobes. Symptoms may be absent although euphoria, flushed face and headache are commonly experienced. At 25-40%, cyanosis is marked but little disability occurs other than that produced on physical exertion. At 40-60%, symptoms include weakness, dizziness, lightheadedness, increasingly severe headache, ataxia, rapid shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy and stupor. Above 60% symptoms include dyspnea, respiratory depression, tachycardia or bradycardia, and convulsions. Levels exceeding 70% may be fatal.

EYE
- This material can cause eye irritation and damage in some persons.

SKIN
- This material can cause inflammation of the skin on contact in some persons.
- The material may accentuate any pre-existing dermatitis condition.
- Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
- 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.

INHALED
- Inhalation of dusts, generated by the material, during the course of normal handling, may produce toxic effects.
- The material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage.

CHRONIC HEALTH EFFECTS
- Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.

Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray. The vapour produces characteristic eye injuries in workmen. These develop gradually over a period of years. No serious cases appear from exposures of duration less than 5-years and no systemic effects appear to be associated with these injuries. Prolonged or repeated exposure may result in a brownish discolouration of the conjunctiva and cornea (confined to the intrapalpebral fissure), small corneal opacities and structural changes of the cornea which may result in astigmatism and loss of visual acuity. Early pigmented stains tend to be reversible while corneal dystrophy tends to be progressive.

<table>
<thead>
<tr>
<th>Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS</th>
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<tbody>
<tr>
<td>HAZARD RATINGS</td>
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<tr>
<td>Min</td>
</tr>
<tr>
<td>Flammability: 1</td>
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<tr>
<td>Toxicity: 3</td>
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<td>Body Contact: 2</td>
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<tr>
<td>Reactivity: 1</td>
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<td>Chronic: 2</td>
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<table>
<thead>
<tr>
<th>NAME</th>
<th>CAS RN</th>
<th>%</th>
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<tbody>
<tr>
<td>benzoquinone</td>
<td>106-51-4</td>
<td>&gt;98</td>
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<table>
<thead>
<tr>
<th>Section 4 - FIRST AID MEASURES</th>
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<tbody>
<tr>
<td>SWALLOWED</td>
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<tr>
<td>- Give a slurry of activated charcoal in water to drink. NEVER GIVE AN UNCONSCIOUS PATIENT WATER TO DRINK.</td>
</tr>
<tr>
<td>- At least 3 tablespoons in a glass of water should be given.</td>
</tr>
<tr>
<td>- Although induction of vomiting may be recommended (IN CONSCIOUS PERSONS ONLY), such a first aid measure is dissuaded because to 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.</td>
</tr>
</tbody>
</table>

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 contact occurs:
  - 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.

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
  - 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.

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### Section 5 - FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
<td>Vapor Pressure (mmHg)</td>
<td>0.1 @ 25 C</td>
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<tr>
<td>Upper Explosive Limit (%)</td>
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<tr>
<td>Specific Gravity (water=1)</td>
<td>1.318</td>
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<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not available</td>
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</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 breathing apparatus plus protective gloves.
- 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), nitrogen oxides (NOx), 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:
- 1. SARANEX-

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 breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or water courses.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse / absorb vapour.
- Contain or absorb spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Collect solid residues and seal in labelled 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

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 (jerrican 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.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

■ 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.
*n 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 *.

STORAGE REQUIREMENTS

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

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS
## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS

<table>
<thead>
<tr>
<th>Source</th>
<th>Material</th>
<th>TWA ppm</th>
<th>TWA mg/m³</th>
<th>STEL ppm</th>
<th>STEL mg/m³</th>
<th>Peak ppm</th>
<th>Peak mg/m³</th>
<th>TWA F/CC</th>
<th>Notes</th>
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<tr>
<td>Canada - Alberta Occupational Exposure Limits</td>
<td>benzoquinone (p-Benzoquinone (Quinone))</td>
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<td>0.4</td>
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<td>Canada - British Columbia Occupational Exposure Limits</td>
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<td>US OSHA Permissible Exposure Levels (PELs) - Table Z1</td>
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<td>US ACGIH Threshold Limit Values (TLV)</td>
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<td>US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants</td>
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<td>US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants</td>
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<td>US - California Permissible Exposure Limits for Chemical Contaminants</td>
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<td>Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances</td>
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<td>Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances</td>
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<td>US - Washington Permissible exposure limits of air contaminants</td>
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<td>0.3</td>
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<td>US - Michigan Exposure Limits for Air Contaminants</td>
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**TLV Basis:**
- Eye irritation; skin damage
Canada - Nova Scotia Occupational Exposure Limits
benzoquinone (Quinone) 0.1

Canada - Prince Edward Island Occupational Exposure Limits
benzoquinone (Quinone) 0.1

US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants
benzoquinone (Quinone) 0.1 0.4

US - Oregon Permissible Exposure Limits (Z1)
benzoquinone (Quinone) 0.1 0.4

Canada - Northwest Territories Occupational Exposure Limits (English)
benzoquinone (p-Benzoquinone (Quinone)) 0.1 0.42 0.3 1.3

EMERGENCY EXPOSURE LIMITS

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<tr>
<th>Material</th>
<th>Revised IDLH Value (mg/m3)</th>
<th>Revised IDLH Value (ppm)</th>
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<td>100</td>
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</table>

**ODOR SAFETY FACTOR (OSF)**

OSF=1.2 (QUINONE)

- Exposed individuals are NOT reasonably expected to be warned, by smell, that the Exposure Standard is being exceeded.

The Odor Safety Factor (OSF) is defined as:

OSF= Exposure Standard (TWA) ppm/ Odor Threshold Value (OTV) ppm

Classification into classes follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>OSF</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>550</td>
<td>Over 90% of exposed individuals are aware by smell that the Exposure Standard is being reached, even when distracted by working activities</td>
</tr>
<tr>
<td>B</td>
<td>26-550</td>
<td>Idem for 50-90% of persons being distracted</td>
</tr>
<tr>
<td>C</td>
<td>1-26</td>
<td>Idem for less than 50% of persons being distracted</td>
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<tr>
<td>D</td>
<td>0.18-1</td>
<td>0-50% of persons aware of being tested perceive by smell that the Exposure Standard is being reached</td>
</tr>
<tr>
<td>E</td>
<td>&lt;0.18</td>
<td>Idem for less than 10% of persons aware of being tested</td>
</tr>
</tbody>
</table>

Amoore and Hautala* have determined that it is only at an OSF value of 26 that 50% of distracted persons can detect the substance at the Exposure Standard value. In the case of alerted persons, an OSF of 26 means that 99% of them can detect the odor at the Exposure Standard value. It is ONLY for substances belonging to Class A and B that there is a reasonable chance of being warned in time, that the Exposure Standard is being exceeded.* Journal Applied Toxicology: Vol 3, 1983, p272

**NOTE:** The use of the OSF may be inappropriate for mixtures where substances mask the odor of others.

**MATERIAL DATA**

**BENZOQUINONE:**

- 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.

Odour Threshold: 0.084 ppm

Exposure at or below the recommended TLV is thought to minimise the potential of mild, transient ocular irritation, skin depigmentation and characteristic cutaneous lesions.

**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.

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.

**OTHER**

- Overalls.
- Eyewash unit.
- Barrier cream.
- Skin cleansing cream.

**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: benzoquinone

- Protective Material CPI *

**SARANEX-23**

A

* 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.

**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>50 x PEL</td>
<td>Air-line*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>100 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></td>
<td>Air-line*</td>
<td>-</td>
<td>-</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 65°C).
- Type 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.

Use appropriate NIOSH-certified respirator based on informed professional judgement. In conditions where no reasonable estimate of exposure can be made, assume the exposure is in a concentration IDLH and use NIOSH-certified full face pressure demand SCBA with a minimum service life of 30 minutes, or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. Respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used.

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 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, cruiser dusts, gas discharge (active generation into zone of rapid air motion)</td>
<td>1-2.5 m/s (200-500 ft/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 ft/min.)</td>
</tr>
</tbody>
</table>

Within each range the appropriate value depends on:

<table>
<thead>
<tr>
<th>Lower end of the range</th>
<th>Upper end of the range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1: Room air currents minimal or favorable to capture</td>
<td>1: Disturbing room air currents</td>
</tr>
<tr>
<td>2: Contaminants of low toxicity or of nuisance value only</td>
<td>2: Contaminants of high toxicity</td>
</tr>
<tr>
<td>3: Intermittent, low production.</td>
<td>3: High production, heavy use</td>
</tr>
<tr>
<td>4: Large hood or large air mass in motion</td>
<td>4: Small hood-local control only</td>
</tr>
</tbody>
</table>

Simple theory shows that air velocity falls rapidly with distance away from the opening of a simple extraction pipe. Velocity generally decreases with the square of distance from the extraction point (in simple cases). Therefore the air speed at the extraction point should be adjusted, accordingly, after reference to distance from the contaminating source. The air velocity at the extraction fan, for example, should be a minimum of 4-10 m/s (800-2000 ft/min) for extraction of crusher dusts generated 2 meters distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - 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>108.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting Range (°F)</td>
<td>235.4- 239</td>
<td>Viscosity</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>Sublimes</td>
<td>Solubility in water (g/L)</td>
<td>Partly miscible</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>815</td>
<td>Vapor Pressure (mmHg)</td>
<td>0.1 @ 25 C</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available</td>
<td>Specific Gravity (water=1)</td>
<td>1.318</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not available</td>
<td>Relative Vapor Density (air=1)</td>
<td>3.73</td>
</tr>
<tr>
<td>Volatile Component (%vol)</td>
<td>Negligible</td>
<td>Evaporation Rate</td>
<td>Not available</td>
</tr>
</tbody>
</table>

APPEARANCE

Yellow crystalline solid with penetrating, irritating odour resembling chlorine; does not mix well with water (1.5%). Soluble in alcohol, ether, alkaline solutions.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY
Presence of incompatible materials.
Product is considered stable.
Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY
Avoid reaction with oxidizing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

benzoquinone

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

<table>
<thead>
<tr>
<th></th>
<th>TOXICITY</th>
<th>IRRITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral (rat) LD50:</td>
<td>130 mg/kg</td>
<td>Nil Reported</td>
</tr>
<tr>
<td>Intraperitoneal (rat) LD50:</td>
<td>30 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Intravenous (rat) LD50:</td>
<td>25 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Intraperitoneal (mouse) LD50:</td>
<td>8,5 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Subcutaneous (mouse) LD50:</td>
<td>93.8 mg/kg</td>
<td></td>
</tr>
<tr>
<td>Subcutaneous (mammal) LD50:</td>
<td>296 mg/kg</td>
<td></td>
</tr>
</tbody>
</table>

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 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. 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.

The substance is classified by IARC as Group 3:
NOT classifiable as to its carcinogenicity to humans.
Evidence of carcinogenicity may be inadequate or limited in animal testing.
Rat tumorigen
Convulsions, spastic paralysis, spasticity, cyanosis, skin tumours.

CARCINOGEN
para-Quinone International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs Group 3

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

BENZOQUINONE:

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazardous Air Pollutant:</td>
<td></td>
</tr>
<tr>
<td>Half- life Soil - High (hours):</td>
<td>120</td>
</tr>
<tr>
<td>Half- life Soil - Low (hours):</td>
<td>1</td>
</tr>
<tr>
<td>Half- life Air - High (hours):</td>
<td>6.6</td>
</tr>
<tr>
<td>Half- life Air - Low (hours):</td>
<td>0.66</td>
</tr>
<tr>
<td>Half- life Surface water - High (hours):</td>
<td>120</td>
</tr>
<tr>
<td>Half- life Surface water - Low (hours):</td>
<td>1</td>
</tr>
<tr>
<td>Half- life Ground water - High (hours):</td>
<td>240</td>
</tr>
<tr>
<td>Half- life Ground water - Low (hours):</td>
<td>2</td>
</tr>
<tr>
<td>Aqueous biodegradation - Aerobic - High (hours):</td>
<td>120</td>
</tr>
<tr>
<td>Aqueous biodegradation - Aerobic - Low (hours):</td>
<td>1</td>
</tr>
<tr>
<td>Aqueous biodegradation - Anaerobic - High (hours):</td>
<td>480</td>
</tr>
<tr>
<td>Aqueous biodegradation - Anaerobic - Low (hours):</td>
<td>4</td>
</tr>
<tr>
<td>Photooxidation half- life air - High (hours):</td>
<td>6.6</td>
</tr>
<tr>
<td>Photooxidation half- life air - Low (hours):</td>
<td>0.66</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.
The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l
Classification of Substances as Ecotoxic (Dangerous to the Environment)
Appendix 8, Table 1
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>benzoquinone</td>
<td>LOW</td>
<td>LOW</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

Section 13 - DISPOSAL CONSIDERATIONS

US EPA Waste Number & Descriptions

B. Component Waste Numbers

When benzoquinone is present as a solid waste as a discarded commercial chemical product, off-specification species, as a container residue, or as a spill residue, use EPA waste number U197 (waste code T).

Disposal Instructions

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

- 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>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hazard class or Division:</td>
<td>6.1</td>
</tr>
</tbody>
</table>

Identification Numbers:

<table>
<thead>
<tr>
<th>UN:</th>
<th>2587</th>
</tr>
</thead>
<tbody>
<tr>
<td>PG:</td>
<td>II</td>
</tr>
</tbody>
</table>

Label Codes:

<table>
<thead>
<tr>
<th>Code:</th>
<th>6.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special provisions:</td>
<td>IB8, IP2, IP4, T3, TP33</td>
</tr>
</tbody>
</table>

Packaging: Exceptions:

<table>
<thead>
<tr>
<th>Exception:</th>
<th>153</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging: Non-bulk:</td>
<td>212</td>
</tr>
</tbody>
</table>

Packaging: Exceptions:

<table>
<thead>
<tr>
<th>Exception:</th>
<th>153</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity limitations:</td>
<td>25 kg</td>
</tr>
<tr>
<td>Cargo aircraft only:</td>
<td>100 kg</td>
</tr>
<tr>
<td>Vessel stowage: Location:</td>
<td>A</td>
</tr>
</tbody>
</table>

Vessel stowage: Other:

| None |

Hazardous materials descriptions and proper shipping names:

Benzquinone

Air Transport IATA:

<table>
<thead>
<tr>
<th>ICAO/IATA Class:</th>
<th>6.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICAO/IATA Subrisk:</td>
<td>None</td>
</tr>
<tr>
<td>UN/ID Number:</td>
<td>2587</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>II</td>
</tr>
<tr>
<td>Special provisions:</td>
<td>None</td>
</tr>
</tbody>
</table>

Shipping Name: BENZOQUINONE

Maritime Transport IMDG:

<table>
<thead>
<tr>
<th>IMDG Class:</th>
<th>6.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMDG Subrisk:</td>
<td>None</td>
</tr>
<tr>
<td>UN Number:</td>
<td>2587</td>
</tr>
<tr>
<td>Packing Group:</td>
<td>II</td>
</tr>
<tr>
<td>EMS Number:</td>
<td>F-A,S-A</td>
</tr>
<tr>
<td>Special provisions:</td>
<td>None</td>
</tr>
<tr>
<td>Limited Quantities:</td>
<td>500 g</td>
</tr>
</tbody>
</table>
Section 15 - REGULATORY INFORMATION

benzoquinone (CAS: 106-51-4) is found on the following regulatory lists: