Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Eugenol

STATEMENT OF HAZARDOUS NATURE

NFPA

SUPPLIER
Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800

EMERGENCY
ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

SYNONYMS
C10-H12-O2, CH3OC6H3(CH2CH=CH2)OH, "phenol, 4-allyl-2-methoxy-", "4-allyl catechol-2-methyl ether", p-allylguaiaicol, 4-allylguaiaicol, 4-allyl-1-hydroxy-2-methoxybenzene, "carophyllic acid", "eugenic acid", p-eugenol, "1, 3, 4-eugenol", "FA 100", "Fena No. 2467", 1-hydroxy-2-methoxy-4-allylbenzene, 4-hydroxy-3-methoxyallylbenezene, 1-hydroxy-2-methoxy-4-prop-2-enylbenzene, 2-methoxy-4-allylphenol, 2-methoxy-1-hydroxy-4-allylbenzene, 2-methoxy-4-prop-2-enylphenol, 2-methoxy-4(2-propeny)phenol, "phenol, 2-methoxy-4-(2-propenyl)-", "synthetic eugenol"

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>2</td>
<td></td>
</tr>
<tr>
<td>Body Contact</td>
<td>2</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
EMERGENCY OVERVIEW

RISK
Harmful if swallowed.
May cause SENSITISATION by inhalation and skin contact.
Limited evidence of a carcinogenic effect.
Irritating to eyes, respiratory system and skin.
Cumulative effects may result following exposure*.
Inhalation and/or skin contact may produce health damage*.
* (limited evidence).

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED
■ Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
■ Ingestion of eugenol and eugenol-containing oils may produce watery diarrhoea with vomiting with increased stomach secretion. The side effects are less than that of phenol, perhaps because of its relative insolubility. There may be numbness with paralysis of limbs and jaw with severe weakness, coma, and blood in the urine. Death may result from shock.
■ According to WHO/FAO 26th report on food additives, eugenol does not cause cancer and its acceptable daily intake is 2.5mg/kg body weight.
■ Some phenol derivatives can cause damage to the digestive system. If absorbed, profuse sweating, thirst, nausea, vomiting, diarrhoea, cyanosis, restlessness, stupor, low blood pressure, gasping, abdominal pain, anaemia, convulsions, coma and lung swelling can happen followed by pneumonia. There may be respiratory failure and kidney damage. Chemical burns, seizures and irregular heartbeat may result.

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

SKIN
■ The material may cause severe inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterised by redness, swelling and blistering.
■ Skin contact with the material may damage the health of the individual; systemic effects may result following absorption.
■ Eugenol produces local anaesthesia and is a local antiseptic. Skin inflammation has been produced in dental surgeons during exposure in an occupational setting.
■ 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
■ The material can cause respiratory irritation in some persons. The body’s response to such irritation can cause further lung damage.
■ Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.
■ Inhalation hazard is increased at higher temperatures.

CHRONIC HEALTH EFFECTS
■ There has been concern that this material can cause cancer or mutations, but there is not enough data to make an assessment.
Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems.
Inhaling this product is more likely to cause a sensitisation reaction in some persons compared to the general population.
Skin contact with the material is more likely to cause a sensitisation 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.
Some phenol-based naturally occurring substances (eg phenol, guaiacol, tannic acid and eugenol) undergo conversion to produce derivatives which sensitise the skin and possibly the respiratory tract. Each of these compounds has phenolic hydroxyl groups which are readily oxidized to produce reactive quinone-like compounds. Phenol is converted in the body to quinone whilst guaiacol (ortho-methoxyphenol) and eugenol (2-allylguaiacol) are converted to the orthoquinone. Both eugenol and iso-eugenol (4-propenylguaiacol) are precursors that require biotransformation to become protein-reactive haptenes. Although they are structurally similar, their sensitising potentials differ and they are only weakly cross-reactive in laboratory experiments. Iso-eugenol is a strong sensitizer, while eugenol is a moderate sensitizer. It appears that neither share a common mechanism for sensitisation. It appears that both have a common mechanism for sensitisation. This is because they have different mechanisms of biotransformation.
Cinnamaldehyde and cinnamic acid are structurally related to eugenol and iso-eugenol; they seem to generate a common hapten and appear to produce simultaneous sensitisation to eugenol and iso-eugenol despite being metabolised via different pathways.
The phenolics and related substances permeate the deeper skin (dermis) when they are distributed in the body. Phenolic permeation is related to solubility in fat and molecular volume. Phenols are metabolised by skin enzymes or other processes to form reactive metabolic products, or may be chemically modified through the reaction of ultraviolet light. The skin has a wide-ranging metabolic capability which can essentially carry out all the metabolic transformations known to be carried out in the liver. Metabolic by-products may be haptens and produce sensitisation. Although eugenol is itself a weak sensitis, it is oxidised to the highly reactive orthoquinone. The main sensitising compound in poison ivy, a catechol known as urishiol, appears to undergo similar oxidation to produce a reactive hapten. The reactive hapten binds to proteins in the skin (hapten often have an affinity for electrons and bind covalently with amine (NH₂) and sulfhydryl (SH) groups on proteins, modifying the protein which when exposed to the immune system, will react with antigen-presenting cells in the deep skin.

Skin inflammation of the armpits is common, and over-represented in people with contact allergy to fragrances. Many people use their deodorants to be the products responsible. In order to investigate the significance of isoeugenol in deodorants for the development of skin inflammation in the armpits when used by people with and without contact allergy to isoeugenol, patch tests with deodorants and ethanol solutions with isoeugenol, as well as repeated open application tests (ROAT) with roll-on deodorants with and without isoeugenol at various concentrations, were performed in 35 patients with skin inflammation, 10 without and 25 with contact allergy to isoeugenol. A positive ROAT was observed only in patients hypersensitive to isoeugenol and only in the armpit to which the deodorants containing isoeugenol had been applied. Deodorants containing isoeugenol in the concentration range of 0.0063-0.2% used 2 times daily on healthy skin can therefore cause skin inflammation of the armpits within a few weeks in people with contact allergy to isoeugenol.


Certain substances, commonly found in perfumes or perfumed products, produce hypersensitivity. Sensitising constituents have been classified as Class A (common sensitisers) or Class B (rare sensitisers) in a Japanese study (Nakayama 1998). Contact allergy to perfumes occurs with a relatively high incidence, such incidence only surpassed by nickel allergy in the community. In a Danish study, it was found that about 1.1% of the population was allergic to Peru balsam or “fragrance mix”.

There is no cure for perfume allergy. Once sensitised, exposure to even minute amounts of the perfume, gives rise to eruptions and eczema. These symptoms may be treated with steroid creams, although frequent recourse to this treatment produces unwanted side-effects.

Intolerance to perfumes, by inhalation, may occur if the perfume contains a sensitising principal. Symptoms may vary from general illness, coughing, phlegm, wheezing, chest-tightness, headache, exertional dyspnoea, acute respiratory illness, hayfever, and other respiratory diseases (including asthma). Perfumes can induce hyper-reactivity of the respiratory tract without producing an IgE-mediated allergy or demonstrable respiratory obstruction. This was shown by placebo-controlled challenges of nine patients to "perfume mix". The same patients were also subject to perfume provocation, with or without a carbon filter mask, to ascertain whether breathing through a filter with active carbon would prevent symptoms. The patients breathed through the mouth, during the provocations, as a nose clamp was used to prevent nasal inhalation. The patient's earlier symptoms were verified; breathing through the carbon filter had no protective effect. The symptoms were not transmitted via the olfactory nerve but they may have been induced by trigeminal reflex via the respiratory tract or by the eyes.

Cases of occupational asthma induced by perfume substances such as isoamyl acetate, limonene, cinnamaldehyde and benzaldehyde, tend to give persistent symptoms even though the exposure is below occupational exposure limits. Inhalation intolerance has also been produced in animals. The emissions of five fragrances, limonene, cinnamaldehyde and benzaldehyde, were used to prevent nasal inhalation. The patient's earlier symptoms were verified; breathing through a carbon filter had no protective effect. The symptoms were not transmitted via the olfactory nerve but they may have been induced by trigeminal reflex via the respiratory tract or by the eyes.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>NAME</th>
<th>CAS RN</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>eugenol</td>
<td>97-53-0</td>
<td>&gt;98</td>
</tr>
</tbody>
</table>

Section 4 - FIRST AID MEASURES

SWALLOWED

- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- For advice, contact a Poisons Information Centre or a doctor.
- Urgent hospital treatment is likely to be needed.
- 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.

Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:

- INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

NOTE: Wear a protective glove when inducing vomiting by mechanical means.

EYE

If this product comes in contact with the eyes:
• 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.

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
■ For acute or short term repeated exposures to phenols/ cresols:
• Phenol is absorbed rapidly through lungs and skin. [Massive skin contact may result in collapse and death] *
• [Ingestion may result in ulceration of upper respiratory tract; perforation of oesophagus and/or stomach, with attendant complications, may occur. Oesophageal stricture may occur] *
• An initial excitatory phase may present. Convulsions may appear as long as 18 hours after ingestion. Hypotension and ventricular tachycardia that require vasopressor and antiarrhythmic therapy, respectively, can occur.
• Respiratory arrest, ventricular dysrhythmias, seizures and metabolic acidosis may complicate severe phenol exposures so the initial attention should be directed towards stabilisation of breathing and circulation with ventilation, intubation, intravenous lines, fluids and cardiac monitoring as indicated.
• [Vegetable oils retard absorption; do NOT use paraffin oils or alcohols. Gastric lavage, with endotracheal intubation, should be repeated until phenol odour is no longer detectable; follow with vegetable oil. A saline cathartic should then be given.] *
• ALTERNATIVELY: Activated charcoal (1g/kg) may be given. A cathartic should be given after oral activated charcoal.
• Severe poisoning may require slow intravenous injection of methylene blue to treat methaemoglobinaemia.
• [Renal failure may require haemodialysis.] *
• Most absorbed phenol is biotransformed by the liver to ethereal and glucuronide sulfates and is eliminated almost completely after 24 hours. [Ellenhorn and Barceloux: Medical Toxicology] [Union Carbide]

BIOLoGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker who has been exposed to the Exposure Standard (ES or TLV):

<table>
<thead>
<tr>
<th>Determinant</th>
<th>Index</th>
<th>Sampling Time</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total phenol in blood</td>
<td>250 mg/gm creatinine</td>
<td>End of shift</td>
<td>B, NS</td>
</tr>
</tbody>
</table>

B: Background levels occur in specimens collected from subjects NOT exposed
NS: Non-specific determinant; also seen in exposure to other materials.

Section 5 - FIRE FIGHTING MEASURES

<table>
<thead>
<tr>
<th>Vapour Pressure (mmHG)</th>
<th>Not available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available</td>
</tr>
<tr>
<td>Specific Gravity (water=1)</td>
<td>1.067</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 Fire Brigade 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 water delivered as a fine spray to control fire and cool adjacent area.
• Avoid spraying water onto liquid pools.
• 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.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS
- Combustible.
- Slight fire hazard when exposed to heat or flame.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).
- May emit acrid smoke.
- Mists containing combustible materials may be explosive.

Combustion products include: carbon dioxide (CO₂), other pyrolysis products typical of burning organic material.

May emit poisonous fumes.
May emit corrosive fumes.

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

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid breathing vapours and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable, labelled container for waste disposal.

MAJOR SPILLS
Chemical Class: phenols and cresols
For release onto land: recommended sorbents listed in order of priority.

<table>
<thead>
<tr>
<th>SORBENT TYPE</th>
<th>RANK</th>
<th>APPLICATION</th>
<th>COLLECTION</th>
<th>LIMITATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAND SPILL - SMALL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cross-linked polymer -</td>
<td>1</td>
<td>shovel</td>
<td>shovel</td>
<td>R, W, SS</td>
</tr>
<tr>
<td>particulate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cross-linked polymer -</td>
<td>1</td>
<td>throw</td>
<td>pitchfork</td>
<td>R, DGC, RT</td>
</tr>
<tr>
<td>pillow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wood fiber - pillow</td>
<td>1</td>
<td>throw</td>
<td>pitchfork</td>
<td>R, P, DGC, RT</td>
</tr>
<tr>
<td>foamed glass - pillow</td>
<td>2</td>
<td>shovel</td>
<td>shovel</td>
<td>R, W, P, DGC</td>
</tr>
<tr>
<td>sorbent clay - particulate</td>
<td>2</td>
<td>shovel</td>
<td>shovel</td>
<td>R, I, P</td>
</tr>
<tr>
<td>wood fibre - particulate</td>
<td>3</td>
<td>shovel</td>
<td>shovel</td>
<td>R, W, P, DGC</td>
</tr>
<tr>
<td>LAND SPILL - MEDIUM</td>
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<td></td>
</tr>
<tr>
<td>cross-linked polymer -</td>
<td>1</td>
<td>blower</td>
<td>skiploader</td>
<td>R, W, SS</td>
</tr>
<tr>
<td>particulate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cross-linked polymer -</td>
<td>2</td>
<td>throw</td>
<td>skiploader</td>
<td>R, DGC, RT</td>
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<tr>
<td>pillow</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sorbent clay - particulate</td>
<td>3</td>
<td>blower</td>
<td>skiploader</td>
<td>R, I, P</td>
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<tr>
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<tr>
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<td>4</td>
<td>blower</td>
<td>skiploader</td>
<td>R, W, P, DGC</td>
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<tr>
<td>expanded moneral -</td>
<td>4</td>
<td>blower</td>
<td>skiploader</td>
<td>R, I, W, P, DGC</td>
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<tr>
<td>particulate</td>
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<td></td>
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</tbody>
</table>

Legend
- DGC: Not effective where ground cover is dense
- R: Not reusable
- I: Not incinerable
- P: Effectiveness reduced when rainy
- RT: Not effective where terrain is rugged
- SS: Not for use within environmentally sensitive sites
- W: Effectiveness reduced when windy

Moderate hazard.
- Clear area of personnel and move upwind.
- 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.
- No smoking, naked lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labelled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labelled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

**Section 7 - HANDLING AND STORAGE**

**PROCEDURE FOR HANDLING**
- DO NOT allow clothing wet with material to stay in contact with skin.
- 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.
- Avoid smoking, naked lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Use good occupational work practice.
- Observe manufacturer’s storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

**RECOMMENDED STORAGE METHODS**
- Glass container is suitable for laboratory quantities.
- Metal can or drum.
- Packaging as recommended by manufacturer.
- Check all containers are clearly labelled and free from leaks.

**STORAGE REQUIREMENTS**
- Store in original containers.
- Keep containers securely sealed.
- No smoking, naked lights or ignition sources.
- 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.

**Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION**

**EXPOSURE CONTROLS**
The following materials had no OELs on our records:
- eugenol: CAS:97-53-0

**PERSONAL PROTECTION**
RESPIRATOR

EYE
- Safety glasses with side shields.
- Chemical goggles.
- Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59], [AS/NZS 1336 or national equivalent]

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

NOTE:
- The material may produce skin sensitisation 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.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:
- 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, AS/NZS 2161.1 or national equivalent).
- 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, AS/NZS 2161.10.1 or national equivalent) 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, AS/NZS 2161.10.1 or national equivalent) 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.
- Neoprene gloves
- Polyethylene gloves

OTHER
- Overalls.
- P.V.C. apron.
- Barrier cream.
- Skin cleansing cream.
- Eye wash unit.

ENGINEERING CONTROLS
- Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

The basic types of engineering controls are:
- Process controls which involve changing the way a job activity or process is done to reduce the risk.
- Enclosure and/or isolation of emission source which keeps a selected hazard "physically" away from the worker and ventilation that strategically "adds" and "removes" air in the work environment. Ventilation can remove or dilute an air contaminant if designed properly.
- The design of a ventilation system must match the particular process and chemical or contaminant in use.

Employers may need to use multiple types of controls to prevent employee overexposure.
- Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.
- An approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area. Air contaminants generated in the workplace possess varying "escape" velocities which, in turn, determine the "capture velocities" of fresh circulating air required to effectively remove the contaminant.
Type of Contaminant: Air Speed:
solvent, vapours, degreasing etc., evaporating from tank 0.25-0.5 m/s (50-100 f/min.)
(in still air).
aerosols, fumes from pouring operations, intermittent 0.5-1 m/s (100-200 f/min.)
container filling, low speed conveyer transfers, welding,
spray drift, plating acid fumes, pickling (released at low velocity into zone of active generation)
direct spray, spray painting in shallow booths, drum 1-2.5 m/s (200-500 f/min.)
filling, conveyer loading, crusher dusts, gas discharge
(active generation into zone of rapid air motion)
grinding, abrasive blasting, tumbling, high speed wheel 2.5-10 m/s (500-2000 f/min.)
generated dusts (released at high initial velocity into
zone of very high rapid air motion).

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 favourable 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 1-2 m/s (200-400 f/min) for extraction of solvents generated in a tank 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

<table>
<thead>
<tr>
<th>State</th>
<th>Liquid</th>
<th>Molecular Weight</th>
<th>164.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melting Range (°F)</td>
<td>-12 - -10</td>
<td>Viscosity</td>
<td>Not Available</td>
</tr>
<tr>
<td>Boiling Range (°F)</td>
<td>489</td>
<td>Solubility in water (g/L)</td>
<td>Immiscible</td>
</tr>
<tr>
<td>Flash Point (°F)</td>
<td>230</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>Not available</td>
</tr>
<tr>
<td>Upper Explosive Limit (%)</td>
<td>Not available</td>
<td>Specific Gravity (water=1)</td>
<td>1.067</td>
</tr>
<tr>
<td>Lower Explosive Limit (%)</td>
<td>Not available</td>
<td>Relative Vapour Density (air=1)</td>
<td>&gt;1</td>
</tr>
<tr>
<td>Volatile Component (%vol)</td>
<td>Not available</td>
<td>Evaporation Rate</td>
<td>Not available</td>
</tr>
</tbody>
</table>

APPEARANCE

Liquid with odour of clove and spicy pungent taste; does not mix with water. Mixes with alcohol, chloroform, ether, fixed oils and glacial acetic acid. Soluble in aqueous sodium hydroxide.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

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

- Avoid reaction with oxidising agents

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

---

**Section 11 - TOXICOLOGICAL INFORMATION**

*eugenol*

**TOXICITY AND IRRITATION**

**EUGENOL:**

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

<table>
<thead>
<tr>
<th>TOXICITY</th>
<th>IRRITATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral (rat) LD50: 1930 mg/kg</td>
<td>Skin (human) 40 mg/24h - Mild</td>
</tr>
<tr>
<td>Skin (man): 16 mg/48h - Moderate</td>
<td>Skin (rabbit): 100 mg/24h-SEVERE</td>
</tr>
</tbody>
</table>

- Contact allergies quickly manifest themselves as contact eczema, more rarely as urticaria or Quincke’s oedema. 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 sensitisation potential: the distribution of the substance and the opportunities for contact with it are equally important. A weakly sensitising substance which is widely distributed can be a more important allergen than one with stronger sensitising 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 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.

Allergic reactions involving the respiratory tract are usually due to interactions between IgE antibodies and allergens and occur rapidly. Allergic potential of the allergen and period of exposure often determine the severity of symptoms. Some people may be genetically more prone than others, and exposure to other irritants may aggravate symptoms. Allergy causing activity is due to interactions with proteins.

Attention should be paid to atopic diathesis, characterised by increased susceptibility to nasal inflammation, asthma and eczema. Exogenous allergic alveolitis is induced essentially by allergen specific immune-complexes of the IgG type; cell-mediated reactions (T lymphocytes) may be involved. Such allergy is of the delayed type with onset up to four hours following exposure.

The material may cause severe skin irritation after prolonged or repeated exposure and may produce on contact skin redness, swelling, the production of vesicles, scaling and thickening of the skin. Repeated exposures may produce severe ulceration.

For eugenol:

The acute toxicity of eugenol is low. High doses may cause damage to the stomach lining, bleeding, inflammation of the stomach, liver discoloration and congestion in animals. Eugenol is readily absorbed through the skin; products containing eugenol or clove oil may irritate the skin and eyes. Inhalation may be a substantial route of exposure. Eugenol relaxes the blood vessels, causing low blood pressure and a slow heart rate.

Animal testing shows that repeated exposure at high doses may cause damage to stomach lining and the liver, and that eugenol can cause genetic damage. It is believed that it does not cause cancer, and may even reduce the cancer-causing effect of certain other substances.

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.
- Equivocal tumorigen by RTECS criteria

**CARCINOGEN**

<table>
<thead>
<tr>
<th>Substance</th>
<th>International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs</th>
<th>Group</th>
</tr>
</thead>
</table>

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**Section 12 - ECOLOGICAL INFORMATION**

No data

Ecotoxicity
### Section 13 - DISPOSAL CONSIDERATIONS

**Disposal Instructions**

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

- Containers may still present a chemical hazard/ danger when empty.
- Return to supplier for reuse/ recycling if possible.

Otherwise:

- If container can not 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 authorised landfill.
- Where possible retain label warnings and MSDS and observe all notices pertaining to the product.

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. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. 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 or process equipment to enter drains.
- It may be necessary to collect all wash water for treatment before disposal.
- In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
- Where in doubt contact the responsible authority.
- Recycle wherever possible or consult manufacturer for recycling options.
- Consult State Land Waste Authority for disposal.
- Bury or incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorised landfill.

### Section 14 - TRANSPORTATION INFORMATION

**NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: DOT, IATA, IMDG**
Section 15 - REGULATORY INFORMATION

eugenol (CAS: 97-53-0) is found on the following regulatory lists;

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE
■ Inhalation and/or skin contact may produce health damage*.
■ Cumulative effects may result following exposure*.
* (limited evidence).

Denmark Advisory list for selfclassification of dangerous substances
<table>
<thead>
<tr>
<th>Substance</th>
<th>CAS</th>
<th>Suggested codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>eugenol</td>
<td>97-53-0</td>
<td>Xn; R22 R43 Xi; R36</td>
</tr>
</tbody>
</table>

■ 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 (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.

■ For detailed advice on Personal Protective Equipment, refer to the following U.S. Regulations and Standards:
OSHA Standards - 29 CFR:
1910.132 - Personal Protective Equipment - General requirements
1910.132 - Eye and face protection
1910.133 - Respiratory Protection
1910.136 - Occupational foot protection
1910.138 - Hand Protection
Eye and face protection - ANSI Z87.1
Foot protection - ANSI Z41
Respirators must be NIOSH approved.

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