# Dodecylbenzene, mixture of isomers

## sc-300500

**Material Safety Data Sheet**

| Hazard Alert Code Key: | EXTREME | HIGH | MODERATE | LOW |
|---|---|---|---|---|

## Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

### PRODUCT NAME
Dodecylbenzene, mixture of isomers

### STATEMENT OF HAZARDOUS NATURE
**CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.**

### 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
C18-H30, C6H5(CH2)11CH3, "dodecane, 1-phenyl-", dodecylbenzene, dodecylbenzol, "benzene, dodecyl-", tetrapropylenebenzene, laurylbenzene, n-laurylbenzene, n-dodecylbenzene, "dodecylbenzene (hard type) (mixture of branched chain isomers)", "benzene, tetrapropylene", tetrapropylenebenzol, "1, 2, 3, 5-tetrapropylbenzene (sic)"

## Section 2 - HAZARDS IDENTIFICATION

### CHEMWATCH HAZARD RATINGS

| | | Min | Max |
|---|---|---|---|
| Flammability: | 1 | | |
| Toxicity: | 2 | | |
| Body Contact: | 2 | | |
| Reactivity: | 1 | | |
| Chronic: | 0 | | |

Min/Nil=0
Low=1
Moderate=2
High=3
Extreme=4

### CANADIAN WHMIS SYMBOLS

## EMERGENCY OVERVIEW

### RISK

HARMFUL - May cause lung damage if swallowed.
Irritating to eyes and skin.
Vapours may cause drowsiness and dizziness.
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

## POTENTIAL HEALTH EFFECTS

## ACUTE HEALTH EFFECTS

### SWALLOWED

■ Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733).
■ Accidental ingestion of the material may be damaging to the health of the individual.

### EYE

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

### SKIN

■ This material can cause inflammation of the skin oncontact in some persons.
■ The material may accentuate any pre-existing dermatitis condition.
■ Skin contact is not thought to have harmful health effects, however the material may still produce health damage following entry through wounds, lesions or abrasions.
■ Repeated exposure may cause skin cracking, flaking or drying following normal handling and use.
■ 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 vapours may cause drowsiness and dizziness.
This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.
■ Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.
■ There is some evidence to suggest that the material can cause respiratory irritation in some persons.
The body's response to such irritation can cause further lung damage.
■ The acute toxicity of inhaled alkylbenzenes is best described by central nervous system depression.
As a rule, these compounds may also act as general anaesthetics.
■ Inhalation hazard is increased at higher temperatures.
■ Inhalation of high concentrations of gas/vapor causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination.
■ Central nervous system (CNS) depression may include general discomfort, symptoms of giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness.
Serious poisonings may result in respiratory depression and may be fatal.

## CHRONIC HEALTH EFFECTS

■ Long-term exposure to the product is not thought to produce chronic effects adverse to the health (as classified using animal models); nevertheless exposure by all routes should be minimized as a matter of course.
When 1-phenyldodecane was applied the skin of mice for 78 weeks it induced non-malignant tumours. It also enhanced DMBA-initiated (9,10-dimethyl-1,2-benzanthracene) carcinogenicity.

# Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

| NAME | CAS RN | % |
|---|---|---|
| 1-phenyldodecane | 123-01-3 | >98 |

# Section 4 - FIRST AID MEASURES

### SWALLOWED

· If swallowed do NOT induce vomiting. · If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. · Avoid giving milk or oils. · Avoid giving alcohol. · If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomitus.

### 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.

### SKIN
■ If skin contact occurs: · Immediately remove all contaminated clothing, including footwear · Flush skin and hair with running water (and soap if available).

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

### NOTES TO PHYSICIAN
■ Any material aspirated during vomiting may produce lung injury. Therefore emesis should not be induced mechanically or pharmacologically.
For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:
· Primary threat to life, from pure petroleum distillate ingestion and/or inhalation, is respiratory failure.
· Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO2 50 mm Hg) should be intubated.
90% of an oral dose was metabolised to alcohols and carboxylic acids which were excreted in the urine.

## Section 5 - FIRE FIGHTING MEASURES

| | |
|---|---|
| Vapour Pressure (mmHG): | Not available |
| Upper Explosive Limit (%): | Not available. |
| Specific Gravity (water=1): | 0.856 |
| Lower Explosive Limit (%): | Not available |

### EXTINGUISHING MEDIA
· Foam.
· Dry chemical powder.

### FIRE FIGHTING
· Alert Emergency Responders and tell them location and nature of hazard.
· Wear full body protective clothing with breathing apparatus.
When any large container (including road and rail tankers) is involved in a fire,
consider evacuation by 100 metres in all directions.

### GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS
· Combustible.
· Slight fire hazard when exposed to heat or flame.
Combustion products include: carbon dioxide ($CO_2$), other pyrolysis products typical of burning organic material.

### 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:
Type A-P Filter of sufficient capacity

## Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
■ Environmental hazard - contain spillage.
· Clean up all spills immediately.
· Avoid breathing vapors and contact with skin and eyes.
MAJOR SPILLS
■ Environmental hazard - contain spillage.
Moderate hazard.
· Clear area of personnel and move upwind.
· Alert Emergency Responders and tell them location and nature of hazard.

## Section 7 - HANDLING AND STORAGE

### PROCEDURE FOR HANDLING
· Containers, even those that have been emptied, may contain explosive vapours.

· Do NOT cut, drill, grind, weld or perform similar operations on or near containers.
· DO NOT allow clothing wet with material to stay in contact with skin.
· Electrostatic discharge may be generated during pumping - this may result in fire.
· Ensure electrical continuity by bonding and grounding (earthing) all equipment.
· Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<=1 m/sec until fill pipe submerged to twice its diameter, then <= 7 m/sec).
· Avoid splash filling.
· Do NOT use compressed air for filling discharging or handling operations.
· Avoid all personal contact, including inhalation.
· Wear protective clothing when risk of exposure occurs.

### RECOMMENDED STORAGE METHODS
· Metal can or drum
· Packing as recommended by manufacturer.

### STORAGE REQUIREMENTS
· Store in original containers.
· Keep containers securely sealed.

## Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

### EXPOSURE CONTROLS
The following materials had no OELs on our records
• 1-phenyldodecane: CAS:123-01-3 CAS:25265-78-5

### PERSONAL PROTECTION



### RESPIRATOR
• type a-p filter of sufficient capacity.

### EYE
· Safety glasses with side shields.
· Chemical goggles.

### HANDS/FEET
■ Wear chemical protective gloves, eg. PVC.
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.
· Neoprene gloves.

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

### ENGINEERING CONTROLS
■ Local exhaust ventilation usually required. If risk of overexposure exists, wear an approved respirator.

## Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

## PHYSICAL PROPERTIES

Liquid.
Does not mix with water.
Floats on water.

| | | | |
|---|---|---|---|
| State | Liquid | Molecular Weight | 246.44 |
| Melting Range (°F) | 37 | Viscosity | Not Available |
| Boiling Range (°F) | 554- 770 | Solubility in water (g/L) | Immiscible |
| Flash Point (°F) | 285 | pH (1% solution) | Not applicable |
| Decomposition Temp (°F) | Not available. | pH (as supplied) | Not applicable |
| Autoignition Temp (°F) | Not available | Vapour Pressure (mmHG) | Not available |
| Upper Explosive Limit (%) | Not available. | Specific Gravity (water=1) | 0.856 |
| Lower Explosive Limit (%) | Not available | Relative Vapor Density (air=1) | 8.47 |
| Volatile Component (%vol) | Not available | Evaporation Rate | Not available |

## APPEARANCE

Colourless liquid; does not mix with water.

# Section 10 - CHEMICAL STABILITY

## CONDITIONS CONTRIBUTING TO INSTABILITY

· Presence of incompatible materials.
· Product is considered stable.

## STORAGE INCOMPATIBILITY

■ For alkyl aromatics:
The alkyl side chain of aromatic rings can undergo oxidation by several mechanisms. The most common and dominant one is the attack by oxidation at benzylic carbon as the intermediate formed is stabilised by resonance structure of the ring.
· Following reaction with oxygen and under the influence of sunlight, a hydroperoxide at the alpha-position to the aromatic ring, is the primary oxidation product formed (provided a hydrogen atom is initially available at this position) - this product is often short-lived but may be stable dependent on the nature of the aromatic substitution; a secondary C-H bond is more easily attacked than a primary C-H bond whilst a tertiary C-H bond is even more susceptible to attack by oxygen
· Monoalkylbenzenes may subsequently form monocarboxylic acids; alkyl naphthalenes mainly produce the corresponding naphthalene carboxylic acids.
· Oxidation in the presence of transition metal salts not only accelerates but also selectively decomposes the hydroperoxides.
· Hock-rearrangement by the influence of strong acids converts the hydroperoxides to hemiacetals. Peresters formed from the hydroperoxides undergo Criegee rearrangement easily.
· Alkali metals accelerate the oxidation while CO2 as co-oxidant enhances the selectivity.
· Microwave conditions give improved yields of the oxidation products.
· Photo-oxidation products may occur following reaction with hydroxyl radicals and NOx - these may be components of photochemical smogs.
Oxidation of Alkylaromatics: T.S.S Rao and Shubhra Awasthi: E-Journal of Chemistry Vol 4, No. 1, pp 1-13 January 2007.
· Vigorous reactions, sometimes amounting to explosions, can result from the contact between aromatic rings and strong oxidizing agents.
· Aromatics can react exothermically with bases and with diazo compounds.

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

# Section 11 - TOXICOLOGICAL INFORMATION

1-phenyldodecane

## TOXICITY AND IRRITATION

## 1-PHENYLDODECANE:

■ unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
■ No significant acute toxicological data identified in literature search.
for linear alkybenzenes (LABs)
Linear alkylbenzenes are not acutely toxic. Data from repeat exposure, reproductive and genotoxicity studies also indicate a low potential for toxic effects. The levels of both consumer and occupational exposure are expected to be very low based on their physical and chemical properties, use and handling patterns Linear alkyl benzenes do not present any significant acute or subchronic health effects by various exposure routes. LAB is not teratogenic and does not produce selective reproductive toxicity. Several short-term assays have found LAB to be non-mutagenic and non-clastogenic. Thus, LAB is unlikely to be a tumour initiator. The human health significance of a reported tumor promoting effect for a LAB is unclear, particularly, in face of the uncertainties introduced by the design of

the study.
Toxicokinetics and Metabolism: The distribution, metabolism and excretion of 1 mg/kg body weight of 2-(14C)-phenyldodecane (PD) was studied in male and female rats after intravenous (IV), oral and dermal administration
Dermally administered PD was absorbed slowly and eliminated principally via urine. Only tissues having a high lipid content displayed some accumulation of the compound and/or its metabolites. Metabolism of PD was extensive with little or no unchanged test material present in the urine.
LAB is practically non-toxic after a single dose by the oral (LD50 >5 g/kg) and dermal (LD50, typically >2 g/kg) routes.
LC50 value in rats after a four-hour inhalation exposure to Alkylate 215 (<1% C9, 16% C10, 43% C11, 40% C12, 1% C13, <1% C14) was greater than 1.82 mg/L
Linear alkylbenzenes are slightly irritating to the rabbit eye and slightly to moderately irritating to rabbit skin after single applications.
A human repeat insult patch test found that undiluted Alkylate 215 was a primary and cumulative irritant in 149 of 205 individuals tested.
Sensitization tests have been conducted on guinea pigs . None of the test animals exhibited sensitization reactions.
A human repeat insult patch test found that Alkylate 215 was not a sensitiser in any of the 205 individuals tested.
Repeated Dose Toxicity: . Rodents exposed to vapor concentrations of Alkylate 215 (340 and 830 mg/m3), Alkylate 225 (105 and 293 mg/m3) or Alkylate 230 (32, 97, and 308 mg/m3; 1% C10, 2% C11, 16% C12, 50% C13, 30% C14, 1% C15) for 28 days, exhibited eye and nose irritation, decreased body weight gains and organ weight changes. No adverse microscopic effects were seen in the test animals. No-effect levels in these studies ranged from 0.03-0.1 mg/L. Rats exposed to Alkylate 215 showed similar signs of irritation and body weight changes in a 90-day inhalation study which resulted in a no-effect level of 0.l0 mg/L
Exposure of rats to dietary levels of 2500-7500 ppm Alkylate 215 (equivalent to dose levels of about 200 to 2500 mg/kg) for 28 days resulted in reductions in body weight gain and food consumption.
Genotoxicity: Linear alkylbenzenes did not exhibit mutagenic activity in the Ames bacterial assay or in the CHO/HGPRT mammalian cell forward gene mutation assay. LAB exhibited no clastogenic activity in a rat bone marrow cytogenetics assay.
Carcinogenicity: One investigator has reported that a linear alkylbenzene (described as a C12-C20 monosubstituted LAB composed primarily of C9 and C10 substituted components) promoted the production of lymphomas in a
chronic skin painting study of dimethylbenzanthracene pre-treated mice. The basis of this conclusion is unclear, particularly since the investigator combined different histological types of lymphoma. Furthermore, the use of high dermal concentrations of LAB, which would cause severe chronic injury to the skin such as ulceration and chronic dermatitis, also complicates the interpretation of this study. Prolonged epidermal hyperplasia has been shown to promote skin tumors in mice . The use of excessive concentrations of skin irritants in chronic dermal bioassays is questionable.
Reproduction / Developmental Toxicity: Depressed weight gains in parental animals and decreases in litter size, pup viability, pup survival, and pup weight gains were observed in a two-generation reproduction study in which rats were exposed orally to Alkylate 215 at dose levels of 0, 5, 50 and 500 mg/kg/day . The NOEL for reproductive effects in offspring was 5 mg/kg, and the NOEL for parental toxicity was 50 mg/kg.
No abnormalities were found in rats in two developmental studies conducted on Alkylate 215 and Alkylate 230. The only effect observed was a depression of maternal weight gain which was statistically significant at the mid and high dose levels, and not at the low dose level of 125 mg/kg. The NOEL for developmental toxicity was 125 mg/kg.

## Section 12 - ECOLOGICAL INFORMATION

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
This material and its container must be disposed of as hazardous waste.
Avoid release to the environment.
Refer to special instructions/ safety data sheets.

**Ecotoxicity**

| Ingredient | Persistence: Water/Soil | Persistence: Air | Bioaccumulation | Mobility |
|---|---|---|---|---|
| 1-phenyldodecane | HIGH | No Data Available | HIGH | LOW |

**GESAMP/EHS COMPOSITE LIST - GESAMP Hazard Profiles**

Name / EHS TRN A1a A1b A1 A2 B1 B2 C1 C2 C3 D1 D2 D3 E1 E2 E3 Cas No / RTECS No _____ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ Dodecyl 126 304 0 NI 0 NR 0 3 0 0 (2) (2) (1) F 2 benzene / CAS:123- 01- 3 /

Legend: EHS=EHS Number (EHS=GESAMP Working Group on the Evaluation of the Hazards of Harmful Substances Carried by Ships) NRT=Net Register Tonnage, A1a=Bioaccumulation log Pow, A1b=Bioaccumulation BCF, A1=Bioaccumulation, A2=Biodegradation, B1=Acuteaquatic toxicity LC/ECIC50 (mg/l), B2=Chronic aquatic toxicity NOEC (mg/l), C1=Acute mammalian oral toxicity LD50 (mg/kg), C2=Acutemammalian dermal toxicity LD50 (mg/kg), C3=Acute mammalian inhalation toxicity LC50 (mg/kg), D1=Skin irritation & corrosion, D2=Eye irritation& corrosion, D3=Long-term health effects, E1=Tainting, E2=Physical effects on wildlife & benthic habitats, E3=Interference with coastal amenities, For column A2: R=Readily biodegradable, NR=Not readily biodegradable. For column D3: C=Carcinogen, M=Mutagenic, R=Reprotoxic, S=Sensitising, A=Aspiration hazard, T=Target organ systemic toxicity, L=Lunginjury, N=Neurotoxic, I=Immunotoxic. For column E1: NT=Not tainting (tested), T=Tainting test positive. For column E2: Fp=Persistent floater, F=Floater, S=Sinking substances. The numerical scales start from 0 (no hazard), while higher numbers reflect increasing hazard. (GESAMP/EHS Composite List of Hazard Profiles - Hazard evaluation of substances transported by ships)

## Section 13 - DISPOSAL CONSIDERATIONS

### Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.
¦ 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 equipment to enter drains. Collect all wash water for treatment before disposal.
· Recycle wherever possible or consult manufacturer for recycling options.
· Consult Waste Management Authority for disposal.

## Section 14 - TRANSPORTATION INFORMATION


DOT:
Symbols: G Hazard class or Division: 9
Identification Numbers: UN3082 PG: III
Label Codes: 9 Special provisions: 8, 146,
335, IB3,
T4, TP1,
TP29
Packaging: Exceptions: 155 Packaging: Non- bulk: 203
Packaging: Exceptions: 155 Quantity limitations: No limit
Passenger aircraft/rail:
Quantity Limitations: Cargo No limit Vessel stowage: Location: A
aircraft only:
Vessel stowage: Other: None
Hazardous materials descriptions and proper shipping names:
Environmentally hazardous substance, liquid, n.o.s

### Air Transport IATA:

ICAO/IATA Class: 9 ICAO/IATA Subrisk: None
UN/ID Number: 3082 Packing Group: III
Special provisions: A97
Cargo Only
Packing Instructions: 450 L Maximum Qty/Pack: 964
Passenger and Cargo Passenger and Cargo
Packing Instructions: 450 L Maximum Qty/Pack: 964
Passenger and Cargo Limited Quantity Passenger and Cargo Limited Quantity
Packing Instructions: 30 kg G Maximum Qty/Pack: Y964
Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID,
N.O.S. *(CONTAINS 1-PHENYLDODECANE)

### Maritime Transport IMDG:

IMDG Class: 9 IMDG Subrisk: None
UN Number: 3082 Packing Group: III
EMS Number: F-A , S-F Special provisions: 179 274 335 909
Limited Quantities: 5 L Marine Pollutant: Yes
Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.(contains 1-phenyldodecane)

## Section 15 - REGULATORY INFORMATION

### 1-phenyldodecane (CAS: 123-01-3,25265-78-5) is found on the following regulatory lists;

"GESAMP/EHS Composite List - GESAMP Hazard Profiles","IMO IBC Code Chapter 17: Summary of minimum requirements","IMO MARPOL 73/78 (Annex II) - List of Noxious Liquid Substances Carried in Bulk","OECD Representative List of High Production Volume (HPV) Chemicals","US DOT Coast Guard Bulk Hazardous Materials - List of Flammable and Combustible Bulk Liquid Cargoes","US EPA

High Production Volume Program Chemical List","US EPA Master Testing List - Index I Chemicals Listed","US Toxic Substances Control Act (TSCA) - Inventory"

## Section 16 - OTHER INFORMATION

**ND**
Substance CAS Suggested codes 1- phenyldodecane 123- 01- 3 N; R50 1- phenyldodecane 25265- 78- 5 R43

**Ingredients with multiple CAS Nos**
Ingredient Name CAS 1-phenyldodecane 123-01-3, 25265-78-5

*Reasonable care has been taken in the preparation of this information, but the author makes no warranty of merchantability or any other warranty, expressed or implied, with respect to this information. The author makes no representations and assumes no liability for any direct, incidental or consequential damages resulting from its use. For additional technical information please call our toxicology department on +800 CHEMCALL.*

■ 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.



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