

Cydetin Plus Fluke Pour-On for Cattle

Virbac (Australia) Pty Limited

Chemwatch: 42-5592

Version No: 8.1.16.10

Safety Data Sheet according to WHS Regulations (Hazardous Chemicals) Amendment 2020 and ADG requirements

Chemwatch Hazard Alert Code: 2

Issue Date: 08/20/2021

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L.GHS.AUS.EN

SECTION 1 Identification of the substance / mixture and of the company / undertaking

Product Identifier

Product name	Cydetin Plus Fluke Pour-On for Cattle
Chemical Name	Not Applicable
Synonyms	APVMA No.: 66660
Chemical formula	Not Applicable
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Use according to manufacturer's directions.
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Details of the supplier of the safety data sheet

Registered company name	Virbac (Australia) Pty Limited
Address	361 Horsley Road Milperra NSW 2214 Australia
Telephone	1800 242 100
Fax	+61 2 9772 9773
Website	au.virbac.com
Email	au_customerservice@virbac.com.au

Emergency telephone number

Association / Organisation	Poisons Information Centre
Emergency telephone numbers	13 11 26
Other emergency telephone numbers	Not Available

SECTION 2 Hazards identification

Classification of the substance or mixture

HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.


ChemWatch Hazard Ratings

	Min	Max
Flammability	1	1
Toxicity	1	1
Body Contact	2	2
Reactivity	1	1
Chronic	2	2

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

Poisons Schedule	S5
Classification [1]	Skin Corrosion/Irritation Category 2, Sensitisation (Skin) Category 1, Serious Eye Damage/Eye Irritation Category 2A, Specific Target Organ Toxicity - Single Exposure (Respiratory Tract Irritation) Category 3, Hazardous to the Aquatic Environment Acute Hazard Category 2, Hazardous to the Aquatic Environment Long-Term Hazard Category 2
Legend:	1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI

Label elements

Hazard pictogram(s)	
Signal word	Warning

Hazard statement(s)

H315	Causes skin irritation.
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H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s) Prevention

P271	Use only a well-ventilated area.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P261	Avoid breathing mist/vapours/spray.
P273	Avoid release to the environment.
P264	Wash all exposed external body areas thoroughly after handling.
P272	Contaminated work clothing should not be allowed out of the workplace.

Precautionary statement(s) Response

P302+P352	IF ON SKIN: Wash with plenty of water.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312	Call a POISON CENTER/doctor/physician/first aider/if you feel unwell.
P333+P313	If skin irritation or rash occurs: Get medical advice/attention.
P337+P313	If eye irritation persists: Get medical advice/attention.
P362+P364	Take off contaminated clothing and wash it before reuse.
P391	Collect spillage.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.

Precautionary statement(s) Storage

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

Precautionary statement(s) Disposal

P501	Dispose of contents/container to authorised hazardous or special waste collection point in accordance with any local regulation.
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SECTION 3 Composition / information on ingredients

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
470-82-6	10-30	<u>eucalyptol</u>
68786-66-3	10-30	<u>triclabendazole</u>
Not Available		(200 g/L)
113507-06-5	<1	<u>moxidectin</u>
Not Available		(5 g/L)
Not Available	30-60	Ingredients determined not to be hazardous

Legend: 1. Classified by Chemwatch; 2. Classification drawn from HCIS; 3. Classification drawn from Regulation (EU) No 1272/2008 - Annex VI; 4. Classification drawn from C&L; * EU IOELVs available

SECTION 4 First aid measures

Description of first aid measures

Eye Contact	<p>If this product comes in contact with the eyes:</p> <ul style="list-style-type: none"> Wash out immediately with fresh running water. Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. Seek medical attention without delay; if pain persists or recurs seek medical attention. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	<p>If skin contact occurs:</p> <ul style="list-style-type: none"> Immediately remove all contaminated clothing, including footwear. Flush skin and hair with running water (and soap if available). Seek medical attention in event of irritation.
Inhalation	<ul style="list-style-type: none"> 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.

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Ingestion

- ▶ If swallowed do **NOT** induce vomiting.
- ▶ If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- ▶ Observe the patient carefully.
- ▶ Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.
- ▶ Give water to rinse out mouth, then provide liquid slowly and as much as casualty can comfortably drink.
- ▶ Seek medical advice.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

For abamectin (avermectins):

Toxicity following accidental ingestion may be minimised by emesis-induction within one half hour of exposure. Since abamectin is thought to bind to glutamate-gated chloride ion channels, it is probably wise to avoid drugs that also interact with other ligand-gated chloride channels, including those that enhance GABA activity in patients with potentially toxic abamectin exposure

Avoid drugs that enhance GABA activity (barbiturate, benzodiazepines, valproic acid, etc.).

Following exposures to chlorophenoxy compounds:

- ▶ Acute toxic reactions are rare. The by-product of production, dioxin, may be implicated in subacute features such as hepatic enlargement, chloracne, neuromuscular symptoms and deranged porphyrin metabolism.
- ▶ Large intentional overdoses result in coma, metabolic acidosis, myalgias, muscle weakness, elevated serum creatine kinase, myoglobinuria, irritation of the skin, eyes, respiratory tract and gut and mild renal and hepatic dysfunction.
- ▶ Several cases of sensorimotor peripheral neuropathies have been associated with chronic dermal exposure to 2,4-D. For acute exposures the usual methods of gut and skin contamination (lavage, charcoal, cathartic) are recommended in the first several hours. Alkalisation of the urine and generous fluid replacement have the added benefit of treating any myoglobinuria present. Monitor metabolic acidosis, hyperthermia, hyperkalaemia, myoglobinuria and hepatic/renal dysfunction. for 2,4-dichlorophenoxyacetic acid (2,4-D) and its derivatives
- ▶ Gastric lavage if there are no signs of impending convulsions.
- ▶ Cautious administration of short-acting anticonvulsant drug if convulsions appear imminent.
- ▶ General supportive measures for central nervous system depression.
- ▶ If hypotension appears, search vigorously for a contributing cause (e.g. dehydration, electrolyte balance, acidosis, myocardial disturbances and hyperpyrexia).
- ▶ As appropriate, treat dehydration, electrolyte disturbances, acidosis, and hyperexia.
- ▶ To promote excretion of 2,4-D, initiate alkaline diuresis, as in salicylate poisoning by injecting sodium bicarbonate, intravenously, until the urine pH exceeds 7.5 and then infuse mannitol; renal clearance rises sharply as urine pH rises above 7.5 - above pH 8.0, it is said to be 100-fold greater than pH 6.0.
- ▶ If cardiac disturbances are suspected, monitor ECG continuously when possible. Prepare to deliver defibrillating shocks in the event of ventricular fibrillation.
- ▶ If hypotension intensifies, a trial with a vasopressor drug may be appropriate. Adrenalin (epinephrine) should be avoided because of possible fibrillation.
- ▶ If myotonia appears, a trial with quinidine may be helpful.
- ▶ Physiotherapy may be necessary for motion disorders associated with peripheral neuritis, myopathy or brain stem dysfunction.

GOSSELIN, SMITH HODGE: Clinical Toxicology of Commercial Products, 5th Ed.

In general, chlorophenoxy herbicides are rapidly absorbed from the gastrointestinal tract and evenly distributed throughout the body; accumulation in human tissues is not expected. A steady-state level in the human body will be achieved within 3–5 days of exposure. The herbicides are eliminated mainly in the urine, mostly unchanged, although fenoprop may be conjugated to a significant extent. Biological half-lives of chlorophenoxy herbicides in mammals range from 10 to 33 h; between 75% and 95% of the ingested amount is excreted within 96 h. Dogs appear to retain chlorophenoxy acids longer than other species as a result of relatively poor urinary clearance and thus may be more susceptible to their toxic effects. Metabolic conversions occur only at high doses. The salt and ester forms are rapidly hydrolysed and follow the same pharmacokinetic pathways as the free acids

SECTION 5 Firefighting measures

Extinguishing media

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

Special hazards arising from the substrate or mixture

Fire Incompatibility

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

Advice for firefighters

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.

Fire/Explosion Hazard

- ▶ 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)

hydrogen chloride

phosgene

nitrogen oxides (NO_x)

sulfur oxides (SO_x)

other pyrolysis products typical of burning organic material.

May emit poisonous fumes.

May emit corrosive fumes.

WARNING: Long standing in contact with air and light may result in the formation

of potentially explosive peroxides.

CARE: Water in contact with hot liquid may cause foaming and a steam explosion with wide scattering of hot oil and possible severe burns.

Foaming may cause overflow of containers and may result in possible fire.

HAZCHEM

Not Applicable

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SECTION 6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	<ul style="list-style-type: none">Remove all ignition sources.Clean up all spills immediately.Avoid breathing vapours and contact with skin and eyes.Control personal contact with the substance, 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: ester and ethers				
	For release onto land: recommended sorbents listed in order of priority.				
	SORBENT TYPE	RANK	APPLICATION	COLLECTION	LIMITATIONS
	LAND SPILL - SMALL				
	cross-linked polymer - particulate	1	shovel	shovel	R, W, SS
	cross-linked polymer - pillow	1	throw	pitchfork	R, DGC, RT
	sorbent clay - particulate	2	shovel	shovel	R,I, P
	wood fiber - particulate	3	shovel	shovel	R, W, P, DGC
	wood fiber - pillow	3	throw	pitchfork	R, P, DGC, RT
	treated wood fiber - pillow	3	throw	pitchfork	DGC, RT
	LAND SPILL - MEDIUM				
	cross-linked polymer - particulate	1	blower	skiploader	R,W, SS
	cross-linked polymer - pillow	2	throw	skiploader	R, DGC, RT
	sorbent clay - particulate	3	blower	skiploader	R, I, P
	polypropylene - particulate	3	blower	skiploader	W, SS, DGC
	expanded mineral - particulate	4	blower	skiploader	R, I, W, P, DGC
	wood fiber - particulate	4	blower	skiploader	R, W, P, DGC
	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					
Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;					
R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988					
CARE: Absorbent materials wetted with occluded oil must be moistened with water as they may auto-oxidize, become self heating and ignite.					
Some oils slowly oxidise when spread in a film and oil on cloths, mops, absorbents may autoxidise and generate heat, smoulder, ignite and burn.					
In the workplace oily rags should be collected and immersed in water.					
Moderate hazard.					
<ul style="list-style-type: none">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.					

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

SECTION 7 Handling and storage

Precautions for safe handling

Safe handling	<ul style="list-style-type: none"> DO NOT allow clothing wet with material to stay in contact with skin <p>The substance accumulates peroxides which may become hazardous only if it evaporates or is distilled or otherwise treated to concentrate the peroxides. The substance may concentrate around the container opening for example. Purchases of peroxidisable chemicals should be restricted to ensure that the chemical is used completely before it can become peroxidised.</p> <ul style="list-style-type: none"> A responsible person should maintain an inventory of peroxidisable chemicals or annotate the general chemical inventory to indicate which chemicals are subject to peroxidation. An expiration date should be determined. The chemical should either be treated to remove peroxides or disposed of before this date. The person or laboratory receiving the chemical should record a receipt date on the bottle. The individual opening the container should add
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	<p>an opening date.</p> <ul style="list-style-type: none"> ▶ Unopened containers received from the supplier should be safe to store for 18 months. ▶ Opened containers should not be stored for more than 12 months. ▶ 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 storage and handling recommendations contained within this SDS. ▶ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Other information	<p>Consider storage under inert gas.</p> <ul style="list-style-type: none"> ▶ 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 storage and handling recommendations contained within this SDS.

Conditions for safe storage, including any incompatibilities

Suitable container	<ul style="list-style-type: none"> ▶ 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 incompatibility	<p>d-Limonene:</p> <ul style="list-style-type: none"> ▶ forms unstable peroxides in storage, unless inhibited; may polymerise ▶ reacts with strong oxidisers and may explode or combust ▶ is incompatible with strong acids, including acidic clays, peroxides, halogens, vinyl chloride and iodine pentafluoride ▶ flow or agitation may generate electrostatic charges due to low conductivity <p>For lactones (also known as cyclic esters):</p> <ul style="list-style-type: none"> · The reactions of lactones are similar to those of esters · Heating a lactone with a base (sodium hydroxide) will hydrolyse the lactone to its parent compound, the straight chained bifunctional compound. Like straight-chained esters, the hydrolysis-condensation reaction of lactones is a reversible reaction, with an equilibrium. However, the equilibrium constant of the hydrolysis reaction of the lactone is lower than that of the straight-chained ester i.e. the products (hydroxyacids) are less favoured in the case of the lactones. · Lactones can be reduced to diols using lithium aluminium hydride in dry ether. · Lactones also react with ethanolic ammonia, gamma-Lactones will react to yield $\text{CH}_2(\text{OH})-(\text{CH}_2)_2-\text{CO}-\text{NH}_2$. · gamma-Lactones (5-membered cyclic esters), delta-lactones (6-membered cyclic esters) and epsilon lactones (7-membered cyclic esters) are the most stable lactone structures because, as in all organic cycles, 5, 6 and 7-membered rings minimise the strain of bond angles · alpha-Lactones (3-membered cyclic esters) and beta-lactones (4-membered cyclic esters) represent a group of strained-ring (unstable) substances · beta-Lactones (such as the oxetanones) exhibit similar reactivities to epoxides due to their inherent ring strain (beta-lactones, 22.8 kcal/mol; epoxides, 27.2 kcal/mol). In general, hard nucleophiles such as alkoxides, alkyllithiums, and Grignard reagents react with beta-lactones to cleave the acyl C-O bond, while alkyl C-O cleavage occurs with soft nucleophiles including organocuprates, azides, halides, and thiolates · Sesquiterpene lactones, (generally 5-membered cyclic esters with an alkene side chain) found in many plants, can react with other molecules via a Michael reaction · Lactones readily form polyesters <p>Naturally occurring lactones are mainly saturated and unsaturated gamma- and delta-lactones, and to a lesser extent macrocyclic lactones. The gamma and delta-lactones are intramolecular esters of the corresponding hydroxy fatty acids.</p> <p>For gamma-butyrolactone (GBL):</p> <p>In an altered process to prepare 2,4-dichlorophenoxybutyric acid, GBL was added to the other components butanol, 2,4-dichlorophenol, sodium hydroxide), and soon after, the reaction temperature reacted 165 C, higher than the usual 160 C. Application of cooling failed to check thermal runaway and the vessel began to fail at 180 deg C with explosion and fire.</p> <ul style="list-style-type: none"> ▶ Esters react with acids to liberate heat along with alcohols and acids. ▶ Strong oxidising acids may cause a vigorous reaction with esters that is sufficiently exothermic to ignite the reaction products. ▶ Heat is also generated by the interaction of esters with caustic solutions. ▶ Flammable hydrogen is generated by mixing esters with alkali metals and hydrides. ▶ Esters may be incompatible with aliphatic amines and nitrates. <p>Due to their structural relationship within the same chemical group, essential oil components are known to easily convert into each other by oxidation, isomerisation, cyclisation, or dehydrogenation reactions, triggered either enzymatically or chemically.</p> <p>Temperature, light, and oxygen availability are recognised to have a crucial impact on essential oil integrity.</p> <p>Susceptibility of essential oils to degradation largely depends on compound spectra as components' molecular structures have a substantial effect on the degree of oxidation.</p> <p>Constituting an array of many lipophilic and highly volatile components derived from a great range of different chemical classes, essential oils are known to be susceptible to conversion and degradation reactions. Oxidative and polymerization processes may result in a loss of quality and pharmacological properties.</p> <p>Upon distillation in primitive stills or during storage in metallic containers, impurities of metals can be released into essential oils. Equal to light and heat, heavy metals, especially copper and ferrous ions, are considered to promote autooxidation, in particular if hydroperoxides are already present. By catalysing hydroperoxide decomposition, Fe^{2+} or Cu^{+} as well as Fe^{3+} or Cu^{2+} give rise to alkoxy and peroxy radicals, respectively, which, in turn, promote radical oxidation reactions.</p> <p>Moisture has been considered as a possible reason for essential oil spoilage.</p> <p>Peroxy radicals as well as hydroperoxides have been reported to be the most numerous compounds upon oxidation of essential oils (as well as edible unsaturated fixed oils) at lower temperatures. Compounds formed through termination reactions such as polymers were only built up at later oxidation stages and at the end of the induction period, when either the amount of oxygen or oxidisable substrate was exhausted. On the other hand, alkyl or hydroxyl radicals and reactions thereof, became more important at elevated temperature as oxygen availability was limited. For the most part, essential oil components can be assigned as lipophilic terpenoids, phenylpropanoids, or short-chain aliphatic hydrocarbon derivatives of low molecular weight, with the first being the most frequent and characteristic constituents.</p> <p>A multitude of different, but often structurally closely related, components have been identified in essential oils. Each oil in turn can be composed</p>

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of only a few up to a complex mixture of far more than 100 single substances, respectively. Flavour contribution of single compounds though does not strictly depend on their respective concentration but relies on the specific odor threshold that is determined by structure and volatility. Consequently, even minor components deriving from oxidation or degradation reactions may have a strong impact on the flavour if their aroma value is high enough.

The chemical composition of essential oils is moreover dependent on the conditions during processing and storage of the plant material, upon distillation as well as in the course of subsequent handling of the oil itself. Upon stability evaluation of essential oils, it needs to be kept in mind that the chemical composition may already vary in the starting material, being influenced by plant health, growth stage, habitat including climate, edaphic factors (those pertaining to soil), as well as harvest time.

- The various oxides of nitrogen and peroxyacids may be dangerously reactive in the presence of alkenes. BREThERICK L.: Handbook of Reactive Chemical Hazards
- Avoid reaction with strong Lewis or mineral acids.
- Reaction with halogens requires carefully controlled conditions.
- Free radical initiators should be avoided.

HAZARD:

- Although anti-oxidants may be present, in the original formulation, these may deplete over time as they come into contact with air.
- Rags wet / soaked with unsaturated hydrocarbons / drying oils may auto-oxidise; generate heat and, in-time, smoulder and ignite. This is especially the case where oil-soaked materials are folded, bunched, compressed, or piled together - this allows the heat to accumulate or even accelerate the reaction
- Oily cleaning rags should be collected regularly and immersed in water, or spread to dry in safe-place away from direct sunlight or stored, immersed, in solvents in suitably closed containers.
- Avoid oxidising agents, acids, acid chlorides, acid anhydrides, chloroformates.
- The unhindered oxygen atom found on cyclic ethers such as the epoxides, oxetanes, furans, dioxanes and pyrans, carries two unshared pairs of electrons - a structure which favors the formation of coordination complexes and the solvation of cations.
- Cyclic ethers are used as important solvents, as chemical intermediate and as monomers for ring-opening polymerization.
- They are unstable at room temperature due to possibility of peroxide formation; stabiliser is sometimes needed for storage and transportation.

NOTE: Ethers lacking non-methyl hydrogen atoms adjacent to the ether link are thought to be relatively safe

Terpenoids and terpenes, are generally unsaturated, are thermolabile, are often volatile and may be easily oxidised or hydrolysed depending on their respective structure.

Terpenoids are subject to autoxidation. Autoxidation is any oxidation that occurs in open air or in presence of oxygen (and sometimes UV radiation) and forms peroxides and hydroperoxides.

Though autoxidation has been particularly investigated in the field of fatty oils, it also plays a most crucial part for terpenoid deterioration.

Although virtually all types of organic materials can undergo air oxidation, certain types are particularly prone to autoxidation, including unsaturated compounds that have allylic or benzylic hydrogen atoms (C6H5CH2-); these materials are converted to hydroperoxides by autoxidation. Promoted by heat, catalytic quantities of redox-reactive metals, and exposure to light, autoxidation may result in the formation of explosive peroxides which may become explosive upon concentration.

As a rule, however, primary autoxidation products such as hydroperoxides eventually break down during advanced stages of oxidation depending on their individual stability. Thereby they give rise to a range of stable oxidised secondary products such as mono- to polyvalent alcohols, aldehydes, ketones, epoxides, peroxides, or acids as well as highly viscous, often oxygen-bearing polymers. Light, heat, or increasing acidity often promote this breakdown.

Compounds rich in allylic hydrogen atoms (2HC=CHCH2-R), found in most terpenoids, make up the most probable targets for autoxidation.

Several terpenoids (typically oxygen containing derivatives) are saturated and do not react in a similar fashion to their unsaturated congeners.

Thermolabile terpenoids, especially mere terpenes and aldehydes, are susceptible to rearrangement processes at elevated temperatures.

Terpene conversion reactions, upon heating, have been reported both for isolated compounds as well as for essential oils, (which tend to be rich in mono-, and sesqui-terpenes).

Mono-, bi-, or tricyclic mono- terpenoids (those containing two isoprene units, dienes) and sesquiterpenoids (with three isoprene units, trienes) of different chemical classes, such as hydrocarbons, ketones, alcohols, oxides, aldehydes, phenols, or esters, make up the major part in essential oils.

Electron-donating groups and increasing alkyl substitution contribute to a stronger carbon-peroxide bond through a hyperconjugative effect, thus leading to more stable and subsequently built-up hydroperoxides.

Some oxygen-bearing terpenoids such as menthol, eucalyptol (1,8-cineol), and menthone do not form hydroperoxides upon oxidation but are directly converted into ketones, acids, and aldehydes. None of these are unsaturated compounds.

Due to their low volatility, diterpenes (with four isoprenes, tetraenes) are barely encountered in genuine essential oils obtained by distillation, while tri- and higher terpenoids such as sterols or carotenoids are only present in the nonvolatile fractions such as plant resins or gums and will remain in the residue

Aging processes generally come along with a more or less pronounced quality loss. In addition to the frequent development of unpleasant and often pungent flavours, shifting colors such as the formation of a yellow staining or changes in consistency up to resinification have been reported both upon degradation of single terpenoids as well as of essential oils.

- The interaction of alkenes and alkynes with nitrogen oxides and oxygen may produce explosive addition products; these may form at very low temperatures and explode on heating to higher temperatures (the addition products from 1,3-butadiene and cyclopentadiene form rapidly at -150 C and ignite or explode on warming to -35 to -15 C). These derivatives ("pseudo- nitrosites") were formerly used to characterise terpene hydrocarbons.

- Exposure to air must be kept to a minimum so as to limit the build-up of peroxides which will concentrate in bottoms if the product is distilled. The product must not be distilled to dryness if the peroxide concentration is substantially above 10 ppm (as active oxygen) since explosive decomposition may occur. Distillate must be immediately inhibited to prevent peroxide formation. The effectiveness of the antioxidant is limited once the peroxide levels exceed 10 ppm as active oxygen. Addition of more inhibitor at this point is generally ineffective. Prior to distillation it is recommended that the product should be washed with aqueous ferrous ammonium sulfate to destroy peroxides; the washed product should be immediately re-inhibited.

- A range of exothermic decomposition energies for double bonds is given as 40-90 kJ/mol. The relationship between energy of decomposition and processing hazards has been the subject of discussion; it is suggested that values of energy released per unit of mass, rather than on a molar basis (J/g) be used in the assessment. For example, in "open vessel processes" (with man-hole size openings, in an industrial setting), substances with exothermic decomposition energies below 500 J/g are unlikely to present a danger, whilst those in "closed vessel processes" (opening is a safety valve or bursting disk) present some danger where the decomposition energy exceeds 150 J/g.

BREThERICK: Handbook of Reactive Chemical Hazards, 4th Edition

- The reaction of ozone with alkenes is believed to proceed via the formation of a vibrationally excited Primary Ozonide (POZ) which falls apart to give a vibrationally excited Criegee Intermediate (CI) The CI can decompose to give OH radicals, or be stabilised. This may be of relevance in atmospheric chemistry.

- Violent explosions at low temperatures in ammonia synthesis gas units have been traced to the addition products of dienes and nitrogen dioxide

SECTION 8 Exposure controls / personal protection**Control parameters**

Occupational Exposure Limits (OEL)

INGREDIENT DATA

Continued...

Cydectin Plus Fluke Pour-On for Cattle

Not Available

Emergency Limits

Ingredient	TEEL-1	TEEL-2	TEEL-3
Cydectin Plus Fluke Pour-On for Cattle	Not Available	Not Available	Not Available

Ingredient	Original IDLH	Revised IDLH
eucalyptol	Not Available	Not Available
triclabendazole	Not Available	Not Available
moxidectin	Not Available	Not Available

Occupational Exposure Banding

Ingredient	Occupational Exposure Band Rating	Occupational Exposure Band Limit
eucalyptol	E	≤ 0.1 ppm
triclabendazole	C	> 0.1 to ≤ milligrams per cubic meter of air (mg/m³)
moxidectin	E	≤ 0.01 mg/m³

Notes: Occupational exposure banding is a process of assigning chemicals into specific categories or bands based on a chemical's potency and the adverse health outcomes associated with exposure. The output of this process is an occupational exposure band (OEB), which corresponds to a range of exposure concentrations that are expected to protect worker health.

MATERIAL DATA

Fragrance substance lacking human data, with respect to contact allergenicity in humans and used in high volumes according to industry information. Scientific Committee on Consumer Safety SCCS OPINION on Fragrance allergens in cosmetic products 2012

For abamectin (avermectins)

CEL TWA: 0.04 mg/m3 [Manufacturer]

(CEL = Chemwatch Exposure Limit)

The acceptable daily intake (ADI) of 0.4 mg/day was derived using an NOAEL of 0.25 mg/kg/day from oral toxicity studies in dogs, adjusting for body weight (50 kg) and by applying a composite uncertainty factor of 30 to account for interindividual variability, interspecies extrapolation and the severity of the critical endpoint (neurotoxicity). The recommended exposure standard and a wipe test criteria of 0.4 mg/100 cm2 were derived using the ADI.

for d-Limonene:

CEL TWA: 30 ppm, 165.6 mg/m3 (compare WEEL-TWA*)

(CEL = Chemwatch Exposure Limit)

A Workplace Environmental Exposure Level* has been established by AIHA (American Industrial Hygiene Association) who have produced the following rationale:

d-Limonene is not acutely toxic. In its pure form it is not a sensitiser but is irritating to the skin. Although there is clear evidence of carcinogenicity in male rats, the effect has been attributed to an alpha-2u-globin (a2u-G) renal toxicity which is both species and gender specific. Humans do not synthesise a2u-G, and metabolism studies indicate that 75% to 95% of d-limonene is excreted in 2-3 days with different metabolites identified between humans and rats. In a 2-year study, liver effects were noted in male mice at 500 mg/kg and reduced survival was noted in female rats at 600 mg/kg. The no observable effect levels (NOELs) were 250 and 300 mg/kg, respectively. A WEEL of 30 ppm is recommended to protect against these effects.

2,6-di-tert-butyl-4-methylphenol (syn: butylated hydroxytoluene - BHT)

Because high dose levels are required to produce toxic effects and because there is little evidence of either acute or chronic effects amongst workers the recommended TLV-TWA is identical to that proposed for nuisance particulates.

Exposure controls

Appropriate engineering controls	Care: Atmospheres in bulk storages and even apparently empty tanks may be hazardous by oxygen depletion. Atmosphere must be checked before entry.	
	Requirements of State Authorities concerning conditions for tank entry must be met. Particularly with regard to training of crews for tank entry; work permits; sampling of atmosphere; provision of rescue harness and protective gear as needed	
	Enclosed local exhaust ventilation is required at points of dust, fume or vapour generation.	
	HEPA terminated local exhaust ventilation should be considered at point of generation of dust, fumes or vapours.	
	Barrier protection or laminar flow cabinets should be considered for laboratory scale handling.	
Appropriate engineering controls	A fume hood or vented balance enclosure is recommended for weighing/ transferring quantities exceeding 500 mg.	
	When handling quantities up to 500 gram in either a standard laboratory with general dilution ventilation (e.g. 6-12 air changes per hour) is preferred. Quantities up to 1 kilogram may require a designated laboratory using fume hood, biological safety cabinet, or approved vented enclosures. Quantities exceeding 1 kilogram should be handled in a designated laboratory or containment laboratory using appropriate barrier/ containment technology.	
	Manufacturing and pilot plant operations require barrier/ containment and direct coupling technologies.	
	Barrier/ containment technology and direct coupling (totally enclosed processes that create a barrier between the equipment and the room) typically use double or split butterfly valves and hybrid unidirectional airflow/ local exhaust ventilation solutions (e.g. powder containment booths). Glove bags, isolator glove box systems are optional. HEPA filtration of exhaust from dry product handling areas is required.	
	Fume-hoods and other open-face containment devices are acceptable when face velocities of at least 1 m/s (200 feet/minute) are achieved. Partitions, barriers, and other partial containment technologies are required to prevent migration of the material to uncontrolled areas. For non-routine emergencies maximum local and general exhaust are necessary. 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, etc. evaporating from tank (in still air)		0.25-0.5 m/s (50-100 f/min.)
aerosols, fumes from pouring operations, intermittent container filling, low speed conveyer transfers (released at low velocity into zone of active generation)		0.5-1 m/s (100-200 f/min.)

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	<p>direct spray, drum filling, conveyer loading, crusher dusts, gas discharge (active generation into zone of rapid air motion)</p> <p>1-2.5 m/s (200-500 f/min.)</p> <p>Within each range the appropriate value depends on:</p> <table> <tr> <th>Lower end of the range</th><th>Upper end of the range</th></tr> <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> </table> <p>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 1-2.5 m/s (200-500 f/min.) for extraction of gases discharged 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.</p> <p>The need for respiratory protection should also be assessed where incidental or accidental exposure is anticipated: Dependent on levels of contamination, PAPR, full face air purifying devices with P2 or P3 filters or air supplied respirators should be evaluated.</p> <p>The following protective devices are recommended where exposures exceed the recommended exposure control guidelines by factors of:</p> <p>10; high efficiency particulate (HEPA) filters or cartridges</p> <p>10-25; loose-fitting (Tyvek or helmet type) HEPA powered-air purifying respirator.</p> <p>25-50; a full face-piece negative pressure respirator with HEPA filters</p> <p>50-100; tight-fitting, full face-piece HEPA PAPR</p> <p>100-1000; a hood-shroud HEPA PAPR or full face-piece supplied air respirator operated in pressure demand or other positive pressure mode.</p>	Lower end of the range	Upper end of the range	1: Room air currents minimal or favourable to capture	1: Disturbing room air currents	2: Contaminants of low toxicity or of nuisance value only.	2: Contaminants of high toxicity	3: Intermittent, low production.	3: High production, heavy use	4: Large hood or large air mass in motion	4: Small hood-local control only
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4: Large hood or large air mass in motion	4: Small hood-local control only										
Personal protection											
Eye and face protection	<p>When handling very small quantities of the material eye protection may not be required. For laboratory, larger scale or bulk handling or where regular exposure in an occupational setting occurs:</p> <ul style="list-style-type: none"> Chemical goggles. Face shield. Full face shield may be required for supplementary but never for primary protection of eyes. Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lenses or restrictions on use, should be created for each workplace or task. 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] 										
Skin protection	See Hand protection below										
Hands/feet protection	<p>NOTE:</p> <ul style="list-style-type: none"> 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. <p>The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.</p> <p>The exact break through time for substances has to be obtained from the manufacturer of the protective gloves and has to be observed when making a final choice.</p> <p>Personal hygiene is a key element of effective hand care. 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.</p> <p>Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include:</p> <ul style="list-style-type: none"> frequency and duration of contact, chemical resistance of glove material, glove thickness and dexterity <p>Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739, AS/NZS 2161.1 or national equivalent).</p> <ul style="list-style-type: none"> 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. Some glove polymer types are less affected by movement and this should be taken into account when considering gloves for long-term use. Contaminated gloves should be replaced. <p>As defined in ASTM F-739-96 in any application, gloves are rated as:</p> <ul style="list-style-type: none"> Excellent when breakthrough time > 480 min Good when breakthrough time > 20 min Fair when breakthrough time < 20 min Poor when glove material degrades <p>For general applications, gloves with a thickness typically greater than 0.35 mm, are recommended.</p> <p>It should be emphasised that glove thickness is not necessarily a good predictor of glove resistance to a specific chemical, as the permeation efficiency of the glove will be dependent on the exact composition of the glove material. Therefore, glove selection should also be based on consideration of the task requirements and knowledge of breakthrough times.</p> <p>Glove thickness may also vary depending on the glove manufacturer, the glove type and the glove model. Therefore, the manufacturers' technical data should always be taken into account to ensure selection of the most appropriate glove for the task.</p>										

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	<p>Note: Depending on the activity being conducted, gloves of varying thickness may be required for specific tasks. For example:</p> <ul style="list-style-type: none"> Thinner gloves (down to 0.1 mm or less) may be required where a high degree of manual dexterity is needed. However, these gloves are only likely to give short duration protection and would normally be just for single use applications, then disposed of. Thicker gloves (up to 3 mm or more) may be required where there is a mechanical (as well as a chemical) risk i.e. where there is abrasion or puncture potential <p>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.</p> <ul style="list-style-type: none"> Rubber gloves (nitrile or low-protein, powder-free latex, latex/ nitrile). Employees allergic to latex gloves should use nitrile gloves in preference. Double gloving should be considered. PVC gloves. Change gloves frequently and when contaminated, punctured or torn. Wash hands immediately after removing gloves. Protective shoe covers. [AS/NZS 2210] Head covering.
Body protection	See Other protection below
Other protection	<ul style="list-style-type: none"> For quantities up to 500 grams a laboratory coat may be suitable. For quantities up to 1 kilogram a disposable laboratory coat or coverall of low permeability is recommended. Coveralls should be buttoned at collar and cuffs. For quantities over 1 kilogram and manufacturing operations, wear disposable coverall of low permeability and disposable shoe covers. For manufacturing operations, air-supplied full body suits may be required for the provision of advanced respiratory protection. Eye wash unit. Ensure there is ready access to an emergency shower. For Emergencies: Vinyl suit

Respiratory protection

Type A-P Filter of sufficient capacity. (AS/NZS 1716 & 1715, EN 143:2000 & 149:2001, ANSI Z88 or national equivalent)

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Required minimum protection factor	Maximum gas/vapour concentration present in air p.p.m. (by volume)	Half-face Respirator	Full-Face Respirator
up to 10	1000	A-AUS / Class1 P2	-
up to 50	1000	-	A-AUS / Class 1 P2
up to 50	5000	Airline *	-
up to 100	5000	-	A-2 P2
up to 100	10000	-	A-3 P2
100+			Airline**

* - Continuous Flow ** - Continuous-flow or positive pressure demand

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

- Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content.
- The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.
- Cartridge performance is affected by humidity. Cartridges should be changed after 2 hr of continuous use unless it is determined that the humidity is less than 75%, in which case, cartridges can be used for 4 hr. Used cartridges should be discarded daily, regardless of the length of time used

SECTION 9 Physical and chemical properties**Information on basic physical and chemical properties**

Appearance	Liquid.		
Physical state	Liquid	Relative density (Water = 1)	1.051-1.093
Odour	Not Available	Partition coefficient n-octanol / water	Not Available
Odour threshold	Not Available	Auto-ignition temperature (°C)	Not Available
pH (as supplied)	Not Applicable	Decomposition temperature	Not Available
Melting point / freezing point (°C)	Not Available	Viscosity (cSt)	Not Available
Initial boiling point and boiling range (°C)	Not Available	Molecular weight (g/mol)	Not Applicable
Flash point (°C)	Not Available	Taste	Not Available
Evaporation rate	Not Available	Explosive properties	Not Available
Flammability	Not Available	Oxidising properties	Not Available
Upper Explosive Limit (%)	Not Available	Surface Tension (dyn/cm or mN/m)	Not Available
Lower Explosive Limit (%)	Not Available	Volatile Component (%vol)	Not Available
Vapour pressure (kPa)	Not Available	Gas group	Not Available
Solubility in water	Not Available	pH as a solution (%)	Not Available
Vapour density (Air = 1)	Not Available	VOC g/L	Not Available

Continued...

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SECTION 10 Stability and reactivity

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

SECTION 11 Toxicological information

Information on toxicological effects

Inhaled	<p>Evidence shows, or practical experience predicts, that the material produces irritation of the respiratory system, in a substantial number of individuals, following inhalation. In contrast to most organs, the lung is able to respond to a chemical insult by first removing or neutralising the irritant and then repairing the damage. The repair process, which initially evolved to protect mammalian lungs from foreign matter and antigens, may however, produce further lung damage resulting in the impairment of gas exchange, the primary function of the lungs. Respiratory tract irritation often results in an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system.</p> <p>Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by narcosis, reduced alertness, loss of reflexes, lack of coordination and vertigo.</p> <p>Inhalation of chlorophenoxy pesticide dusts or mist may produce a sore throat and burning sensations in the nasopharynx region and chest, coughing, lachrymation, rhinitis, dizziness and ataxia. Toxic effects may result following absorption from the lungs.</p>
Ingestion	<p>Accidental ingestion of the material may be damaging to the health of the individual.</p> <p>Benzimidazole carbamate anthelmintics, when administered in therapeutic doses, have produced allergic reaction (which may be associated with destruction of parasites), raised liver enzyme values, and may be associated with leukopenia and alopecia. Extremely large oral doses may produce intestinal cramps, anorexia, lethargy, pulmonary haemorrhage, oedema, hepatic and epicardial haemorrhage, and nausea, vomiting and diarrhoea. Other symptoms include dizziness, giddiness, tinnitus, insomnia, anxiety, confusion, convulsions, hallucinations and headache.</p> <p>Overdose may produce gastrointestinal symptoms, visual disturbance and psychic alterations. Absorption is generally limited.</p> <p><i>Animal studies suggest that this family of drugs may also be teratogenic</i></p> <p>Severe over-exposure to gamma-butyrolactone (GBL) may lead to coma and possible death due to respiratory failure. Ingestion may also cause kidney damage and peripheral neuropathy, a progressive disorder of the nervous system, characterised by sensory and motor abnormalities, muscle spasms, weakness and pain in the arms and legs, numbness and tingling of the fingers and toes and paralysis.</p> <p>In Scandanavia, some cases of poisoning in children have been reported after ingestion of small amounts (less than 8ml) of gamma-butyrolactone</p> <p>Butyrolactone is rapidly metabolised to gamma-hydroxybutyric acid and the toxicological profile of the lactone substantially resembles that of the acid (which occurs naturally in animals and humans). Although the function of the acid is unknown in peripheral tissues, in the brain and neuronal tissues it is thought to act as a neuromodulator. gamma-Hydroxybutyric acid readily crosses the blood-brain barrier, the oral, intraperitoneal, or intravenous administration elicits characteristic neuropharmacological responses. The acid is synthesised and released in specific neuronal pathways and its actions are mediated by a set of specific, high affinity receptors which are heterogeneously distributed within the cerebral cortex and hippocampus. The acid and its salts have been described as "date-rape drugs" because of hypnotic effects produced, in a social context, when these substances have been surreptitiously introduced to unsuspecting individuals.</p> <p>Administration of exogenous gamma-hydroxybutyrolactone induces a state described as behavioural arrest characterised by specific dose-dependent changes in the encephalogram. Administration of low doses to rats produces no changes in the encephalogram. Higher doses induce behavioural arrest, facial myoclonus, vibrissal twitching and loss of righting reflex. Behavioural changes are accompanied by encephalogram patterns resembling those produced during seizures in humans with non-convulsive or absent (petitmal) epilepsy.</p> <p>For exposure to the sodium salt of gamma-hydroxybutyrate:</p> <p>Swallowing may result in intoxication and drowsiness with lowering of inhibitions and increased libido.</p> <p>Side effects of exposure include abnormal muscular activity during the induction phase and nausea and vomiting. Bradycardia frequently occurs. Emergence delirium has been reported. Respiration may be slowed and hypokalaemia has also been recorded</p> <p>Consumption of less than 1 gram of the material acts as a relaxant, causing a loss of muscle tone and reduced inhibitions. Consumption of 1 to 2 grams causes a strong feeling of relaxation and slows the heart rate and respiration. At this dosage level, the material also interferes with blood circulation, motor coordination, and balance. In stronger doses, 2 to 4 grams, pronounced interference with motor and speech control occurs. A coma-like sleep may be induced, requiring intubation to wake the user. When mixed with alcohol, the depressant effects of the material are enhanced. This can lead to respiratory depression, unconsciousness, coma, and overdose.</p> <p>Side effects associated with the sodium salt of GBL may include nausea, vomiting, delusions, depression, vertigo, hallucinations, seizures, respiratory distress, loss of consciousness, slowed heart rate, lowered blood pressure, amnesia, and coma. It can become addictive with sustained use.</p> <p>Patients with a history of around-the-clock use of this material (every 2 to 4 hours) exhibit withdrawal symptoms including anxiety, insomnia, tremors, and episodes of tachycardia (abnormally fast heart rates), and may progress to delirium and agitation. Because it has a short duration of action and quickly leaves the user's system, withdrawal symptoms may occur within 1 to 6 hours of the last dose. These symptoms may last for many months.</p> <p>Terpenes and their oxygen-containing counterparts, the terpenoids, produce a variety of physiological effects. Pine oil monoterpenes, for example, produce a haemorrhagic gastritis characterised by stomach pain and bleeding and vomiting. Systemic effects of pine oils include weakness and central nervous depression, excitement, loss of balance, headache, with hypothermia and respiratory failure.</p> <p>Chlorophenoxy compounds may cause irritation of the mouth, throat, and gastrointestinal tract, nausea, vomiting, chest and abdominal pain, and diarrhea. Ingestion of very large doses may produce metabolic acidosis, fever or subnormal temperature, hyperventilation, hypotension, vasodilation, flushing, sweating, cardiac arrhythmias, tachycardia, lethargy, weakness, intercostal paralysis, renal and hepatic disorders, myotonia, coma, and convulsions. Skeletal muscle damage may produce muscle twitching, aching and elevated serum enzymes and myoglobin in both blood and urine. Circulatory collapse may be fatal.</p> <p>Acute exposure to 2,4-dichlorophenoxyacetic acid (2,4-D) and its derivatives and analogues may produce headache, dizziness, nausea, vomiting, raised temperature, low blood pressure, leucocytotoxic heart and liver injury and convulsions.</p> <p>All animal species tested seem to react similarly and there is only a minor difference in potency between various salts and esters of 2,4-D either as pure chemicals or as commercial preparations although the free acid exhibits a somewhat higher toxicity. In several species systemic intoxication after massive doses produces ventricular fibrillation or, if death is delayed, motor disturbances. A disinclination to move progresses to rigidity of skeletal muscles (myotonia) and ataxia (involuntary muscle movement). Severe cases show progressive apathy, depression, muscle weakness of the hind limbs, periodic clonic spasms and coma. Subacute poisonings are characterised by anorexia, eye and nose irritation, and possible epistaxis or bleeding from the mouth. Clinical reports of poisonings are rare although protracted peripheral neuropathies with myopathy appear to be characteristic. Significant cumulative toxicity does not occur with 2,4-D and most of its congeners are not metabolised and do not</p>

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	<p>accumulate in body fat or in the food chain. Urinary excretion is slow with a plasma half-life of about 33 hours.</p> <p>Central nervous system (CNS) depression may include nonspecific 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.</p> <p>Repeated exposures to, or a single acute overexposure to eucalyptol (cineole)-containing oils, may produce nausea, vomiting and diarrhoea. Ingestion may produce epigastric burning, vertigo, ataxia, muscle weakness, stupor, pallor, occasional cyanosis, respiratory stridor (oedema), miosis and delirium. Symptoms may be delayed for up to 2 hours.</p> <p>In rats, a lethal dose caused rapid cyanosis and stupor accompanied by irregular breathing, extreme sensitivity to noise, convulsions, and death from respiratory failure</p> <p>Eucalyptol is absorbed rapidly from the gastrointestinal tract. Transient coma followed ingestion of 1 ml. of eucalyptus oil (which contains 70% eucalyptol) and fatalities have resulted from the consumption of 3.5 ml. Recovery has occurred after a dose of 30 ml.</p> <p>Seizures are common and rapid in onset, similar to camphor. Symptoms might include headache, ataxia, delirium, obtundation, coma, convulsions, hypotension, hyperpnoea and gastrointestinal distress.</p>
Skin Contact	<p>Evidence exists, or practical experience predicts, that the material either produces inflammation of the skin in a substantial number of individuals following direct contact, and/or produces significant inflammation when applied to the healthy intact skin of animals, for up to four hours, such inflammation being present twenty-four hours or more after the end of the exposure period. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis. At the microscopic level there may be intercellular oedema of the spongy layer of the skin (spongiosis) and intracellular oedema of the epidermis.</p> <p>The material may accentuate any pre-existing dermatitis condition</p> <p>Skin contact is not thought to have harmful health effects (as classified under EC Directives); the material may still produce health damage following entry through wounds, lesions or abrasions.</p> <p>Open cuts, abraded or irritated skin should not be exposed to this material</p> <p>2,4-D and its derivatives all penetrate intact skin of laboratory rats and man. Subacute application of 2,4-D esters and of the dimethylamine salt to rabbit skin produced only local irritation due probably to the carrier vehicle (oil). Percutaneous absorption has produced severe peripheral neuropathy in elderly patients exposed to spilled 2,4-D ester, fatigue, nausea, vomiting, anorexia, diarrhoea, swelling and aching of the extremities and muscle fasciculations progressing over a period of days to pain, paraesthesias, and severe limb paralysis. Disability was protracted and continued for several years.</p> <p>Entry into the blood-stream through, for example, cuts, abrasions, puncture wounds 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.</p> <p>Many essential oils affect the skin and mucous membranes in ways that are valuable or harmful. When applied to intact skin essential oils have an irritant and rubefacient action (i.e cause redness of the skin by causing dilation of the capillaries and an increase in blood circulation), causing first a sensation of warmth and smarting followed by mild local anesthesia. They have been used as counter-irritants and cutaneous stimulants in the treatment of chronic inflammatory conditions and to relieve neuralgia and rheumatic pain. Care should be taken to avoid blistering. These oils may also produce sensitisation.</p>
Eye	<p>Evidence exists, or practical experience predicts, that the material may cause eye irritation in a substantial number of individuals and/or may produce significant ocular lesions which are present twenty-four hours or more after instillation into the eye(s) of experimental animals.</p> <p>Repeated or prolonged eye contact may cause inflammation characterised by temporary redness (similar to windburn) of the conjunctiva (conjunctivitis); temporary impairment of vision and/or other transient eye damage/ulceration may occur.</p> <p>Corneal injury resulting from 2,4-D exposure may be slow to heal.</p>
Chronic	<p>Long-term exposure to respiratory irritants may result in disease of the airways involving difficult breathing and related systemic problems. Practical experience shows that skin contact with the material is capable either of inducing a sensitisation reaction in a substantial number of individuals, and/or of producing a positive response in experimental animals.</p> <p>Substances that can cause occupational asthma (also known as asthmagens and respiratory sensitisers) can induce a state of specific airway hyper-responsiveness via an immunological, irritant or other mechanism. Once the airways have become hyper-responsive, further exposure to the substance, sometimes even to tiny quantities, may cause respiratory symptoms. These symptoms can range in severity from a runny nose to asthma. Not all workers who are exposed to a sensitiser will become hyper-responsive and it is impossible to identify in advance who are likely to become hyper-responsive.</p> <p>Substances than can cuase occupational asthma should be distinguished from substances which may trigger the symptoms of asthma in people with pre-existing air-way hyper-responsiveness. The latter substances are not classified as asthmagens or respiratory sensitisers</p> <p>Wherever it is reasonably practicable, exposure to substances that can cuase occupational asthma should be prevented. Where this is not possible the primary aim is to apply adequate standards of control to prevent workers from becoming hyper-responsive.</p> <p>Activities giving rise to short-term peak concentrations should receive particular attention when risk management is being considered. Health surveillance is appropriate for all employees exposed or liable to be exposed to a substance which may cause occupational asthma and there should be appropriate consultation with an occupational health professional over the degree of risk and level of surveillance.</p> <p>Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.</p> <p>A number of benzimidazoles have been shown to also inhibit mammalian tubulin polymerisation and to be aneugenic <i>in vivo</i>. Aneugens affect cell division and the mitotic spindle apparatus resulting in loss or gain of whole chromosomes, thereby inducing an "aneuploidy". Mitotic aneuploidy is a characteristic of many types of tumorigenesis (in cancer). Several benzimidazoles have been shown to be genotoxic. Genotoxicity may arise as aneugens may also be clastogens, or may produce clastogenic metabolites. Clastogens increase the rate of genetic mutation by interfering with the function of nucleic acids. A clastogen is a specific mutagen that causes breaks in chromosomes.</p> <p>Cyclic ethers, including tetrahydrofuran, furan and 1,4-dioxane, produce neoplasms and carcinomas in experimental animals, typically of the liver; other target organs include the adrenal gland, nasal cavity and gall-bladder. 1,4-Dioxane was a promoter in a two-stage skin carcinogenic study in mice. Results of studies with cyclic ethers indicate that carcinogenicity is often species and sex dependent. Furan has been used to induce apoptosis (programmed cell death). Oxetanes are under investigation.</p> <p>gamma-Butyrolactone is rapidly converted to gamma-hydroxybutyric acid by enzymes in the blood and liver of animals and humans. An equivocal response produced by the lactone, in carcinogenicity studies in rats, has been reported in terms of its ability to increase the incidence of pheochromocytomas in the renal medulla. Because of the rapid and extensive conversion of gamma-butyrolactone to the acid, the evaluation of the lactone was in fact an evaluation of gamma-hydroxybutyric acid.</p> <p>In the presence of air, a number of common flavour and fragrance chemicals can form peroxides surprisingly fast. Antioxidants can in most cases minimise the oxidation.</p> <p>Fragrance terpenes are generally easily oxidised in air. Non-oxidised limonene, linalool and caryophyllene turned out to be very weak sensitizers, however after oxidation limonene hydroperoxide and linalool hydroperoxide are strong sensitizers. Of the patients tested 2.6% showed positive reaction to oxidised limonene, 1.3% to oxidised linalool, 1.1% to linalool hydroperoxide, 0.5% to oxidised caryophyllene, while testing with caryophyllene oxide and oxidised myrcene resulted in few positive patch tests. 2/3 of the patients reacting positive to oxidised terpenes had fragrance related contact allergy and/or positive history for adverse reactions to fragrances.</p> <p>As well as the hydroperoxides produced by linalol, limonene and delta-3-carene other oxidation and resinification effects progressively causes other fairly major changes in essential oil quality over time. Autoxidation of fragrance terpenes contributes greatly to fragrance allergy, which emphasizes the need of testing with compounds that patients are actually exposed to and not only with the ingredients originally applied in commercial formulations.</p> <p>Workers exposed to chlorophenoxy herbicides show a significant increase in soft-tissue sarcoma, malignant lymphomas and bronchial carcinomas. Prolonged or repeated contact with solutions may result in non-allergic dermatoses.</p>

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Until recently, most epidemiological studies of the effects of chlorophenoxy herbicides dealt with populations exposed in the 1950s and 1960s, when the trichlorophenol-based herbicides 2,4,5-T and fenoprop were contaminated with polychlorinated dioxins and furans, including 2,3,7,8-tetrachlorodibenzodioxin (TCDD); the effects observed may therefore have been a consequence of the presence of the dioxin contaminants. In addition, most epidemiological studies on chlorophenoxy herbicides conducted to date have involved multiple exposures to chemical agents, including other pesticides and synthetic organic compounds. In a series of case–referent studies conducted in Sweden in the late 1970s and early 1980s, strong associations were noted between soft tissue sarcomas (STS) and multiple lymphomas (including Hodgkin disease (HD) and non-Hodgkin lymphoma (NHL)) and the use of chlorophenoxy herbicides by agricultural or forestry workers. The association between STS and chlorophenoxy herbicide use observed in the Swedish studies has not been confirmed in other case–referent studies. Although a number of cohort studies of occupationally exposed workers have been conducted, the small size of many of them limits their usefulness in assessing the relationship between STS and the herbicides. The risk for malignant lymphoma (HD + NHL) was almost five times greater for agricultural and forestry workers exposed to a mixture of chlorophenoxy herbicides than for controls in the case–referent study in Sweden but was not significantly elevated in a Danish cohort study of 3390 workers in a chemical plant manufacturing MCPA, dichlorprop, mecoprop, and 2,4-D, as well as other industrial chemicals and dyes.

Chronic exposure to 2,4-dichlorophenoxyacetic acid(2,4-D), its salts and its esters and its analogues may result in nausea, liver function changes, contact toxic dermatitis, irritation of the airways and eyes, as well as neurological changes. Persons with chronic diseases of the central nervous system, liver, heart, kidneys, lungs and skin, as well as those with endocrinological or immunological disturbances should not be exposed to herbicides (ILO Encyclopaedia). Groups of rats receiving 2,4-D in their diets for 13 weeks showed growth retardation and decreased food intake at 150 mg/kg/day dosage and an increased serum glutamic pyruvic transaminase (SGPT). A statistically significant incidence of astrocytoma was seen in the brains of male rats receiving 45 mg/kg/day for 104 weeks suggesting a possible carcinogenic effect although the prevalence of naturally occurring tumours in controls makes this result equivocal. A controversial study implicating 2,4-D as the cause of non-Hodgkin's lymphoma among male Kansas residents, aged 21 years or older, was difficult to evaluate because of a number of confounding factors. Agent Orange, a mixture of 2,4-D and 2,4,5-T, with contamination from 2,3,7,8-tetrachlorodibenzo-p-dioxin (also referred to as "dioxin" or TCDD) has been studied due to exposure of military personnel during its use as a herbicide in Vietnam. Neurological, reproductive and carcinogenic effects, purported to have occurred amongst veterans may be related to 2,4-D and 2,4,5-T but given the toxicity of the other components this remains the subject of conjecture.

Most, if not all, occupational illnesses associated with 2,4,5-trichlorophenoxyacetic acids (2,4,5-T) and its derivatives actually result from TCDD contamination.

Repeated overexposure to phenoxy herbicides may cause liver, kidney, gastrointestinal and muscular effects.

Subchronic exposure by dogs to phenoxy herbicides produced a reduction in circulating lymphocytes. Teratogenic response was exhibited in mice (but not rats). Cleft palate was demonstrated. No such findings occurred in non-human primates given up to 10 mg/kg/day (containing 0.05 ppm TCDD) from gestation day 22 to 38.

The no-observed effect level (NOAEL) in hamsters was 2 mg/kg 2,4,5-T

On the basis, primarily, of animal experiments, concern has been expressed that the material may produce carcinogenic or mutagenic effects; in respect of the available information, however, there presently exists inadequate data for making a satisfactory assessment.

Hydroperoxides of d-limonene are potent contact allergens when studied in guinea pigs. They may result when d-limonene is unstabilised against oxidation, or upon prolonged standing at room temperature and/ or upon exposure to light, or when stabiliser levels diminish. The two major hydroperoxides in auto-oxidised d-limonene, are cis- and trans- limonene-2-hydroperoxide (2-hydroperoxy-p-mentha-6,8-diene). In photo-oxidised d-limonene, they represent a minor fraction. Hydroperoxides may bind to proteins of the skin to make antigens either via a radical mechanism or after reactions to give epoxides. The cross-reactivity between the epoxide limonene-1,2-oxide, a potent contact allergen, and the hydroperoxides is NOT significant, indicating different mechanisms of sensitisation.

d-Limonene was considered to be weakly carcinogenic for the mouse fore-stomach epithelium, but not tumour producing. In 13-week and 2-year gavage-studies, male rats showed a range of compound-related kidney lesions including exacerbation of age-related nephropathy, mineralisation in the renal medulla, hyperplasia of the transitional epithelium overlying the renal papilla and proliferation of the renal tubular epithelium. Neoplasms were believed to be caused by progression to tubular cell hyperplasia to tubular cell adenomas and, with increasing size, to adenocarcinomas or carcinomas. The similarity of the nephrotoxicity caused by trichloroethylene and N-(4'-fluoro-4-biphenyl)acetamide, tris(2,3-dibromopropyl)phosphate in rats and the species specific nature of the response suggests that degeneration and necrosis of convoluted tubules may be associated with the accumulation of alpha-2u-globin (a2u-G). Since a2u-G is a species and gender-specific protein that is causal for both the cytotoxic and carcinogenic response in male rats, extrapolation of d-limonene carcinogenicity data from rat studies to other species (including humans) is probably not warranted. Humans do not synthesise a2u-G; they do however produce other related low molecular weight proteins capable of binding chemicals that cause a2u-G nephropathy in rats but this does not necessarily connote human risk. The Risk Assessment Forum of the USA EPA concluded;

- ▶ Male renal rat tumours arising as a result of a process involving a2u-G accumulation do not contribute to the qualitative weight-of-evidence that the chemical poses a human carcinogenic hazard. Such tumours are included in dose-response extrapolations for the estimation of human carcinogenic risk.
- ▶ If the chemical induces a2u-G accumulation in male rats, the associated nephropathy is not to be used as an end-point for determining non-carcinogenic hazard.

Peroxidisable terpenes and terpenoids should only be used when the level of peroxides is kept to the lowest practicable level, for instance by adding antioxidants at the time of production. Such products should have a peroxide value of less than 10 millimoles peroxide per liter. This requirement is based on the published literature mentioning sensitising properties when containing peroxides.

Cydectin Plus Fluke Pour-On for Cattle	TOXICITY	IRRITATION
	Not Available	Not Available
eucalyptol	TOXICITY	IRRITATION
	dermal (rat) LD50: >2000 mg/kg ^[1]	Not Available
triclabendazole	Oral(Rat) LD50; 2480 mg/kg ^[2]	
	TOXICITY	IRRITATION
	dermal (rat) LD50: >4000 mg/kg ^[2]	Eye: slight *
	Inhalation(Rat) LC50; >0.5 mg/L4h ^[2]	
moxidectin	Oral(Rabbit) LD50; 206 mg/kg ^[2]	
	TOXICITY	IRRITATION
	Dermal (rabbit) LD50: >2000 mg/kg ^[2]	Eye (rabbit): slight irritant *
Legend:	Oral(Mouse) LD50; 42 mg/kg ^[2]	Skin (rabbit): non-irritant *
	1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2. * Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances	

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Cydectin Plus Fluke Pour-On for Cattle	<p>Epoxidation of double bonds is a common bioactivation pathway for alkenes. The allylic epoxides, so formed, were found to possess sensitising capacity <i>in vivo</i> and <i>in vitro</i> and to chemically reactive towards a common hexapeptide containing the most common nucleophilic amino acids. Further-more, a SAR study of potentially prohaptenic alkenes demonstrated that conjugated dienes in or in conjunction with a six-membered ring are prohaptenes, whereas related alkenes containing isolated double bonds or an acyclic conjugated diene were weak or nonsensitizing compounds. This difference in sensitizing capacity of conjugated dienes as compared to alkenes with isolated double bonds was found to be due to the high reactivity and sensitizing capacity of the allylic epoxides metabolically formed from conjugated dienes.</p> <p>Allergic Contact Dermatitis—Formation, Structural Requirements, and Reactivity of Skin Sensitizers.</p> <p>Ann-Therese Karlberg et al: Chem. Res. Toxicol. 2008, 21, pp 53–69 http://ftp.cdc.gov/pub/Documents/OEL/06.%20Dotson/References/Karlberg_2008.pdf</p> <p>The systemic toxicity of gamma-butyrolactone (GBL) has been investigated in a full 2-year bioassay in rats and mice that employed gavage dosing (NTP, 1992). The most sensitive effect observed in these studies was clinical signs of CNS toxicity (lethargy) with a NOAEL of 112 mg/kg-day in rats. The only other treatment-related effect observed in rats and mice was for decreased body weight. Thymic depletion was observed in high dose male mice. The authors attributed this reduction to stress induced by fighting in high-dose males. The increased incidence of thymic depletion was similar in both the low- and high-dose males. The relevance of the thymus effects remains uncertain.</p> <p>In other studies, no prenatal developmental effects were observed in rats at doses up to 500 mg/kg-day, while decreased testicular weight was reported in a short-term reproductive study with a LOAEL of 667 mg/kg-day.</p> <p>GBL is metabolised in animals to gamma-hydroxybutyrate. (GHB). The oral toxicity data for GHB are primarily from clinical studies in human subjects or from case reports of oral poisonings. Transient dizziness and a sense of dullness in 50% of human subjects following a single oral dose of 12.5 mg/kg were observed. Standardized measure of psychomotor performance was not affected at this dose. Another study reported on the effects of single oral doses of 35-63 mg/kg GHB in human volunteers. All participants reported drowsiness during the experiment, and some participants receiving doses over 50 mg/kg were rendered unconscious. Medical anesthetic doses of GHB are typically in the range of 60 mg/kg. A full 2-year cancer bioassay by the oral route has been conducted for the tetrahydrofuran (THF) - GBL is the major metabolite of THF (NTP, 1992). This study which showed no evidence of carcinogenicity in rats (male and female) or female mice. The authors concluded that there was equivocal evidence of carcinogenic potential, based on increased incidence of adrenal medulla pheochromocytomas and hyperplasia. Mode-of-action studies for THF following exposure by the inhalation route also suggest that THF itself rather than a metabolite might be responsible for the observed liver and kidney responses. Based on these mode-of-action data and the difference in tumor responses for THF and GBL in NTP (1992) bioassays, the cancer bioassay data for THF metabolites cannot be used directly for the assessment of THF carcinogenicity in humans</p>
EUCALYPTOL	<p>For monoterpenes:</p> <p>The chemical category designated terpenoid hydrocarbons includes three simple C10 isomeric monocyclic terpene hydrocarbons (<i>d</i>-limonene, <i>d</i>-limonene, and terpinolene) two simple C10 acyclic terpene hydrocarbons (<i>beta</i>-myrcene and dihydromyrcene) and mixtures composed primarily of <i>d</i>-limonene, <i>d</i>-limonene (dipentene), terpinolene, myrcene, and <i>alpha</i> and <i>beta</i>-pinene</p> <p>Monoterpene hydrocarbons are mainly released by coniferous woodland such as pine trees, cedars, redwood and firs. To a lesser extent, they are also produced and released by deciduous plants. They are common components of traditional foods occurring in essentially all fruits and vegetables.</p> <p>Members of this chemical category are of very low acute toxicity</p> <p>Studies of terpene hydrocarbons indicate that they are rapidly absorbed, distributed, metabolised and excreted. The principal metabolic pathway involves side chain oxidation to yield monocyclic terpene alcohols and carboxylic acids. These metabolites are mainly conjugated with glucuronic acid and excreted in the urine, or to a lesser extent in the feces. A secondary pathway involves epoxidation of either the exocyclic or endocyclic double bond yielding an epoxide that is subsequently detoxicated <i>via</i> formation of the corresponding diol or conjugation with glutathione.</p> <p>Although some species- and sex-specific differences exist, studies for <i>d</i>-limonene and <i>beta</i>-myrcene indicate that the monoterpene hydrocarbons in this chemical category will participate in common pathways of absorption, distribution, metabolism and excretion.</p> <p>Genotoxicity: Based on the results of this <i>in vivo</i> genotoxicity assay and the numerous <i>in vitro</i> genotoxicity assays, it is unlikely that any of these materials would exhibit a significant genotoxic potential <i>in vivo</i>.</p> <p>Carcinogenicity: Under the conditions of 2-year gavage studies, conducted by NTP, there was clear evidence of carcinogenic activity of <i>d</i>-limonene for male F344/N rats as shown by increased incidences in tubular cell hyperplasia, adenomas, and adenocarcinomas of the kidney. There was no evidence of carcinogenic activity of <i>d</i>-limonene for female rats receiving 300 or 600 mg/kg bw/d. It has been demonstrated that renal lesions, which were observed in the NTP study, resulted from the accumulation of aggregates of <i>alpha</i>-2 microglobulin (a low molecular-weight protein synthesised in the liver) and limonene-1,2-epoxide in the P2 segment of the renal proximal tubule. While humans produce low molecular weight serum proteins, which are reabsorbed by the kidney, there is no evidence that a similar <i>alpha</i>-2 microglobulin is produced. The kidney changes seen in male rats administered limonene have been well characterized, and are known to be specific to the male rat and of no significance in human risk assessment.</p> <p>Reproductive toxicity: Substances within this chemical category exhibit low reproductive toxicity potential. This is based on the results of three reproductive toxicity assays. using sweet orange peel oil predominantly composed of <i>d</i>-limonene and <i>beta</i>-myrcene.</p> <p>Developmental toxicity: Given the results of six developmental toxicity assays using limonene, sweet orange oil and <i>beta</i>-myrcene, it may be concluded that the substances within this chemical category exhibit low developmental toxicity potential</p> <p>Adverse reactions to fragrances in perfumes and in fragranced cosmetic products include allergic contact dermatitis, irritant contact dermatitis, photosensitivity, immediate contact reactions (contact urticaria), and pigmented contact dermatitis. Airborne and connubial contact dermatitis occur.</p> <p>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.</p> <p>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.</p> <p>Inhalation intolerance has also been produced in animals. The emissions of five fragrance products, for one hour, produced various combinations of sensory irritation, pulmonary irritation, decreases in expiratory airflow velocity as well as alterations of the functional observational battery indicative of neurotoxicity in mice. Neurotoxicity was found to be more severe after mice were repeatedly exposed to the fragrance products, being four brands of cologne and one brand of toilet water.</p> <p>Contact allergy to fragrances is relatively common, affecting 1 to 3% of the general population, based on limited testing with eight common fragrance allergens and about 16 % of patients patch tested for suspected allergic contact dermatitis.</p> <p>Contact allergy to fragrance ingredients occurs when an individual has been exposed, on the skin, to a sufficient degree of fragrance contact allergens. Contact allergy is a life-long, specifically altered reactivity in the immune system. This means that once contact allergy is developed, cells in the immune system will be present which can recognise and react towards the allergen. As a consequence, symptoms, i.e. allergic contact dermatitis, may occur upon re-exposure to the fragrance allergen(s) in question. Allergic contact dermatitis is an inflammatory skin disease characterised by erythema, swelling and vesicles in the acute phase. If exposure continues it may develop into a chronic condition with scaling and painful fissures of the skin. Allergic contact dermatitis to fragrance ingredients is most often caused by cosmetic products and usually involves the face and/or hands. It may affect fitness for work and the quality of life of the individual. Fragrance contact allergy has long been recognised as a frequent and potentially disabling problem. Prevention is possible as it is an environmental disease and if the environment is modified (e.g. by reduced use concentrations of allergens), the disease frequency and severity will decrease. Fragrance contact allergy is mostly non-occupational and related to the personal use of cosmetic products. Allergic contact dermatitis can be severe and widespread, with a significant impairment of quality of life and potential consequences for fitness for work. Thus, prevention of contact sensitisation to fragrances,</p>

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both in terms of primary prevention (avoiding sensitisation) and secondary prevention (avoiding relapses of allergic contact dermatitis in those already sensitised), is an important objective of public health risk management measure.

Hands: Contact sensitisation may be the primary cause of hand eczema, or may be a complication of irritant or atopic hand eczema. The number of positive patch tests has been reported to correlate with the duration of hand eczema, indicating that long-standing hand eczema may often be complicated by sensitisation. Fragrance allergy may be a relevant problem in patients with hand eczema; perfumes are present in consumer products to which their hands are exposed. A significant relationship between hand eczema and fragrance contact allergy has been found in some studies based on patients investigated for contact allergy. However, hand eczema is a multi-factorial disease and the clinical significance of fragrance contact allergy in (severe) chronic hand eczema may not be clear.

Axillae Bilateral axillary (underarm) dermatitis may be caused by perfume in deodorants and, if the reaction is severe, it may spread down the arms and to other areas of the body. In individuals who consulted a dermatologist, a history of such first-time symptoms was significantly related to the later diagnosis of perfume allergy.

Face Facial eczema is an important manifestation of fragrance allergy from the use of cosmetic products (16). In men, after-shave products can cause an eczematous eruption of the beard area and the adjacent part of the neck and men using wet shaving as opposed to dry have been shown to have an increased risk of being fragrance allergic.

Irritant reactions (including contact urticaria): Irritant effects of some individual fragrance ingredients, e.g. citral are known. Irritant contact dermatitis from perfumes is believed to be common, but there are no existing investigations to substantiate this. Many more people complain about intolerance or rashes to perfumes/perfumed products than are shown to be allergic by testing. This may be due to irritant effects or inadequate diagnostic procedures. Fragrances may cause a dose-related contact urticaria of the non-immunological type (irritant contact urticaria). Cinnamal, cinnamic alcohol, and Myroxylon pereirae are well recognised causes of contact urticaria, but others, including menthol, vanillin and benzaldehyde have also been reported. The reactions to Myroxylon pereirae may be due to cinnamates. A relationship to delayed contact hypersensitivity was suggested, but no significant difference was found between a fragrance-allergic group and a control group in the frequency of immediate reactions to fragrance ingredients in keeping with a nonimmunological basis for the reactions seen.

Pigmentary anomalies: The term "pigmented cosmetic dermatitis" was introduced in 1973 for what had previously been known as melanosis faciei feminae when the mechanism (type IV allergy) and causative allergens were clarified. It refers to increased pigmentation, usually on the face/neck, often following sub-clinical contact dermatitis. Many cosmetic ingredients were patch tested at non-irritant concentrations and statistical evaluation showed that a number of fragrance ingredients were associated: jasmine absolute, ylang-ylang oil, cananga oil, benzyl salicylate, hydroxycitronellal, sandalwood oil, geraniol, geranium oil.

Photo-reactions Musk ambrette produced a considerable number of allergic photocontact reactions (in which UV-light is required) in the 1970s and was later banned from use in the EU. Nowadays, photoallergic contact dermatitis is uncommon. Furocoumarins (psoralens) in some plant-derived fragrance ingredients caused phototoxic reactions with erythema followed by hyperpigmentation resulting in Berloque dermatitis. There are now limits for the amount of furocoumarins in fragrance products. Phototoxic reactions still occur but are rare.

General/respiratory: Fragrances are volatile and therefore, in addition to skin exposure, a perfume also exposes the eyes and naso-respiratory tract. It is estimated that 2-4% of the adult population is affected by respiratory or eye symptoms by such an exposure. It is known that exposure to fragrances may exacerbate pre-existing asthma. Asthma-like symptoms can be provoked by sensory mechanisms. In an epidemiological investigation, a significant association was found between respiratory complaints related to fragrances and contact allergy to fragrance ingredients, in addition to hand eczema, which were independent risk factors in a multivariate analysis.

Fragrance allergens act as haptens, i.e. low molecular weight chemicals that are immunogenic only when attached to a carrier protein. However, not all sensitising fragrance chemicals are directly reactive, but require previous activation. A **prehapten** is a chemical that itself is non- or low-sensitising, but that is transformed into a hapten outside the skin by simple chemical transformation (air oxidation, photoactivation) and without the requirement of specific enzymatic systems.

In the case of prehapten, it is possible to prevent activation outside the body to a certain extent by different measures, e.g. prevention of air exposure during handling and storage of the ingredients and the final product, and by the addition of suitable antioxidants. When antioxidants are used, care should be taken that they will not be activated themselves and thereby form new sensitisers.

Prehapten

Most terpenes with oxidisable allylic positions can be expected to autoxidise on air exposure due to their inherent properties. Depending on the stability of the oxidation products that are formed, a difference in the sensitisation potency of the oxidised terpenes can be seen. Autoxidation is a free radical chain reaction in which hydrogen atom abstraction in combination with addition of oxygen forms peroxy radicals. The reaction shows selectivity for positions where stable radicals can be formed. So far, all fragrance substances that have been investigated with regard to the influence of autoxidation on the allergenic potential, including identification of formed oxidation products, have oxidisable allylic positions that are able to form hydroperoxides and/or hydrogen peroxide as primary oxidation products upon air exposure. Once the hydroperoxides have been formed outside the skin they form specific antigens and act as skin sensitisers. Secondary oxidation products such as aldehydes and epoxides can also be allergenic, thus further increasing the sensitisation potency of the autoxidation mixture. The process of photoactivation may also play a role, but further research is required to establish whether this activation route is currently underestimated in importance due to insufficient knowledge of the true haptens in this context.

It should be noted that activation of substances via air oxidation results in various haptens that might be the same or cross-reacting with other haptens (allergens). The main allergens after air oxidation of linalool and linalyl acetate are the hydroperoxides. If linalyl acetate is chemically hydrolysed outside the skin it can thereafter be oxidised to the same haptens as seen for linalool. A corresponding example is citronellol and citronellyl acetate. In clinical studies, concomitant reactions to oxidised linalool and oxidised linalyl acetate have been observed. Whether these reactions depend on cross-reactivity or are due to exposure to both fragrance substances cannot be elucidated as both have an allergenic effect themselves. Linalool and linalyl acetate are the main components of lavender oil. They autoxidise on air exposure also when present in the essential oil, and form the same oxidation products found in previous studies of the pure synthetic terpenes. Experimental sensitisation studies showed that air exposure of lavender oil increased the sensitisation potency. Patch test results in dermatitis patients showed a connection between positive reactions to oxidised linalool, linalyl acetate and lavender oil.

Prohapten

Compounds that are bioactivated in the skin and thereby form haptens are referred to as prohapten.

In the case of prohapten, the possibility to become activated is inherent to the molecule and activation cannot be avoided by extrinsic measures. Activation processes increase the risk for cross-reactivity between fragrance substances. Crossreactivity has been shown for certain alcohols and their corresponding aldehydes, i.e. between geraniol and geranial (citral) and between cinnamyl alcohol and cinnamal.

The human skin expresses enzyme systems that are able to metabolise xenobiotics, modifying their chemical structure to increase hydrophilicity and allow elimination from the body. Xenobiotic metabolism can be divided into two phases: phase I and phase II. Phase I transformations are known as activation or functionalisation reactions, which normally introduce or unmask hydrophilic functional groups. If the metabolites are sufficiently polar at this point they will be eliminated. However, many phase I products have to undergo subsequent phase II transformations, i.e. conjugation to make them sufficiently water soluble to be eliminated. Although the purpose of xenobiotic metabolism is detoxification, it can also convert relatively harmless compounds into reactive species. Cutaneous enzymes that catalyse phase I transformations include the cytochrome P450 mixed-function oxidase system, alcohol and aldehyde dehydrogenases, monoamine oxidases, flavin-containing monooxygenases and hydrolytic enzymes. Acyltransferases, glutathione S-transferases, UDP-glucuronosyltransferases and sulfotransferases are examples of phase II enzymes that have been shown to be present in human skin. These enzymes are known to catalyse both activating and deactivating biotransformations, but the influence of the reactions on the allergenic activity of skin sensitisers has not been studied in detail. Skin sensitising prohapten can be recognised and grouped into chemical classes based on knowledge of xenobiotic bioactivation reactions, clinical observations and/or in vivo and in vitro studies of sensitisation potential and chemical reactivity.

QSAR prediction: The relationships between molecular structure and reactivity that form the basis for structural alerts are based on well established principles of mechanistic organic chemistry. Examples of structural alerts are aliphatic aldehydes (alerting to the possibility of sensitisation via a Schiff base reaction with protein amino groups), and alpha,beta-unsaturated carbonyl groups, C=C-CO- (alerting to the possibility of sensitisation via Michael addition of protein thiol groups). Prediction of the sensitisation potential of compounds that can act via abiotic or metabolic activation (pre- or prohapten) is more complex compared to that of compounds that act as direct haptens without any activation. The autoxidation patterns can differ due to differences in the stability of the intermediates formed, e.g. it has been shown that autoxidation of the structural isomers linalool and geraniol results in different major haptens/allergens. Moreover, the complexity of the prediction increases further for those compounds that can act both as pre- and prohapten. In such cases, the impact on the sensitisation potency depends

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	on the degree of abiotic activation (e.g. autoxidation) in relation to the metabolic activation.
TRICLABENDAZOLE	<p>Foetotoxicity recorded. * Transchem MSDS Skin sensitisation: In vitro and in vivo tests did not show mutagenic effects. Germ cell mutagenicity: Carcinogenicity No effects identified in animal studies. Reproductive toxicity Specific target organ toxicity -single exposure: No effects identified in animal studies. Specific target organ toxicity - repeated exposure: No effects identified in animal studies. ** Elanco SDS</p>
MOXIDECTIN	<p>For avermectins:</p> <p>Technical avermectin exhibits high mammalian acute toxicity. In vertebrates, the effects occur via poisoning of the central nervous system (CNS) through reactions at the receptor for the inhibitory neurotransmitter GABA. The avermectins open the GABAA receptor chloride channel by binding to the GABA recognition site (receptor protein) and act as partial agonists. Chloride ions then flow into the postsynaptic neuron. This chloride permeability increase can significantly hyperpolarize (make more negative) the membrane potential, which has a dampening effect on nerve impulse firing. There is also a reversible dose-dependent increase in chloride ion permeability in response to very low doses of avermectins.</p> <p>In GABA-insensitive neurons with no inhibitory innervation, the avermectins induce an irreversible increase in chloride ion conductance through interacting with voltage-dependent chloride channels. Avermectin intoxication in mammals begins with hyperexcitability, tremors, and incoordination and later develops into ataxia and coma-like sedation. This is similar to the mode of action of ethanol and barbiturates and benzodiazepine sedatives. However, the avermectins are less specific in their action and can affect a variety of other ligand- and voltage-gated chloride channels. The general safety of the avermectins depends on the presence of an intact P-glycoprotein blood-brain barrier.</p> <p>Avermectin is not considered to be mutagenic and does not sensitise skin. It is not readily absorbed by mammals and the majority of the residue is excreted in the faeces within 2 days. The 24-month rat chronic feeding/ oncogenicity study and 94-week mouse chronic toxicity oncogenicity study were negative for oncogenic potential. The results of a series of developmental toxicity studies (rat, rabbit, mouse) have been evaluated and showed that avermectin B1 produces developmental toxicity (cleft palate) in the CF1 mouse. Toxicology data were also evaluated for the delta-8,9-isomer of avermectin B1 which is a plant photodegradate that can range between 5 and 20 percent of the residue on/in cottonseed. This isomer possesses avermectin-like toxicological activity. It was concluded that the delta 8,9-isomer also produces developmental toxicity (cleft palate) in mice, but not in rats. In addition to avermectin and its delta 8,9-isomer, toxicology data were also evaluated for the "polar degradates" of avermectin, which constitute a large percentage (up to 70%) of the total residue on cottonseed. Review of the toxicology data indicated that these polar degradates do not possess avermectin-like toxicological activity and for this reason need not be included in the tolerance expression for residues in/on cottonseed.</p> <p>Abamectin (a mixture of avermectin isomers) is a reproductive toxin in laboratory animals at doses which are acutely toxic to the mother. In development toxicity studies with abamectin, cleft palates were seen in mice and rabbits and clubbing of the forepaws was seen in rabbits. The no-observed-adverse-effect-level (NOAEL) for maternal and developmental toxicity in rabbits was 1 mg/kg/day. In CF-1 mice, a strain recognised to be particularly sensitive to avermectins, the NOAEL for maternal toxicity was 0.05 mg/kg/day and the NOAEL for malformations was 0.2 mg/kg/day. Studies show that the sensitivity of a subpopulation of CF-1 mice to avermectins is due to the absence of a transmembrane P-glycoprotein, a significant component of the blood-brain interface that normally acts as a non-selective protective barrier in a wide range of species including humans. CF-1 mice are therefore an unlikely candidate for assessing human risk. No evidence of developmental toxicity was seen in oral studies in rats in the absence of maternal toxicity (NOAEL = 1.6 mg/kg/day). In a rat multigenerational reproduction study, pup toxicity and deaths were seen at 0.4 mg/kg/day (NOAEL = 0.12 mg/kg/day). Neonatal rats are not an appropriate model for assessing human risk in humans because (a) rat milk has a greater fat content than human breast milk and abamectin concentrates in fat; (b) on a weight basis, the neonatal rat consumes significantly greater quantities of milk than the newborn human and (c) the blood brain barrier in rodents is formed post-natally (as evidenced by low P-glycoprotein levels) while in humans this membrane is formed pre-natally.</p> <p>Ivermectin, a close structural analogue, has been used extensively in the treatment of human onchocerciasis at an oral therapeutic dose of 0.2 mg/kg, without serious drug-related effects. Despite its wide usage in animals and humans, ivermectin does not appear to produce birth defects. Abamectin is non-mutagenic in the Ames test and the micronucleus test.</p> <p>Dietary carcinogenicity studies in mice and rats showed negative results. In a 14-week oral study in monkeys no effects were seen at 0.2, 0.5 or 1.0 mg/kg/day; emesis was seen at 2.0 mg/kg/day; delayed pupillary obstruction at 6 and 8 mg/kg/day and mydriasis at 12 mg/kg/day. In chronic oral toxicity, abamectin produced decreased body weight gain in mice (no-observed-adverse-effect-level (NOAEL) = 1.5 mg/kg/day); tremors in rats (NOAEL = 1.5 mg/kg/day), weight loss, tremors, mydriasis, liver and gall bladder changes and death in dogs (NOAEL = 0.25 mg/kg/day); and emesis, mydriasis and sedation in monkeys (NOAEL = 1 mg/kg/day).</p> <p>May produce developmental toxicity in rat offspring at maternally toxic doses. This does not occur in rabbits. * * Cyanamid The ADI for Moxidectin is set at 0.01mg/kg/day. The corresponding NOEL is set at 1mg/kg/day. ADI means Acceptable Daily Intake and NOEL means No-observable-effect-level. In rats given oral doses of moxidectin, decreased activity, prostration, tremors, chromodacryorrhea, decreased respiration, diarrhoea, hypersensitivity to touch and sound, and epistaxis occurred. Congestion of the liver, kidneys and lungs were observed in animals that died, but animals which were sacrificed at the end of the 14-day observation period showed no abnormalities. No overt signs of toxicity were noted in rabbits treated dermally with moxidectin. Studies of moxidectin show the side effects vary by animal and may be affected by the product's formulation, application method and dosage. An overdose of moxidectin enhances the effect of gamma-aminobutyric acid (GABA) in the central nervous system. In horses, overdose may lead to depression, drooping of the lower lip, tremor, lack of coordination when moving (ataxia), decreased rate of breathing (respiratory rate), stupor and coma. If a dog licks moxidectin from the skin which was applied as a "spot-on" (topical) treatment, this has the same effect as an overdose, and may cause vomiting, salivation and neurological signs such as ataxia, tremor, and nystagmus. Collie dogs cannot be administered moxidectin.</p>
Cydectin Plus Fluke Pour-On for Cattle & EUCALYPTOL	<p>The following information refers to contact allergens as a group and may not be specific to this product.</p> <p>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.</p> <p>Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. Key criteria for the diagnosis of RADS include the absence of preceding respiratory disease, in a non-atopic individual, with abrupt onset of persistent asthma-like symptoms within minutes to hours of a documented exposure to the irritant. A reversible airflow pattern, on spirometry, with the presence of moderate to severe bronchial hyperreactivity on methacholine challenge testing and the lack of minimal lymphocytic inflammation, without eosinophilia, have also been included in the criteria for diagnosis of RADS. 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.</p> <p>d-Limonene is readily absorbed by inhalation and ingestion. Dermal absorption is reported to be lower than by the inhalation route. d-Limonene is rapidly distributed to different tissues in the body, readily metabolised and eliminated primarily through the urine.</p> <p>Limonene exhibits low acute toxicity by all three routes in animals. Limonene is a skin irritant in both experimental animals and humans. Limited data are available on the potential to cause eye and respiratory irritation. Autooxidised products of d-limonene have the potential to be skin sensitisers. Limited data are available in humans on the potential to cause respiratory sensitisation. Autooxidation of limonene occurs readily in the presence of light and air forming a variety of oxygenated monocyclic terpenes. Risk of skin sensitisation is high in situations where contact with oxidation products of limonene occurs.</p> <p>Renal tumours induced by limonene in male rats is thought to be sex and species specific and are not considered relevant to humans. Repeated exposure affects the amount and activity of liver enzymes, liver weight, blood cholesterol levels and bile flow in animals. Increase in liver weight is considered a physiological adaptation as no toxic effects on the liver have been reported. From available data it is not possible to identify an NOAEL for these effects. Limonene is neither genotoxic or teratogenic nor toxic to the reproductive system.</p>

Cydectin Plus Fluke Pour-On for Cattle

Cydectin Plus Fluke Pour-On
for Cattle &
TRICLABENDAZOLE

For chlorophenoxy pesticides:
551chlph

WARNING: This substance has been classified by the IARC as Group 2B: Possibly Carcinogenic to Humans.

Side-reactions during manufacture of the parent compound may result in the production of trace amounts of polyhalogenated aromatic hydrocarbon(s). Halogenated phenols, and especially their alkali salts, can condense above 300 deg. C. to form polyphenoxyphenols or, in a very specific reaction, to form dibenzo-p-dioxins

Polyhalogenated aromatic hydrocarbons (PHAHs) comprise two major groups. The first group represented by the halogenated derivatives of dibenzodioxins (the chlorinated form is PCDD), dibenzofurans (PCDF) and biphenyls (PCB) exert their toxic effect (as hepatocarcinogens, reproductive toxicants, immunotoxicants and procarcinogens) by interaction with a cytosolic protein known as the Ah receptor. In guinea pigs the Ah receptor is active in a mechanism which "pumps" PHAH into the cell whilst in humans the reverse appears to be true. This, in part, may account for species differences often cited in the literature. This receptor exhibits an affinity for the planar members of this group and carries these to the cellular nucleus where they bind, reversibly, to specific genomes on DNA. This results in the regulation of the production of certain proteins which elicit the toxic response. The potency of the effect is dependent on the strength of the original interaction with the Ah receptor and is influenced by the degree of substitution by the halogen and the position of such substitutions on the parent compound.

The most potent molecule is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) while the coplanar PCBs (including mono-ortho coplanars) possess approximately 1% of this potency. Nevertheless, all are said to exhibit "dioxin-like" behaviour and in environmental and health assessments it has been the practice to assign each a TCDD-equivalence value.

The most subtle and important biological effects of the PHAHs are the effects on endocrine hormones and vitamin homeostasis. TCDD mimics the effect of thyroxine (a key metamorphosis signal during maturation) and may disrupt patterns of embryonic development at critical stages. Individuals from exposed wildlife populations have been observed to have altered sexual development, sexual dysfunction as adults and immune system suppression. Immunotoxic effects of the PHAHs (including the brominated congener, PBB) have been the subject of several studies. No clear pattern emerges in human studies however with T-cell numbers and function (a blood marker for immunological response) increasing in some and decreasing in others.

Developmental toxicity (e.g. cleft palate, hydronephrosis) occurs in relatively few species; functional alterations following TCDD exposure leads to deficits in cognitive functions in monkeys and to adverse effects in the male reproductive system of rats.

Three incidences have occurred which have introduced abnormally high levels of dioxin or dioxin-like congeners to humans. The explosion at a trichlorophenol-manufacturing plant in Seveso, Italy distributed TCDD across a large area of the country-side, whilst rice-oil contaminated with heat-transfer PCBs (and dioxin-like contaminants) has been consumed by two groups, on separate occasions (one in Yusho, Japan and another in Yu-cheng, Taiwan). The only symptom which can unequivocally be related to all these exposures is the development of chloracne, a disfiguring skin condition, following each incident. Contaminated oil poisonings also produced eye-discharge, swelling of eyelids and visual disturbances. The Babies born up to 3 years after maternal exposure (so-called "Yusho-babies") were characteristically brown skinned, coloured gums and nails and (frequently) produced eye-discharges. Delays in intellectual development have been noted. It has been estimated that Yu-cheng patients consumed an average level of 0.06 mg/kg body weight/day total PCB and 0.0002 mg/kg/day of PCDF before the onset of symptoms after 3 months. When the oil was withdrawn after 6 months they had consumed 1 gm total PCB containing 3.8 mg PCDF. Taiwanese patients consumed 10 times as much contaminated oil as the Japanese patients (because of later withdrawal); however since PCB/PCDF concentration in the Japanese oil was 10 times that consumed in Taiwan, patients from both countries consumed about the same amount of PCBs/PCDFs. Preliminary data from the Yusho cohort suggests a six-fold excess of liver cancer mortality in males and a three-fold excess in women.

Recent findings from Seveso indicate that the biological effects of low level exposure (BELLEs), experienced by a cohort located at a great distance from the plant, may be hormetic, i.e. may be protective AGAINST the development of cancer. The PHAHs do not appear to be genotoxic - they do not alter the integrity of DNA. This contrasts with the effects of the many polycyclic aromatic hydrocarbons (PAHs) (or more properly, their reactive metabolites). TCDD induces carcinogenic effects in the laboratory in all species, strains and sexes tested. These effects are dose-related and occur in many organs. Exposures as low as 0.001 ug/kg body weight/day produce carcinoma. Several studies implicate PCBs in the development of liver cancer in workers as well as multi-site cancers in animals. The second major group of PHAH consists of the non-planar PCB congeners which possess two or more ortho-substituted halogens. These have been shown to produce neurotoxic effects which are thought to reduce the concentration of the brain neurotransmitter, dopamine, by inhibiting certain enzyme-mediated processes. The specific effect elicited by both classes of PHAH seems to depend on the as much on the developmental status of the organism at the time of the exposure as on the level of exposure over a lifetime.

NOTE: Some jurisdictions require that health surveillance be conducted on workers occupationally exposed to polycyclic aromatic hydrocarbons.

Such surveillance should emphasise

- ▶ demography, occupational and medical history
- ▶ health advice, including recognition of photosensitivity and skin changes
- ▶ physical examination if indicated
- ▶ records of personal exposure including photosensitivity

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Based on available data, the classification criteria are not met.

Acute Toxicity	✗	Carcinogenicity	✗
Skin Irritation/Corrosion	✓	Reproductivity	✗
Serious Eye Damage/Irritation	✓	STOT - Single Exposure	✓
Respiratory or Skin sensitisation	✓	STOT - Repeated Exposure	✗
Mutagenicity	✗	Aspiration Hazard	✗

Legend: ✗ – Data either not available or does not fill the criteria for classification
✓ – Data available to make classification

SECTION 12 Ecological information

Toxicity

Cydectin Plus Fluke Pour-On for Cattle	Endpoint	Test Duration (hr)	Species	Value	Source
	Not Available	Not Available	Not Available	Not Available	Not Available

Continued...

Cydectin Plus Fluke Pour-On for Cattle

eucalyptol	Endpoint	Test Duration (hr)	Species	Value	Source
	NOEC(ECx)	96h	Algae or other aquatic plants	9.1mg/l	2
	EC50	72h	Algae or other aquatic plants	>74mg/l	2
	LC50	96h	Fish	57mg/l	2
	EC50	48h	Crustacea	>100mg/l	2
	EC50	96h	Algae or other aquatic plants	>74mg/l	2
triclabendazole	Endpoint	Test Duration (hr)	Species	Value	Source
	Not Available	Not Available	Not Available	Not Available	Not Available
moxidectin	Endpoint	Test Duration (hr)	Species	Value	Source
	Not Available	Not Available	Not Available	Not Available	Not Available
Legend: <i>Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data</i>					

Harmful to aquatic organisms.

May cause long-term adverse effects in the aquatic environment.

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.

for chlorophenoxy herbicides:

Environmental fate:

Residues of chlorophenoxy herbicides in the environment are the consequence of the direct application of these compounds to agricultural and non-agricultural areas. Biodegradation is the primary route of elimination from the environment; photolysis and hydrolysis also contribute to their removal.

The chlorophenoxy herbicides are considered to have only marginal potential for leaching to groundwater. In basic waters, phenoxy herbicide esters are hydrolysed to the anionic forms; in acidic waters, photodegradation or vaporisation predominates, depending on the ester.

Chlorophenoxy herbicides may be transported in the atmosphere in the form of droplets, vapour, or powder following application by spraying.

Chlorophenoxy herbicides may be present in food as a result of their direct application to crops; however, concentrations are normally low.

For monoterpenes:

Environmental fate:

Photodegradation: The calculated photodegradation half-lives for the structurally defined terpenoid hydrocarbons in

this chemical category, are in the range from 0.884 to 0.64 hours. These calculations are based on measured rate constants for radical reactions of OH, O₃ and NO₃ with monoterpene hydrocarbons in this category. The short half-lives are predicted based on the abundant presence of reactive allylic hydrogens on members of this chemical category. Therefore these figures can be considered reliable.

Stability in Water: No hydrolysis is possible for any of the materials in this group. All are expected to be stable in aqueous solution.

Biodegradation: Terpinolene was found to be biodegradable in two studies. In one study of inherent biodegradability, 80% biodegradation was reported using an OECD 302C guideline protocol after 28 and 31 days. In a study of ready biodegradability, 62.1% biodegradation was reported using an OECD 301B protocol after 28 days. Additional studies in extracts and slurries prepared from soils of coniferous and deciduous forest indicate rapid and complete biodegradation of limonene and terpinolene in a closed bottle test. Limonene and terpinolene underwent 100% biodegradation after approximately 1 day in acclimated medium and after day 8 in non-acclimated medium. The authors concluded the limonene and terpinolene are completely degradable in extracts prepared from watershed soils of coniferous or deciduous forests.

Ecotoxicity:

Fish LC50 (96 h): fathead minnow 0.702 mg/l (limonene), 0.720 mg/l (terpinolene)

Daphnia pulex EC50 (48 h): 69.6 mg/l (limonene)

Daphnia magna LC50 (96 h): 0.577 mg/l; EC50 0.421 mg/l (limonene)

Daphnia magna LC50 (96 h): 2.55 mg/l; EC50 1.38 mg/l (terpinolene)

Daphnia magna LC50 (48 h): 31 mg/l (myrcene)

Monomethyltin chloride, thioglycolate esters, and tall oil ester reaction product

Monomethyltin trichloride (MMTC, CAS RN: 993-16-8), monomethyltin tris[2-ethylhexylmercaptoacetate] (MMT (EHTG); MMT (2-EHMA)), CAS RN: 57583-34-3, monomethyltin tris[isooctylmercaptoacetate] (MMT(IOTG), CAS RN: 54849-38-6), CAS RN: 57583-34-3 and methyltin reverse ester tallate reaction product (TERP, CAS RNs: 201687-58-3, 201687-57-2, 68442-12-6, 151436-98-5) are considered as a single category of compounds for the purpose of an environmental assessment.

All share a MMTC as a building block.

Environmental fate:

MMT(IOTG), MMT(EHTG), and TERP are sparingly soluble in water (0.6-10.7 mg/L). In water, these monomethyltin compounds undergo rapid degradation by hydrolysis. Although there is no stability data for MMT(EHTG)/(IOTG) or TERP, data for other organotin [DOTC, DBTL and DBT(EHTG)] indicate that the monomethyltin compounds are expected to hydrolyze within minutes to hours in water. The thioester ligands on MMT(EHTG)/(IOTG) will be rapidly displaced to form mono-methyltin hydroxide which eventually precipitates as the oxide. It is also possible that the labile ligands can be displaced by other anions in the medium. The displaced thioester ligands, EHTG/IOTG, can also undergo further hydrolysis of the ester linkage to form thioglycolic acid and ethylhexanol or isooctanol, respectively.

MMTC is a solid at room temperature and melts at 43 deg C, boils at 171 deg C, has a calculated vapour pressure of 1.7 hPa at 25 deg C, and is soluble in water (1038 g/L at 20 deg C). The measured log Kow is -0.9 and MMTC is not readily biodegradable. Atmospheric degradation occurs by photochemical induced hydroxyl radicals, with a half-life of 15.7 days. A Henry's Law constant of 3.83×10^{-7} atm-m³/mol predicts MMTC will volatilize from surface water (t_{1/2} = 99 days and 3 years for model river and lake, respectively). If released to the environment, MMTC is expected to partition primarily into water (54%) and soil (43%).

In water, MMTC undergoes rapid degradation by hydrolysis and is expected to hydrolyze within minutes. It is expected that the chlorines in MMTC will be displaced to form mono-methyltin hydroxide which eventually precipitates as the oxide (the alkyltin moiety (MMT) was hydrolytically stable at pH 4, 7, and 9 (t_{1/2} > 1 year at 25 deg C)).

TERP is a liquid at room temperature, boils at 216 deg C, and has a calculated vapour pressure of 0.2 hPa at 25 deg C. TERP is slightly soluble in water (4.4 mg/L), highly hydrophobic (log Kow = 25.5), has low potential for bioaccumulation (log BCF = 2.0), and is readily biodegradable. It is degraded atmospherically by hydroxyl radicals and ozone, with a half-life of 0.5 hours. If released to the environment, TERP is predicted to partition primarily to sediment (99%).

MMT(EHTG) is a liquid at room temperature and has a freezing point of -85 to -65 deg C, decomposes at 260 deg C has a derived vapour pressure of 0.02 hPa at 25 deg C, a calculated log Kow of 10.98, is slightly soluble in water (1.8-6 mg/L), and is readily biodegradable. MMT(EHTG) is also degraded atmospherically, with a half-life of 6.3 hours. A Henry's Law constant of 3.18×10^{-4} atm-m³/mol predicts MMT(EHTG) will volatilize from surface water (t_{1/2} = 8 hours and 11 days for a model river and lake, respectively). If released to the environment, MMT(EHTG) is expected to partition primarily into sediment (71%) and soil (25%).

Bioavailability:

Continued...

Cydectin Plus Fluke Pour-On for Cattle

The considerable difference in the structures of the labile ligands causes differences in water solubility between the alkyltin chloride and thioesters affecting their respective bioavailabilities and distribution in the environment. Furthermore, MMT(EHTG) and MMT(IOTG) will degrade in aqueous solution such that organisms will be exposed to the parent material and their different degradation products. MMTC is not an appropriate surrogate for the thioesters or TERP for the ecotoxicity and environmental fate endpoints.

Ecotoxicity:

In the ecotoxicity tests the organisms were most likely exposed to parent substance as well as hydrolysis/degradation products.

MMTC was not acutely toxic to zebra fish (*Brachydanio rerio*) (96-h LC50 > 102 mg/L) or *Daphnia magna* (48-h EC50 > 101 mg/L). MMTC inhibited the growth (72-h EC50 = 0.03 mg/L) and biomass (72-h EC50 = 0.02 mg/L) of the green alga *Scenedesmus subspicatus* (NOEC = 0.007 mg/L). MMTC was not acutely toxic to earthworms at nominal concentrations up to 1000 mg/kg.

TERP was not acutely toxic to rainbow trout (*Oncorhynchus mykiss*) (96-hr LC50 > 4.4 mg/L), inhibited *D. magna* survival and mobility (48-h EC50 = 0.27 mg/L), and inhibited growth of the freshwater green alga *Pseudokirchneriella subcapitata* was (72-h EC50 = 0.64 mg/L; NOEC = 0.28 mg/L).

MMT(EHTG) was not acutely toxic to *B. rerio* (LC50 > 6 mg/L; NOEC = 3.6 mg/L) and did not inhibit the growth of *S. subspicatus* (72-h EC50 > 1.84 mg/L; NOEC = 0.6 mg/L). The 21-d EC50 for reproduction in a chronic *Daphnia magna* study was > 0.134 mg/L (NOEC = 0.134 mg/L).

Substances containing unsaturated carbons are ubiquitous in indoor environments. They result from many sources (see below). Most are reactive with environmental ozone and many produce stable products which are thought to adversely affect human health. The potential for surfaces in an enclosed space to facilitate reactions should be considered.

Source of unsaturated substances	Unsaturated substances (Reactive Emissions)	Major Stable Products produced following reaction with ozone.
Occupants (exhaled breath, ski oils, personal care products)	Isoprene, nitric oxide, squalene, unsaturated sterols, oleic acid and other unsaturated fatty acids, unsaturated oxidation products	Methacrolein, methyl vinyl ketone, nitrogen dioxide, acetone, 6MHQ, geranyl acetone, 4OPA, formaldehyde, nonanol, decanal, 9-oxo-nonanoic acid, azelaic acid, nonanoic acid.
Soft woods, wood flooring, including cypress, cedar and silver fir boards, houseplants	Isoprene, limonene, alpha-pinene, other terpenes and sesquiterpenes	Formaldehyde, 4-AMC, pinolaldehyde, pinic acid, pinonic acid, formic acid, methacrolein, methyl vinyl ketone, SOAs including ultrafine particles
Carpets and carpet backing	4-Phenylcyclohexene, 4-vinylcyclohexene, styrene, 2-ethylhexyl acrylate, unsaturated fatty acids and esters	Formaldehyde, acetaldehyde, benzaldehyde, hexanal, nonanal, 2-nonenal
Linoleum and paints/polishes containing linseed oil	Linoleic acid, linolenic acid	Propanal, hexanal, nonanal, 2-heptenal, 2-nonenal, 2-decenal, 1-pentene-3-one, propionic acid, n-butyric acid
Latex paint	Residual monomers	Formaldehyde
Certain cleaning products, polishes, waxes, air fresheners	Limonene, alpha-pinene, terpinolene, alpha-terpineol, linalool, linalyl acetate and other terpenoids, longifolene and other sesquiterpenes	Formaldehyde, acetaldehyde, glycoaldehyde, formic acid, acetic acid, hydrogen and organic peroxides, acetone, benzaldehyde, 4-hydroxy-4-methyl-5-hexen-1-al, 5-ethenyl-dihydro-5-methyl-2(3H)-furanone, 4-AMC, SOAs including ultrafine particles
Natural rubber adhesive	Isoprene, terpenes	Formaldehyde, methacrolein, methyl vinyl ketone
Photocopier toner, printed paper, styrene polymers	Styrene	Formaldehyde, benzaldehyde
Environmental tobacco smoke	Styrene, acrolein, nicotine	Formaldehyde, benzaldehyde, hexanal, glyoxal, N-methylformamide, nicotinaldehyde, cotinine
Soiled clothing, fabrics, bedding	Squalene, unsaturated sterols, oleic acid and other saturated fatty acids	Acetone, geranyl acetone, 6MHO, 4OPA, formaldehyde, nonanal, decanal, 9-oxo-nonanoic acid, azelaic acid, nonanoic acid
Soiled particle filters	Unsaturated fatty acids from plant waxes, leaf litter, and other vegetative debris; soot; diesel particles	Formaldehyde, nonanal, and other aldehydes; azelaic acid; nonanoic acid; 9-oxo-nonanoic acid and other oxo-acids; compounds with mixed functional groups (=O, -OH, and -COOH)
Ventilation ducts and duct liners	Unsaturated fatty acids and esters, unsaturated oils, neoprene	C5 to C10 aldehydes
"Urban grime"	Polycyclic aromatic hydrocarbons	Oxidized polycyclic aromatic hydrocarbons
Perfumes, colognes, essential oils (e.g. lavender, eucalyptus, tea tree)	Limonene, alpha-pinene, linalool, linalyl acetate, terpinene-4-ol, gamma-terpinene	Formaldehyde, 4-AMC, acetone, 4-hydroxy-4-methyl-5-hexen-1-al, 5-ethenyl-dihydro-5-methyl-2(3H)-furanone, SOAs including ultrafine particles
Overall home emissions	Limonene, alpha-pinene, styrene	Formaldehyde, 4-AMC, pinonaldehyde, acetone, pinic acid, pinonic acid, formic acid, benzaldehyde, SOAs including ultrafine particles

Abbreviations: 4-AMC, 4-acetyl-1-methylcyclohexene; 6MHQ, 6-methyl-5-heptene-2-one, 4OPA, 4-oxopentanal, SOA, Secondary Organic Aerosols

Reference: Charles J Weschler; Environmental Health Perspectives, Vol 114, October 2006

The group of acidic herbicides, including the phenoxy acids, possess functional groups that ionise in aqueous systems yielding pKa values of less than 4. The behaviour of these materials is closely correlated with their acid character. The most significant factor with respect to soil mobility is the organic content of the soil which readily absorbs these compounds. Furthermore in acidic systems these compounds are also absorbed by clay particles. The esters and ethers are expected to behave differently from the acid forms although hydrolysis may influence subsequent binding. In general the esters and ethers are considered non-persistent in the environment.

For limonenes

Atmospheric fate: Due to the high volatility of limonene the atmosphere is expected to be the major environmental sink for this chemical where it is expected to undergo gas-phase reactions with photochemically produced hydroxyl radicals, ozone and nitrate radicals. Calculated lifetimes for the reaction of d-limonene with photochemically produced hydroxyl radicals range from 0.3-2 h based on experimentally determined rate constants. The oxidation of limonene may contribute to aerosol and photochemical smog formation. Calculated lifetimes for the night-time reaction of d-limonene with nitrate radicals range from 0.9 to 9 minutes. The daytime atmospheric lifetime of d-limonene is estimated to range from 12 to 48 min. depending upon local hydroxyl rate and ozone concentrations. Products produced from hydroxyl radical reaction with limonene are 4-acetyl-1-methylcyclohexene, a keto-aldehyde, formaldehyde, 3-oxobutanal, glyoxal and a C10 dicarbonyl. The same carbonyls, along with formic acid and C8 and C9 carboxylic acids, may form in reactions with ozone. Ozonolysis of limonene may also lead to the formation of hydrogen peroxide and organic peroxides, which have various toxic effects on plant cells and may damage forests. Products of ozonolysis include bis(hydroxymethyl)peroxide, a precursor to hydroxymethyl hydroperoxide and hydrogen peroxide. The reaction of d-limonene with ozone in the dark results in the formation of 4-acetyl-1-methylcyclohexene and formaldehyde. Reactions with nitrogen oxides produce aerosol formation as well as lower molecular weight products such as formaldehyde, acetaldehyde, formic acid, acetone and peroxyacetyl nitrate.

Terrestrial fate: When released to the ground limonene is expected to have low to very low mobility in soil based on its physicochemical properties. The soil adsorption coefficient (Koc) calculated on the basis of solubility (13.8 mg/L, 25 C) and the log octanol/ water partition coefficient (4.23) ranges from 1030 and 4780. The Henry's law constant indicates that limonene will rapidly volatilise from both dry and moist soil; however its absorption to soil may slow the process.

Aquatic fate: In the aquatic environment, limonene is expected to evaporate to a significant extent owing to its high volatility. The estimated half-life for volatilisation of limonene from a model river (1 m deep, flow 1 m/s and wind speed 3 m/s) is 3.4 h. Some limonene is expected to absorb to sediment and suspended organic matter.

Biodegradation and bioaccumulation: Limonene does not have functional groups for hydrolysis and its cyclohexene ring and ethylene group are known to resist hydrolysis.

Therefore, hydrolysis of limonene is not expected in terrestrial or in aquatic environments. The hydrolytic half-life of d-limonene is estimated to be >1000 days. Biotic degradation of limonene has been shown with some species of microorganisms such as *Penicillium digitatum*, *Corynespora cassicola*, *Diplodia gossypina* and a soil strain of *Pseudomonas sp* (*SL strain*). Limonene is readily biodegradable (41-98% degradation by biological oxygen demand in 14 d) under aerobic conditions in a standard test (OECD 301 C "Modified MITI Test (1)", OECD, 1981a; MITI, 1992). Also in a test simulating aerobic sewage treatment (OECD 303 A "Simulation Test - Aerobic Sewage Treatment: Coupled Units Test"; OECD, 1981b), limonene disappeared almost completely (>93.8%) during 14 days of incubation.

Biodegradation has been assessed under anaerobic conditions; there was no indication of any metabolisms, possibly because of the toxicity to micro-organisms.

The bioconcentration factor, calculated on the basis of water solubility and the log octanol/ water partition coefficient (log Kow) is 246-262, suggesting that limonene may bioaccumulate in fish and other aquatic species.

Ecotoxicity: Technical limonene is practically nontoxic to birds on a subacute dietary basis, and is slightly toxic to freshwater fish and invertebrates on an acute basis. for d-limonene:

LD50 *Colinus virginianus* (Bobwhite quail, 16 weeks old) oral >2000 mg/kg

LC50 *Colinus virginianus* (Bobwhite quail, 10 day old) dietary >5620 ppm/8 days

LC50 *Colinus virginianus* (Bobwhite quail, 14 day old) dietary >5000 ppm/8 days

LC50 *Anas platyrhynchos* (Mallard duck, 14 day old) dietary >5000 ppm/8 days

LC50 *Oncorhynchus mykiss* (Rainbow trout) 80 ppm/96 hr (95% confidence limit: 71.4-88.7 ppm); static /92% AI formulated product

LC50 *Oncorhynchus mykiss* (Rainbow trout) 568 ppm/96 hr (95% confidence limit: 437-852 ppm); static /4.0% AI formulated product

EC50 *Daphnia magna* (Water flea, <24 hr old; intoxication, immobilization) 17 ppm/48 hr (95% confidence limit: 11-33 ppm); static /4.0% AI formulated product

LC50 *Pimephales promelas* (Fathead minnow) 966 ppm/96 hr (95% confidence limit: 740-1652 ppm); static /4.0% AI formulated product

LC50 *Pimephales promelas* (Fathead minnow) 38.5 mg/L/96 hr; flow through /from table/ LC50

Cydectin Plus Fluke Pour-On for Cattle

Leuciscus idus (Golden orfe) 32 mg/L/48 hr /Conditions of bioassay not specified in source examined

The acute toxicity of d-limonene ranges from slight to high for aquatic organisms. The lowest acute toxicity values (EC50 or LC50) identified were approximately 0.4 mg/litre for Daphnia (US EPA, 1990b) and 0.7 mg/litre for fish (US EPA, 1990a,b). The no-observed-effect concentration (NOEC) for green algae is approximately 4 mg/litre (US EPA, 1990a). The acute toxicity (EC50 or LC50) of dipentene to Daphnia and fish is about 50-70 times lower than that for d-limonene (US EPA, 1990b). No studies were identified on the chronic toxicity of limonene to aquatic organisms.

DO NOT discharge into sewer or waterways.

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
eucalyptol	HIGH	HIGH

Bioaccumulative potential

Ingredient	Bioaccumulation
eucalyptol	LOW (LogKOW = 2.74)

Mobility in soil

Ingredient	Mobility
eucalyptol	LOW (KOC = 106.7)


SECTION 13 Disposal considerations

Waste treatment methods

Product / Packaging disposal	<ul style="list-style-type: none"> Containers may still present a chemical hazard/ danger when empty. Return to supplier for reuse/ recycling if possible.
	<p>Otherwise:</p> <ul style="list-style-type: none"> 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 SDS and observe all notices pertaining to the product. <p>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.</p> <p>A Hierarchy of Controls seems to be common - the user should investigate:</p> <ul style="list-style-type: none"> Reduction Reuse Recycling Disposal (if all else fails) <p>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.</p> <ul style="list-style-type: none"> 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 Transport information

Labels Required

Marine Pollutant	
HAZCHEM	Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

Transport in bulk in accordance with MARPOL Annex V and the IMSBC Code

Product name	Group
eucalyptol	Not Available
triclabendazole	Not Available
moxidectin	Not Available

Transport in bulk in accordance with the ICG Code

Product name	Ship Type
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Continued...

Product name	Ship Type
eucalyptol	Not Available
triclabendazole	Not Available
moxidectin	Not Available

SECTION 15 Regulatory information

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

eucalyptol is found on the following regulatory lists	
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6	Australian Inventory of Industrial Chemicals (AIIC)
triclabendazole is found on the following regulatory lists	
Australia Chemicals with non-industrial uses removed from the Australian Inventory of Chemical Substances (old Inventory)	Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
moxidectin is found on the following regulatory lists	
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 4	Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 6
Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 5	Australia Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) - Schedule 7

National Inventory Status

National Inventory	Status
Australia - AIIC / Australia Non-Industrial Use	No (moxidectin)
Canada - DSL	No (triclabendazole; moxidectin)
Canada - NDSL	No (eucalyptol; triclabendazole; moxidectin)
China - IECSC	No (triclabendazole; moxidectin)
Europe - EINEC / ELINCS / NLP	No (triclabendazole; moxidectin)
Japan - ENCS	No (triclabendazole; moxidectin)
Korea - KECI	No (triclabendazole; moxidectin)
New Zealand - NZIoC	Yes
Philippines - PICCS	No (triclabendazole; moxidectin)
USA - TSCA	No (triclabendazole; moxidectin)
Taiwan - TCSI	No (triclabendazole)
Mexico - INSQ	No (triclabendazole; moxidectin)
Vietnam - NCI	No (moxidectin)
Russia - FBEPH	No (triclabendazole; moxidectin)
Legend:	Yes = All CAS declared ingredients are on the inventory No = One or more of the CAS listed ingredients are not on the inventory. These ingredients may be exempt or will require registration.

SECTION 16 Other information

Revision Date	08/20/2021
Initial Date	05/11/2016

SDS Version Summary

Version	Date of Update	Sections Updated
7.1.1.1	09/03/2020	Classification change due to full database hazard calculation/update.
7.1.2.1	04/26/2021	Regulation Change
7.1.3.1	05/03/2021	Regulation Change
7.1.4.1	05/06/2021	Regulation Change
7.1.5.1	05/10/2021	Regulation Change
7.1.5.2	05/30/2021	Template Change
7.1.5.3	06/04/2021	Template Change
7.1.5.4	06/05/2021	Template Change
7.1.6.4	06/07/2021	Regulation Change
7.1.6.5	06/09/2021	Template Change
7.1.6.6	06/11/2021	Template Change
7.1.6.7	06/15/2021	Template Change
7.1.7.7	06/17/2021	Regulation Change
7.1.8.7	06/21/2021	Regulation Change
7.1.8.8	07/05/2021	Template Change
7.1.9.8	07/14/2021	Regulation Change

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Version	Date of Update	Sections Updated
7.1.10.8	07/19/2021	Regulation Change
7.1.10.9	08/01/2021	Template Change
7.1.11.9	08/02/2021	Regulation Change
7.1.12.9	08/05/2021	Regulation Change
7.1.13.9	08/09/2021	Regulation Change
8.1.13.9	08/20/2021	Classification change due to full database hazard calculation/update.
8.1.14.9	08/23/2021	Regulation Change
8.1.15.9	08/26/2021	Regulation Change
8.1.15.10	08/29/2021	Template Change
8.1.16.10	08/30/2021	Regulation Change

Other information

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

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

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
 PC—STEL: Permissible Concentration-Short Term Exposure Limit
 IARC: International Agency for Research on Cancer
 ACGIH: American Conference of Governmental Industrial Hygienists
 STEL: Short Term Exposure Limit
 TEEL: Temporary Emergency Exposure Limit.
 IDLH: Immediately Dangerous to Life or Health Concentrations
 ES: Exposure Standard
 OSF: Odour Safety Factor
 NOAEL :No Observed Adverse Effect Level
 LOAEL: Lowest Observed Adverse Effect Level
 TLV: Threshold Limit Value
 LOD: Limit Of Detection
 OTV: Odour Threshold Value
 BCF: BioConcentration Factors
 BEI: Biological Exposure Index
 AIIC: Australian Inventory of Industrial Chemicals
 DSL: Domestic Substances List
 NDSL: Non-Domestic Substances List
 IECSC: Inventory of Existing Chemical Substance in China
 EINECS: European INventory of Existing Commercial chemical Substances
 ELINCS: European List of Notified Chemical Substances
 NLP: No-Longer Polymers
 ENCS: Existing and New Chemical Substances Inventory
 KECI: Korea Existing Chemicals Inventory
 NZIoC: New Zealand Inventory of Chemicals
 PICCS: Philippine Inventory of Chemicals and Chemical Substances
 TSCA: Toxic Substances Control Act
 TCSI: Taiwan Chemical Substance Inventory
 INSQ: Inventario Nacional de Sustancias Químicas
 NCI: National Chemical Inventory
 FBEPH: Russian Register of Potentially Hazardous Chemical and Biological Substances

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