Monocrotophos

sc-250417

Material Safety Data Sheet

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

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

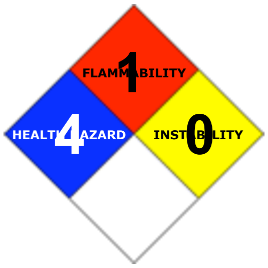
PRODUCT NAME

Monocrotophos

STATEMENT OF HAZARDOUS NATURE

CONSIDERED A HAZARDOUS SUBSTANCE ACCORDING TO OSHA 29 CFR 1910.1200.

NFPA



SUPPLIER

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

PRODUCT USE

- Dangerous POISON. Available ONLY for industrial and manufacturing purposes. To be used by or in accordance with directions of accredited pest control officers. Operators to be trained in procedures for safe use of material. Concentrate active used in systemic insecticide and acaricide preparations with contact and stomach action. Used to control many pests including sucking, chewing and boring insects, spider mites on cotton, citrus, olives, rice, maize, sorghum, sugar cane, sugar beet, potatoes, soya beans, vegetables, ornamentals, tobacco. Fragrance

SYNONYMS

C7-H14-N-O5-P, C7-H14-N-O5-P, "phosphoric acid, dimethyl ester, ester with (E)-3-hydroxy-N-", methylcrotonamide, "phosphoric acid, dimethyl ester, ester with (E)-3-hydroxy-N-", methylcrotonamide, "crotonamide, 3-hydroxy-N-methyl-, dimethylphosphate, cis-", "crotonamide, 3-hydroxy-N-methyl-, dimethylphosphate, cis-", 3-(dimethoxyphosphinyloxy)-N-methyl-cis-crotonamide, 3-(dimethoxyphosphinyloxy)-N-methyl-cis-crotonamide, "(E)-dimethyl 1-methyl-3-(methylamino)-3-oxo-1-propenyl phosphate", "(E)-dimethyl 1-methyl-3-(methylamino)-3-oxo-1-propenyl phosphate", "O, O-dimethyl-O-(2-N-methylcarbamoyl-1-methyl-vinyl) phosphate", "O, O-dimethyl-O-(2-N-methylcarbamoyl-1-methyl-vinyl) phosphate", "dimethyl 1-methyl-2-(methylcarbamoyl)vinyl phosphate, cis", "dimethyl 1-methyl-2-(methylcarbamoyl)vinyl phosphate, cis", "dimethyl phosphate ester with (E)-3-hydroxy-N-methyl-cis-crotonamide", "dimethyl phosphate ester with (E)-3-hydroxy-N-methyl-cis-crotonamide", "3-hydroxy-n-methylcrotonamide dimethyl phosphate", "3-hydroxy-n-methylcrotonamide dimethyl phosphate", "cis-1-methyl-2-methyl carbamoyl vinyl phosphate", "cis-1-methyl-2-methyl carbamoyl vinyl phosphate", "phosphoric acid, dimethyl ester, ester with cis-3-hydroxy-N-", methylcrotonamide, "phosphoric acid, dimethyl ester, ester with cis-3-hydroxy-N-", methylcrotonamide, "phosphoric acid, dimethyl 1-methyl-3-(methylamino)-3-oxo-1-propenyl ester", "phosphoric acid, dimethyl 1-methyl-3-(methylamino)-3-oxo-1-propenyl ester", Apadrin, Azodrin, Bilobran, Biloborn, C-1414, Crisodrin, E-monocrotonophos, E-monocrotonophos, "Glore Phos 36", Hazodrin, "Monocil 40", Monocron, Monodrin, Nuvacron, OMS-834, Plantdrin, Pillardrin, SD-9129, Susvin, Ulvair

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK

Toxic in contact with skin.
Possible risk of irreversible effects.
Very toxic by inhalation and if swallowed.
Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

POTENTIAL HEALTH EFFECTS

ACUTE HEALTH EFFECTS

SWALLOWED

- Severely toxic effects may result from the accidental ingestion of the material; animal experiments indicate that ingestion of less than 5 gram may be fatal or may produce serious damage to the health of the individual.
- Strong evidence exists that the substance may cause irreversible but non-lethal mutagenic effects following a single exposure.
- Ingestion may produce nausea, vomiting, depressed appetite, abdominal cramps,and diarrhea.

EYE

- There is some evidence to suggest that this material can causeeye irritation and damage in some persons.
- Direct eye contact can produce tears, eyelid twitches, pupil contraction, loss of focus, and blurred or dimmed vision. Dilation of the pupils occasionally occurs.

SKIN

- Skin contact with the material may produce toxic effects; systemic effectsmay result following absorption.
- The material is not thought to be a skin irritant (as classified using animal models). Abrasive damage however, may result from prolonged exposures. Good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting.
- There may be sweating and muscle twitches at site of contact. Reaction may bedelayed by hours.
- Open cuts, abraded or irritated skin should not be exposed to this material.
- Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

INHALED

- Inhalation of vapors, aerosols (mists, fumes) or dusts, generated by the material during the course of normal handling, may produce severely toxic effects; these may be fatal.
- The material is not thought to produce respiratory irritation (as classified using animal models). Nevertheless inhalation of dusts, or fume, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.
- Persons with impaired respiratory function, airway diseases and conditions such as emphysema or chronic bronchitis, may incur further disability if excessive concentrations of particulate are inhaled.
- Poisoning due to cholinesterase inhibitors causes symptoms such as increased blood flow to the nose, watery discharge, chest discomfort, shortness of breath and wheezing. Other symptoms include increased production of tears, nausea and vomiting, diarrhea, stomach pain, involuntary passing of urine and stools, chest pain, breathing difficulty, low blood pressure, irregular heartbeat, loss of reflexes, twitching, visual disturbances, altered pupil size, convulsions, lung congestion, coma and heart failure. Nervous system effects include inco-ordination, slurred speech, tremors of the tongue and eyelids, and paralysis of the limbs and muscles of breathing, which can cause death, although death is also seen due to cardiac arrest.

CHRONIC HEALTH EFFECTS

- Exposure to the material may result in a possible risk of irreversible effects. The material may produce mutagenic effects in man. This concern is raised, generally, on the basis of

appropriate studies using mammalian somatic cells in vivo. Such findings are often supported by positive results from in vitro mutagenicity studies.

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

Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Repeated or prolonged exposures to cholinesterase inhibitors produce symptoms similar to acute effects. In addition workers exposed repeatedly to these substances may exhibit impaired memory and loss of concentration, severe depression and acute psychosis, irritability, confusion, apathy, emotional liability, speech difficulties, headache, spatial disorientation, delayed reaction times, sleepwalking, drowsiness or insomnia. An influenza-like condition with nausea, weakness, anorexia and malaise has been described. There is a growing body of evidence from epidemiological studies and from experimental laboratory studies that short-term exposure to some cholinesterase-inhibiting insecticides may produce behavioral or neuro- chemical changes lasting for days or months, presumably outlasting the cholinesterase inhibition. Although the number of adverse effects following humans poisonings subside, there are still effects in some workers months after cholinesterase activity returns to normal. These long-lasting effects include blurred vision, headache, weakness, and anorexia. The neurochemistry of animals exposed to chlorpyrifos or fenthion is reported to be altered permanently after a single exposure. These effects may be more severe in developing animals where both acetyl- and butyrylcholinesterase may play an integral part in the development of the nervous system. Padilla S., The Neurotoxicity of Cholinesterase-Inhibiting Insecticides: Past and Present Evidence Demonstrating Persistent Effects. Inhalation Toxicology 7:903-907, 1995.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS

		Min Max
Flammability:	1	
Toxicity:	4	
Body Contact:	3	
Reactivity:	2	
Chronic:	2	

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

NAME	CAS RN	%
monocrotophos	6923-22-4	>98

Section 4 - FIRST AID MEASURES

SWALLOWED

• If swallowed:

- Contact a Poisons Information Center or a doctor at once.
- If swallowed, activated charcoal may be advised.
- Give atropine if instructed.
- REFER FOR MEDICAL ATTENTION WITHOUT DELAY.
- In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided.
- Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

EYE

• If this product comes in contact with the eyes:

- Immediately hold eyelids apart and flush the eye continuously with running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Continue flushing until advised to stop by the Poisons Information Center or a doctor, or for at least 15 minutes.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

• If product comes in contact with skin:

- Contact a Poisons Information Center or a doctor.
- DO NOT allow clothing wet with product to remain in contact with skin, strip all contaminated clothing including boots.
- Quickly wash affected areas vigorously with soap and water.
- DO NOT give anything by mouth to a patient showing signs of narcosis, i.e. losing consciousness.
- Give atropine if instructed.
- DO NOT delay, get to a doctor or hospital quickly.

INHALED

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- If spray mist, vapor are inhaled, remove from contaminated area.
- Contact a Poisons Information Center or a doctor at once.
- Lay patient down in a clean area and strip any clothing wet with spray.
- 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.
- DO NOT give anything by mouth to a patient showing signs of narcosis, i.e. losing consciousness.
- Give atropine if instructed.
- Get to doctor or hospital quickly.

NOTES TO PHYSICIAN

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- Most organophosphate compounds are rapidly well absorbed from the skin, conjunctiva, gastro-intestinal tract and lungs.
- They are detoxified by Cytochrome P450-mediated monoxygenases in the liver but some metabolites are more toxic than parent compounds.
- Metabolites are usually detected 12-48 hours postexposure.
- Organophosphates phosphorylate acetylcholinesterase with resultant accumulation of large amounts of acetylcholine causing initial stimulation, then exhaustion of cholinergic synapse.
- gamma-aminobutyric acid (GABA)-ergic and dopaminergic pathways provide compensatory inhibition.

- The clinical manifestation of organophosphate toxicity results from muscarinic, nicotinic and CNS symptoms.
- A garlic-like odor emanating from the patient or involved container may aid the diagnosis.
- Immediate life-threatening symptoms usually are respiratory problems.
- Frequent suction and, if necessary, endotracheal intubation and assisted ventilation may be necessary to maintain adequate oxygenation.
- Theophylline compounds, to treat bronchospasm, should be used cautiously as they may lower the seizure threshold.
- Excessive secretions and bronchospasm should respond to adequate doses of atropine.
- Diazepam is the drug of choice for convulsions.
- Usual methods of decontamination, (activated charcoal and cathartics) should be used when patients present 4-6 hours postexposure.
- The administration of atropine, as an antidote, does not require confirmation by acetylcholinesterase levels. Severely poisoned patients develop marked resistance to the usual doses of atropine. [Atropine should not be given to a cyanosed patient - ICI] NOTE: Hypoxia must be corrected before atropine is given. For adult: 2 mg repeatedly SC or IV until atropinization is achieved and maintained (atropinization is characterised by decreased bronchial secretions, heart rate >100 bpm, dry mouth, diluted pupils).
- Pralidoxime (2-PAM, Protopam) is a specific antidote when given within 24 hours and perhaps up to 36-48 hours postexposure. Although it ameliorates muscle weakness, fasciculations and alterations of consciousness, it does not relieve bronchospasm or bronchorrhea and must be given concurrently with atropine. NOTE: Pralidoxime should be given as an adjunct to, NOT a replacement for atropine and should be given in every case where atropine therapy is deemed necessary. Traditional dose: 1 g (or 2 g in severe cases) by slow IV injection over 5-10 minutes. 1-2 g, 4 hourly (maximum dose 12 g in 24 hours) until clinical and analytical recovery is achieved and maintained.
- Avoid parasympathomimetic agents. Phenothiazines and antihistamines may potentiate organophosphate activity. [Ellenhorn and Barceloux: Medical Toxicology]

NOTE: Acute pancreatitis in organophosphate intoxication may be more common than reported. The possible pathogenesis of pancreatic insult are excessive cholinergic stimulation of the pancreas and ductular hypertension. Early recognition and appropriate therapy for acute pancreatitis may lead to an improved prognosis. Cheng-Tin Hsiao, et al; Clinical Toxicology 34(3), 343-347 (1996)BIOLOGICAL EXPOSURE INDEX - BEI These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
1. Cholinesterase activity in red cells	70% of individual's baseline	Discretionary	NS

B: Background levels occur in specimens collected from subjects NOT exposed
NS:Non-specific determinant; Also observed after exposure to other materials
SQ:Semi-quantitative determinant; Interpretation may be ambiguous. Should be used as a screening test or confirmatory test.
Some jurisdictions require that health surveillance be conducted on occupationally exposed workers. Such surveillance should emphasise

- demography, occupational and medical history and health advice
- physical examination
- baseline estimation of red cell and plasma cholinesterase activity levels by the Ellman method. Estimation of red cell and plasma cholinesterase activity towards the end of the working day

Within 48-hours of oral administration 62.8% to 71.3% of radiolabelled material appears in the urine and 5% in the faeces of rats. Hydrolytic products accounted for the major urinary metabolites with 12% to 13% recovered as the parent compound.

Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHg):	0.001 mm @ 20C
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	Not available
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA

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

FIRE FIGHTING

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- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Use fire fighting procedures suitable for surrounding area.
- DO NOT approach containers suspected to be hot.
- Cool fire exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS

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- Combustible solid which burns but propagates flame with difficulty.
- Avoid generating dust, particularly clouds of dust in a confined or unventilated space as dusts may form an explosive mixture with air, and

any source of ignition, i.e. flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited.

- Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

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

FIRE INCOMPATIBILITY

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

PERSONAL PROTECTION

Glasses:
Chemical goggles.
Gloves:
Respirator:
Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

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

MAJOR SPILLS
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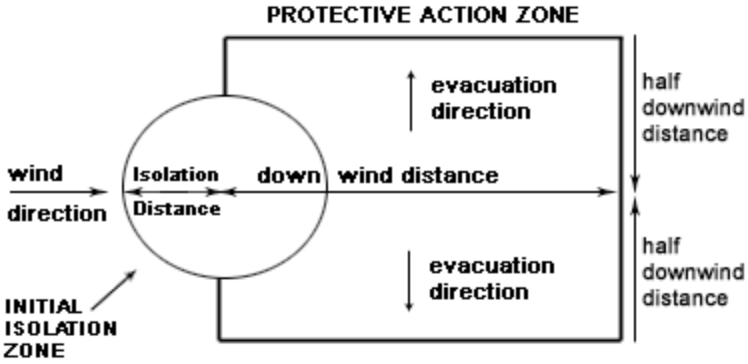
- DO NOT touch the spill material
- Clear area of personnel and move upwind.
- Alert Emergency Responders and tell them location and nature of hazard.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or water course.
- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and re-using.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



From IERG (Canada/Australia)	
Isolation Distance	25 meters
Downwind Protection Distance	250 meters

FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within

the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.

3 INITIAL ISOLATION ZONE is determined as an area, including upwind of the incident, within which a high probability of localised wind reversal may expose nearly all persons without appropriate protection to life-threatening concentrations of the material.

4 SMALL SPILLS involve a leaking package of 200 litres (55 US gallons) or less, such as a drum (jerrican or box with inner containers). Larger packages leaking less than 200 litres and compressed gas leaking from a small cylinder are also considered "small spills". LARGE SPILLS involve many small leaking packages or a leaking package of greater than 200 litres, such as a cargo tank, portable tank or a "one-tonne" compressed gas cylinder.

5 Guide 152 is taken from the US DOT emergency response guide book.

6 IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

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

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

AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

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- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- DO NOT allow material to contact humans, exposed food or food utensils.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Launder contaminated clothing before re-use.
- Use good occupational work practice.
- Observe manufacturer's storing and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Empty containers may contain residual dust which has the potential to accumulate following settling. Such dusts may explode in the presence of an appropriate ignition source.

- Do NOT cut, drill, grind or weld such containers.
- In addition ensure such activity is not performed near full, partially empty or empty containers without appropriate workplace safety authorisation or permit.

RECOMMENDED STORAGE METHODS

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- Lined metal can, Lined metal pail/drum
- Plastic pail
- Polyliner drum
- Packing as recommended by manufacturer.
- Check all containers are clearly labeled and free from leaks.

For low viscosity materials

- Drums and jerricans must be of the non-removable head type.
- Where a can is to be used as an inner package, the can must have a screwed enclosure.

For materials with a viscosity of at least 2680 cSt. (23 deg. C) and solids (between 15 C deg. and 40 deg C.):

- Removable head packaging;
- Cans with friction closures and
- low pressure tubes and cartridges may be used.

- Where combination packages are used, and the inner packages are of glass, there must be sufficient inert cushioning material in contact with inner and outer packages * . - In addition, where inner packagings are glass and contain liquids of packing group I and II there must be sufficient inert absorbent to absorb any spillage *. - * unless the outer packaging is a close fitting molded plastic box and the substances are not incompatible with the plastic. All inner and sole packagings for substances that have been assigned to Packaging Groups I or II on the basis of inhalation toxicity criteria, must be hermetically sealed.

STORAGE REQUIREMENTS

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

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS

X X + X X +

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

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
US - Minnesota Permissible Exposure Limits (PELs)	monocrotophos (Monocrotophos (Azodrin®))		0.25						
Canada - Ontario Occupational Exposure Limits	monocrotophos (Monocrotophos, inhalable, vapour and aerosol)		0.05						Skin
US ACGIH Threshold Limit Values (TLV)	monocrotophos (Monocrotophos)		0.05						TLV Basis: cholinesterase inhibition. BEI-A
US - California Permissible Exposure Limits for Chemical Contaminants	monocrotophos (Monocrotophos)		0.25						
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	monocrotophos (Monocrotophos (Azodrin(R)))		0.25						
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	monocrotophos (Monocrotophos (Azodrin«))		0.25						
Canada - Prince Edward Island Occupational Exposure Limits	monocrotophos (Monocrotophos)		0.05						TLV Basis: cholinesterase inhibition. BEI-A
US - Hawaii Air Contaminant Limits	monocrotophos (Monocrotophos (Azodrin«))		0.25						
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	monocrotophos (Monocrotophos (inhalable fraction++ and vapour))		0.05		0.15				Skin
US - Washington Permissible exposure limits of air contaminants	monocrotophos (Azodrin (Monocrotophos))		0.25		0.75				
US - Alaska Limits for Air Contaminants	monocrotophos (Monocrotophos (Azodrin))		0.25						
Canada - Nova Scotia Occupational Exposure Limits	monocrotophos (Monocrotophos)		0.05						TLV Basis: cholinesterase inhibition. BEI-A

Canada - Northwest Territories Occupational Exposure Limits (English)	monocrotophos (Monocrotophos (Azodrin(R)))	0.25	0.75	
US - Michigan Exposure Limits for Air Contaminants	monocrotophos (Monocrotophos (AzodrinR))	0.25		
Canada - Alberta Occupational Exposure Limits	monocrotophos (Monocrotophos)	0.05		
Canada - British Columbia Occupational Exposure Limits	monocrotophos (Monocrotophos, Inhalable)	0.05 (V)		Skin
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	monocrotophos (Monocrotophos)	0.25		
US NIOSH Recommended Exposure Limits (RELs)	monocrotophos (Monocrotophos)	0.25		

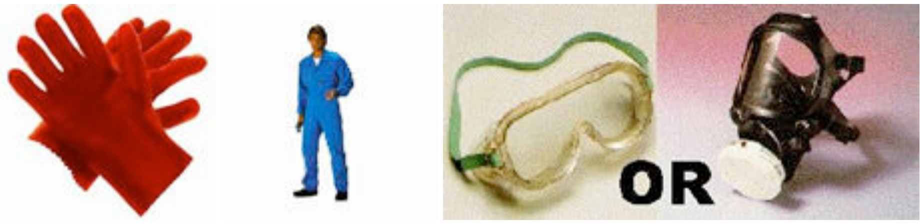
MATERIAL DATA

MONOCROTOPHOS:

• for monocrotophos:

Its been calculated that a worker exposed to air concentrations of 0.25 mg/m3 will receive a daily dose of 0.007 mg/kg. Monocrotophos is highly toxic, direct-acting and capable of penetrating intact skin. Because it metabolised and excreted rapidly it does not appear to accumulate in the body. Exposure at or below the TLV-TWA is thought to protect the worker against the significant risk of cholinesterase inhibition.

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

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

HANDS/FEET

• Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

- frequency and duration of contact,
- chemical resistance of glove material,
- glove thickness and
- dexterity

Select gloves tested to a relevant standard (e.g. Europe EN 374, US F739).

- When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.
- When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.
- Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.
NOTE: Contaminated leather items, such as shoes, belts and watchbands should be removed and destroyed.

OTHER

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- Overalls.
- Eyewash unit.
- Barrier cream.
- Skin cleansing cream.
- Ensure that there is a supply of atropine tablets on hand
- Ensure all employees have been informed of symptoms of carbamate poisoning and that the use of atropine in first aid is understood .

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- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads

which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).

- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory . These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

RESPIRATOR

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Protection Factor	Half-Face Respirator	Full-Face Respirator	Powered Air Respirator
10 x PEL	P1	-	PAPR-P1
	Air-line*	-	-
50 x PEL	Air-line**	P2	PAPR-P2
100 x PEL	-	P3	-
		Air-line*	-
100+ x PEL	-	Air-line**	PAPR-P3

* - Negative pressure demand ** - Continuous flow

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

The local concentration of material, quantity and conditions of use determine the type of personal protective equipment required.

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

ENGINEERING CONTROLS

•

- Local exhaust ventilation is required where solids are handled as powders or crystals; even when particulates are relatively large, a certain proportion will be powdered by mutual friction.
- Exhaust ventilation should be designed to prevent accumulation and recirculation of particulates in the workplace.
- If in spite of local exhaust an adverse concentration of the substance in air could occur, respiratory protection should be considered. Such protection might consist of:

(a): particle dust respirators, if necessary, combined with an absorption cartridge;
(b): filter respirators with absorption cartridge or canister of the right type;
(c): fresh-air hoods or masks

- Build-up of electrostatic charge on the dust particle, may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

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

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

Within each range the appropriate value depends on:

Lower end of the range	Upper end of the range
1: Room air currents minimal or favorable 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

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

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.
Mixes with water.

State	Divided solid	Molecular Weight	223.19
Melting Range (°F)	129.2	Viscosity	Not Applicable
Boiling Range (°F)	257 (0.0005 mm)	Solubility in water (g/L)	Miscible
Flash Point (°F)	>199.4	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available	Vapor Pressure (mmHg)	0.001 mm @ 20C
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	Not available
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	Not Applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not applicable

APPEARANCE

Colourless, hygroscopic crystals. Commercial product is a reddish-brown solid with mild ester odour; mixes with water, acetone, alcohol.

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

•

- Presence of heat source
- Presence of incompatible materials.
- Product is considered stable.
- Hazardous polymerization will not occur.

STORAGE INCOMPATIBILITY

• A number of phosphate and thiophosphate esters are of limited thermal stability and undergo highly exothermic self-accelerating decomposition reactions which may be catalyzed by impurities. The potential hazards can be reduced by appropriate thermal control measures.
BRETHERICK L.: Handbook of Reactive Chemical Hazards.
Avoid reaction with oxidizing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

monocrotophos

TOXICITY AND IRRITATION

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

TOXICITY	IRRITATION
Oral (rat) LD50: 8 mg/kg	Nil Reported
Inhalation (rat) LC50: 63 mg/m³/4h	
Dermal (rat) LD50: 112 mg/kg	
Dermal (rabbit) LD50: 354 mg/kg	

• for monocrotophos:

- Chronic toxicity results: - Rat chronic feeding and oncogenicity: Not carcinogenic at the highest dose tested (HDT), 9 ppm. No Observable Effect Level (NOEL) - ChE I = 0.03 ppm. Lowest Effect Level (LEL) - cholinesterase inhibition (ChE I) = 0.09 ppm. Systemic NOEL = 0.9 ppm. Systemic LEL = 9.0 ppm (body weight decrease in males, decreased survival in females). This study indicates that the rat is the most sensitive species for measuring cholinesterase inhibition (NOEL = 0.03 ppm), compared to the dog (NOEL = 1.6 ppm)

- Dog chronic feeding: NOEL - ChE I = 1.6 ppm. LEL - ChE I = 16.0 ppm. Systemic NOEL = 16.0 ppm. Systemic LEL = 100 ppm (salivation and tremors).

- Rat teratogenicity: Foetotoxic effects were found at 2 mg/kg. The effects consisted of runting, reduced foetal weight and length (NOEL = 1.0 mg/kg), and maternal toxicity in the form of reduced body weight gain at 1.0 mg/kg (NOEL = 0.3 mg/kg). No teratogenic effect was observed at the HDT (2.0 mg/kg/day).

- Rat reproduction: Generated a reproductive (and offspring) NOEL of 2.7 ppm and an LEL of 9.0 ppm (as evidenced by decreased fertility, pup viability and weight, partly attributed to depressed maternal lactation).

- Mutagenicity: A total of 19 studies evaluating monocrotophos for mutagenicity are available, but only 10 are adequate (acceptable). Monocrotophos is weakly mutagenic in vitro, as determined mainly from studies assessing DNA damage/repair and sister chromatid exchange.

Human lymphocyte and fibroblast mutagen (in vitro)
ADI: 0.0003 mg/kg/day
NOEL: 0.003 mg/kg/day

CARCINOGEN

Monocrotophos	ND	Carcinogen Category	A4

SKIN

monocrotophos	ND	Notes	Skin
monocrotophos	ND	Skin Designation	Yes
monocrotophos	ND	Notation	Skin
monocrotophos	Canada - Alberta Occupational Exposure Limits - Skin	Substance Interaction	1

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:
MONOCROTOPHOS:

• Fish LC50 (96hr.) (mg/l):	450
• Daphnia magna EC50 (48hr.) (mg/l):	0.24

• Very toxic 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.
• Organophosphorus pesticides are relatively non-persistent in the environment with half-lives ranging from hours to several weeks or months. Only rarely are they found in crops beyond the growing season during which they are applied. Chemical or photochemical mechanisms may produce a leaving group which is easily degraded. As a rule these compounds do not represent a serious problem as contaminants of soil and water. Breakdown products are usually non-toxic being composed of low-molecular weight, volatile molecules that are easily degraded and utilized by micro-organisms.
Being esters they are also susceptible to hydrolysis. Most organophosphorus pesticides are stable to acid pHs but under alkaline conditions hydrolysis is rapid with the breakdown rate increasing 10-fold for each pH unit above 7. An increase of 10 deg. C of temperature will increase the hydrolysis rate approximately 4-fold. When these compounds are present in the soil their disappearance is affected by their interaction with the physical characteristics and water content of the soil, and the microflora present.
In certain types of soil strong binding may make them unavailable for biological decomposition. In such soils even running water produces little movement and thus minimal contamination of water supplies. Less tightly bound substances are similarly unlikely to produce substantial contamination because of rapid breakdown. Metallic ions in the soil interact with organophosphorus pesticides through hydrogen linkage whilst increased organic matter facilitates further binding.
In general only minute amounts of pesticide residue and their breakdown products are found in natural water systems. In soil however there is a greater likelihood of the presence and buildup of toxic residues.
• for monocrotophos
Environmental fate:
Monocrotophos hydrolyses rapidly (half-life of 14-21 days at pH 9 and 25 degrees C), with the rate decreasing at lower pH's and increasing at higher temperatures. Degradation on soil exposed to natural sunlight is rapid (half-life less than 7 days), and on dark control samples is slower (half-life approximately 30 days). Residues have a low potential for bioaccumulation in catfish and are depurated fairly rapidly. - Monocrotophos is mobile in soil, and although it degrades rapidly, it may possess potential for groundwater contamination.
Ecotoxicity.
Avian acute toxicity: upland game birds 0.763-6.49 mg/kg; waterfowl 1.58-4.76; passerine 1-5.62; golden eagle 0.188 mg/kg (very highly toxic)
Avian dietary toxicity: pheasant 3.1 ppm; mallard duck 9.6 ppm very highly toxic)
Fish LC50 : bluegill sunfish 12.1 ppm; fathead minnow >50 ppm (moderately toxic)
Daphnia magna EC50: 0.034 (very highly toxic)
Honeybee acute toxicity: 0.35 ug/bee (highly toxic)
Test results are sufficient to characterise monocrotophos as not having an effect on the overall reproductive success of birds at levels of 0.1 to 3.0 ppm in the diet (nontoxic to reproduction). Typical reproductive effects in the field are unlikely from the use of monocrotophos. Rather more likely, breeding birds will be exposed to a toxic dose themselves or will feed a toxic dose to their brood.
Monocrotophos is one of the most toxic pesticides to birds. Monitoring and incident reports contain numerous observations of avian mortality attributed to monocrotophos; thus, it has the potential for causing significant impacts on populations of avian wildlife.
• DO NOT discharge into sewer or waterways.
• The material is classified as an ecotoxin* because the Fish LC50 (96 hours) is less than or equal to 0.1 mg/l
* Classification of Substances as Ecotoxic (Dangerous to the Environment)
Appendix 8, Table 1
Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.

Toxicity Fish: LC50(96)280-450mg/L
Toxicity invertebrate: LC50(96)0.24-0.577ppm
Nitrif. inhib.: inhib at >5mg/L
Degradation Biological: resist

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
monocrotophos	HIGH		LOW	MED

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Instructions

All waste must be handled in accordance with local, state and federal regulations.
• Puncture containers to prevent re-use and bury at an authorized landfill.
Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.
A Hierarchy of Controls seems to be common - the user should investigate:

- Reduction
- Reuse
- Recycling
- Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.
DO NOT allow wash water from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible. Special hazard may exist - specialist advicemay be required.
- Consult manufacturer for recycling options.
- Consult Waste Management Authority for disposal.
- Bury or incinerate residue at an approved site.
- Decontaminate empty containers. Observe all label safeguards untilcontainers are cleaned and destroyed.
- Puncture containers to prevent re-use and bury at an authorized landfill.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols:	None	Hazard class or Division:	6.1
Identification Numbers:	UN2783	PG:	I
Label Codes:	6.1	Special provisions:	IB7, IP1, N77, T6, TP33
Packaging: Exceptions:	None	Packaging: Non-bulk:	211
Packaging: Exceptions:	None	Quantity limitations: Passenger aircraft/rail:	5 kg
Quantity Limitations: Cargo aircraft only:	50 kg	Vessel stowage: Location:	A
Vessel stowage: Other:	40	S.M.P.:	YES

Hazardous materials descriptions and proper shipping names:
Organophosphorus pesticides, solid, toxic

Air Transport IATA:

ICAO/IATA Class:	6.1	ICAO/IATA Subrisk:	None
UN/ID Number:	2783	Packing Group:	I
Special provisions:	A3		

Shipping Name: ORGANOPHOSPHORUS PESTICIDE, SOLID, TOXIC *(CONTAINS MONOCROTOPHOS)

Maritime Transport IMDG:

IMDG Class:	6.1	IMDG Subrisk:	None
UN Number:	2783	Packing Group:	I
EMS Number:	F-A,S-A	Special provisions:	61 274
Limited Quantities:	None		

Shipping Name: ORGANOPHOSPHORUS PESTICIDE, SOLID, TOXIC(contains monocrotophos)

Section 15 - REGULATORY INFORMATION

monocrotophos (CAS: 6923-22-4,919-44-8,2157-98-4) is found on the following regulatory lists;

"Canada - Northwest Territories Occupational Exposure Limits (English)","Canada - Nova Scotia Occupational Exposure Limits","Canada - Ontario Occupational Exposure Limits","Canada - Prince Edward Island Occupational Exposure Limits","Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits","Canada Environmental Protection Act (CEPA) 1999 - Schedule 3 Export Control List - Part 2 Substances Subject to Notification or Consent","United Nations List of Prior Informed Consent Chemicals - French","United Nations List of Prior Informed Consent Chemicals - Spanish","United Nations List of Prior Informed Consent Chemicals (English)","US - Alaska Limits for Air Contaminants","US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List","US - California Permissible Exposure Limits for Chemical Contaminants","US - Connecticut Hazardous Air Pollutants","US - Hawaii Air Contaminant Limits","US - Michigan Exposure Limits for Air Contaminants","US - Minnesota Hazardous Substance List","US - Minnesota Permissible Exposure Limits (PELs)","US - New Jersey Right to Know Hazardous Substances","US - Pennsylvania - Hazardous Substance List","US - Rhode Island Hazardous Substance List","US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants","US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants","US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants","US - Washington Permissible exposure limits of air contaminants","US ACGIH Threshold Limit Values (TLV)","US ACGIH Threshold Limit Values (TLV) - Carcinogens","US DOE Temporary Emergency Exposure Limits (TEELs)","US List of Lists - Consolidated List of Chemicals Subject to the Emergency Planning and Community Right-to-Know Act (EPCRA) and Section 112(r) of the Clean Air Act","WHO Guidelines for Drinking-water Quality - Chemicals excluded from guideline value derivation"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Cumulative effects may result following exposure*.
- May produce discomfort of the eyes*.

* (limited evidence).

Ingredients with multiple CAS Nos

Ingredient Name	CAS
monocrotophos	6923-22-4, 919-44-8, 2157-98-4

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

A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

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

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