pupils, aching in and behind the eyes, blurring of the vision, tearing, runny nose, headache, and watering of the mouth.
After swallowing mercaptothion, loss of appetite, nausea, vomiting, abdominal cramps and diarrhea may appear within two hours.
With **percutaneous absorption**, localized sweating and muscular fasciculation in the immediate vicinity are generally the earliest manifestations.
Severe intoxication is manifested by extreme salivation, involuntary defecation and urination, sweating, lacrimation, penile erection, bradycardia and hypotension.
The airway should be kept clear to maintain respiration, particularly when the patient is unconscious or has vomited. The mouth and pharynx should be cleared and dentatures removed. The jaw should be supported and the patient placed in a face down position with the head down and turned to one side, with the tongue drawn forward. First aid should include, if necessary, mouth-to-nose respiration, cardiac massage and avoidance of injury in patients with trauma.
Inhalation:
Remove source of contamination or move victim to fresh air. Keep affected person warm and at rest. Supply oxygen if necessary. Treat symptomatically and supportively.
Seek medical advice immediately.
Skin contact:
Remove contaminated clothing, shoes and leather goods. Gently wipe of excess chemical. Wash skin gently and thoroughly with water and non-abrasive soap. Seek medical advice if necessary. Persons who become sensitized may require specialized medical management with anti-inflammatory agents.
Eye contact :
Immediately flush eyes with gently flowing cold water or saline solution for 20 minutes, holding the eyelid(s) open.
Seek medical attention immediately.
Ingestion:
Have victim rinse mouth thoroughly with water. Do not induce vomiting, due to the aromatic solvent. **Seek medical advice immediately.**
Advice to physician:
Atropine must be administrated as early as possible and could save lives, if given in time and in an adequate dosage. Patients with organophosphate poisoning require amounts of atropine far in excess of doses usually employed in medical practice. The therapeutic objective is to achieve atropinization, as evidenced by dilation of the pupils, drying secretion, pulse rate of over 120/min, and flushing skin. To prevent gastrointestinal absorption in unconscious who have swallowed this product, perform stomach lavage using bicarbonate solution and activated charcoal.
In less severe cases begin with 2 mg atropine intravenously for adults or 0.05 mg atropine/kg body weight intravenously for children under 12 years of age and repeat administration of the drug at 15 – 30 min intervals.
In severe cases a total atropine dose of 20 – 80 mg in the first hour may be necessary, with repeated drug administrations at 3 – 10 min intervals. When signs of atropinization appear the dose and frequency of administration should be reduced to a schedule that will maintain full atropinization for at least 24h. Overdosage with atropine is rarely serious, but under dosage may be fatal in poisoning with organophosphorous compounds.
In any severe progressive case of poisoning a cholinesterase reactivator e.g. pralidoxime (2PAM), if available, should be administered, preferably within 4h after intoxication. An average dose is 1 g for an adult (up to 50 mg/kg for children), usually given half as a single intramuscular or intravenous injection and the other half as an intravenous infusion with glucose and or saline. In severe cases this treatment may be repeated in 1-2 h, then at 10 – 12 h intervals if needed, but not beyond 24 h, or 48 h at the most. Pralidoxime should be administered very slowly. If respiration is depressed during or after pralidoxime injection, pulmonary ventilation should be assisted mechanically.
Toxogonin is a more recent cholinesterase reactivator. It can be administrated instead of 2PAM at a dose of 250 mg intramuscularly for adults (4-8 mg/kg for children) and, if necessary, repeated after 1 –2 h.
Diazepam should be included in the therapy of severe cases and whenever convulsions appear. Doses of 5 – 10 mg for adults (2-5 mg for children) can be administered intravenously or subcutaneously or per rectum, and repeated as required.
NB Because of their respiratory-depressant effects, morphine and similar drugs are contraindicated for patients poisoned with organophosphorous compounds. Avoid aminoglycosides and succinylcholine, which have a blocking effect on the neuromuscular junction.
Phenothiazines, reserpine and theophylline are contraindicated in organophosphorous poisoning.

5. FIRE FIGHTING MEASURES

Extinguishing agents:
This material will not burn or burns with difficulty. Use an extinguishing agent suitable for surrounding fires.

Extinguish small fires with carbon dioxide, dry powder, or alcohol-resistant foam. Water spray can be used for cooling of unaffected stock, but avoid water coming in contact with the product. For large fires water fog can be used. Contain water used for fire-fighting for later disposal. Use as little water as possible.
Avoid the accumulation of polluted run-off from the site.

Firefighting:
Remove spectators from surrounding area. Remove container from fire area if possible. Fight fire from maximum distance. For massive fire, use unmanned hose holder or monitor nozzles. Contain fire control agents for later disposal. Use a recommended extinguishing agent for the type of surrounding fire. Water can be used to cool unaffected containers but must be contained for later disposal. Avoid inhaling hazardous vapours. Keep upwind.
Special Hazards:
Fire may produce irritating or poisonous mists (hydrogen sulfide, carbon oxides and sulfur oxides) or other products of combustion.
Personal protective equipment:
Fire-fighters and others that may be exposed should wear full protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES (SPILLAGE)

Personal precautions:
Do not inhale dust or fumes. Ventilate area of spill or leak, especially confined areas. Avoid contact with skin, eyes or clothes. For personal protection see Section 8.
Environmental precautions:
Do not allow entering drains or watercourses. When the product contaminates public waters, inform appropriate authorities immediately in accordance with local regulations.
Occupational spill:
For small spills, Spills of mercaptothion wettable powder on floors shall be transferred to a suitable container. Seal contaminated clothing and the dust in a vapor-tight plastic bag for eventual disposal. Wash all contaminated surfaces with soap and water. Thoroughly wash body areas, which come into contact with the product. Do not allow the product to come in contact with water systems. For large spills contact the manufacturer. Contain spillage and contaminated water for subsequent disposal. Do not flush spilled material into drains. Keep spectators away and upwind.

7. HANDLING AND STORAGE REQUIREMENTS

Handling:
Harmful by inhalation or if swallowed. Avoid contact with eyes and skin and inhalation of dust. Use with adequate ventilation. Wash hands before eating, drinking, chewing gum, smoking or using the toilet. Operators should change and wash clothing daily. Remove clothing immediately if the insecticide gets inside. Then wash skin thoroughly using a non-abrasive soap and put on clean clothing. Do not apply directly to areas where surface water is present, or to intertidal areas below the mean high water mark. Water used to clean equipment must be disposed of correctly to avoid contamination
Storage:
Store in its original container in isolated, dry, cool (avoid temperatures above 40°C) and well-ventilated area. Avoid cross contamination with other pesticides and fertilizers. Product hydrolyzed rapidly in aqueous alkaline solutions. Keep under lock and key out of reach of unauthorized persons, children and animals. Store away form incompatible substances. Not to be stored next to foodstuffs and water supplies. Local regulations should be complied with.

8. EXPOSURE CONTROL / PERSONAL PROTECTION

Occupational exposure limits:
10 mg/m³ OSHA TWA (total dust) (skin)
10 mg/m³ ACGIH TWA (skin)
15 mg/m³ NIOSH
Engineering control measures:
It is essential to provide adequate ventilation. Ensure that control systems are properly designed and maintained. Comply with occupational safety, environmental, fire and other applicable regulations.
PERSONAL PROTECTIVE EQUIPMENT:
If engineering controls and work practices are not effective in controlling exposure to this material, then wear suitable personal equipment including approved respiratory protection.
Respirator:
An approved full-face respirator suitable for protection from dust/or mists of pesticides is required. Limitations of respirator use specified by the approving agency and the manufacturer must be observed.
Clothing:
Employee must wear appropriate protective (impervious) clothing and equipment to prevent skin contact with the substance.
Gloves:
Employee must wear appropriate chemical resistant protective gloves to prevent contact with this substance.
Eye protection:
Employee must wear splash-proof safety goggles and face-shield to prevent contact with this substance.
Emergency eye wash: Where there is any possibility that an employee's eyes may be exposed to this substance, the employer should provide an eye wash fountain or appropriate alternative within the immediate work area for emergency use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:
A pale off white to gray free flowing wettable powder.

Odour:
Mercaptan or garlick odour.
Flammability:
Not flammable
Explosive properties:
Not explosive.
Oxidising properties:
No information currently available.
pH:
No information currently available.
Storage stability:
Stable for up to 2 years under normal warehouse and field conditions. Product is decomposed by acids and alkalis. Starts to decompose at 49 °C.
Solubility in water:
The products is a wettable powder that will mix with water.
Solubility in organic solvents:
(All solubility figures for technical material at 25°C)
Miscible with most organic solvents (e.g. alcohols, ketones, ethers aromatic hydrocarbons). Slightly soluble in petroleum ether, and some types of mineral oil.
Partition-coefficient in n-octanol / water:
K_{ow} ($\log P_{ow}$) = 2.75*(data for active substance)*.
Melting point:
2.85°C *(data for active substance)*.

10. STABILITY AND REACTIVITY

Stability:
The product is stable at room temperature. Acids and alkalis decompose product.
Incompatibility:
The product is compatible with most other common pesticides but incompatible with alkaline materials such as Bordeaux mixture or Lime Sulphur.
Do not physically mix dustdirectly with other herbicides or pesticides.
Hazardous decomposition:
Product undergoes decomposition at high temperatures. Avoid heating above ambient temperature. Toxic fumes (hydrogen sulfide, carbon oxides and sulfur oxides) may be released when the product decomposes on heating.

11. TOXICOLOGICAL INFORMATION

There is no acute toxicity information available for this particular formulation.
The data below is for the active ingredient.
Acute oral LD_{50}:
1375 -2800 mg/kg body weight in rats.
Acute dermal LD_{50}:
4100 mg/kg in rabbits.
Acute inhalation LC_{50} (4 h):
LC_{50} Rat : 43,790 µg/cu m.
Acute skin irritation:
This product is classified as harmful and a mild irritant.
Acute eye irritation:
This product is classified as harmful and mild irritant for the eyes.
Dermal sensitisation:
Mercaptothion was found to be a weak contact sensitizer, inducing mild cutaneous reaction in high proportion of subjects.
Carcinogenicity:
Studies did not detect carcinogenic activity.
Teratogenicity / Reproductive hazard:
Studies did not detect any tetragenic effects.
Mutagenicity:
Studies did not indicate that any mutagenic activity.

12. ECOLOGICAL INFORMATION

Degradability: *(Technical material)*
This product can be classified as non-persistent.
Biodegradation in soil is rapid with 80-95% biodegradation detected in 10 days. The rate of degradation increased with organic matter content, and half-lives in the 1-6 day range. Biodegradation of 90% in 2 weeks was reported in raw river water.
Mobility:
If released to soil, mercaptothion is expected to have very high mobility based upon an estimated Koc of 30.
Accumulation:
Will not accumulate in soil.

ECOTOXICOLOGY:
Birds:
Non-toxic to birds. The reported acute oral LD50 values are: in mallards, 1485 mg/kg; in pheasants, 167 mg/kg; in blackbirds and starlings, over 100 mg/kg; and in chickens, 525 mg/kg .
Fish:
Highly toxic to fish. Mercaptothion is highly toxic to aquatic invertebrates and to the aquatic stages of amphibians.
LC_{50}: blue gill sunfish; 0,1mg/l
Daphnia:
Toxic to *Daphnia magna*
Bees:
Toxic to bees.
LD_{50}: 0,71µg/Bee
Earthworms:
No information available.

Soil micro-organisms:
No information available.

13. DISPOSAL CONSIDERATION

Pesticide disposal:
Only small amounts may be land filled.
Contaminated absorbents, surplus product, etc., should be burned in a high-temperature incinerator (> 1000 °C) with effluent gas scrubbing. Never pour untreated waste or surplus products into public sewers or where there is any danger of run-off or seepage into water systems. Comply with local legislation applying to waste disposal.
Package product wastes:
Emptied containers retain vapour and product residues. Observe all labeled safeguards until container is destroyed. Combustible containers should be disposed of in pesticide incinerators. Non-combustible containers must be triple rinsed with water and then be punctured and transported to a scrap metal facility for recycling or disposal in approved landfill site. Comply with any local legislation applying to disposal.

14. TRANSPORT INFORMATION

UN NUMBER: 3077

ADR/RID:

Substance name:	Environmentally hazardous substances, solid, n.o.s. (Mercaptothion 25%).
Substance ID NR:	3077
Hazard ID NR:	90
Label:	9
Item no.:	12
Shipping Name:	Environmentally hazardous substances, solid, n.o.s. (Mercaptothion 25%).

AIR/IATA :

Class:	9
Shipping Name:	Environmentally hazardous substances, solid, n.o.s. (Mercaptothion 25%).
Subsidiary Risk:	-
Hazard Label:	Miscellaneous
Packaging group:	III
Passenger aircraft:	Y911 (30kg); 911 (no limit)
Cargo aircraft:	911 (no limit)

IMG/IMO:

Packaging group:	III
Label of class:	9 Marine pollutant.
Shipping Name:	Environmentally hazardous substance, solid,n.o.s (Mercaptothion 25 %).
Subsidiary Risk:	-
Transcard no:	90GM7-III

15. REGULATORY INFORMATION

Symbol : Xn
Indication of danger:
Harmful,

Risk phrase :

R22	Harmful if swallowed.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety phrases :

S 2	Keep out of reach of children
S24	Avoid contact with skin.

National legislation:
In accordance with 91/155/EEC Directive and with French standard T 01-102 and the South African Occupational Health and Safety Act, 1993 (Act. No. 85 of 1993).

16. OTHER INFORMATION

Prepared by: Susan Steyn
Approved by: Danie Fourie

All information and instructions provided in this Material Safety Data Sheet (MSDS) are based on the current state of scientific and technical knowledge at the date indicated on the present MSDS and are presented in good faith and believed to be correct. This information applies to the PRODUCT AS SUCH. In case of new formulations or mixes, it is necessary to ascertain that a new danger will not appear.
It is the responsibility of persons in receipt of this MSDS to ensure that the information contained herein is properly read and understood by all people who may use, handle, dispose or in any way come in contact with the product. If the recipient subsequently produces formulations(s) containing this product, it is the recipient's sole responsibility to ensure the transfers of all relevant information from this MSDS to their own MSDS.

REFERENCES

- Own applicable physical and chemical studies.
- *The Pesticide Manual*; Eleventh Edition; Editor Clive Tomlin; Crop Protection Publications, 1997.
- American Cyanamid, Material safety data sheet (Italy) Malathion 4 % Dust ,March 27, 1997
- American Cyanamid Material safety data sheet (Brazil) Malathion 50 WP, March 27, 1997
- Dangerous Goods Regulations; IATA 2000; International Air Transport Association, 41st Edition, Effective I January 2000.
- ADR, Vol., II (Annex B), 1 January 1997.
- EINECS PLUS
- International Chemical Safety Cards.
- EXTOXNET, PIP. Primary files maintained and archived at Oregon State University.

END OF MSDS.

IPCO

Interprovincial Cooperative Limited

MALATHION 500 MATERIAL SAFETY DATA SHEET

1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	Malathion 500*
Product Use:	Organophosphate Insecticide
Product Number:	5821
Manufacturer/Supplier:	INTERPROVINCIAL COOPERATIVE LTD. 945 Marion St. Winnipeg, Manitoba R2J 0K7 www.ipco.ca
Effective Date:	January 01/2012
	This product is regulated under authority of the Pest Control Products Act

2: HAZARD IDENTIFICATION

Target organs:	Eyes, skin, respiratory system, digestive system, nervous system.
Signs and symptoms of short-term (acute) exposure:	
Inhalation:	This material can cause rapid organophosphorous poisoning. Symptoms of poisoning may include headache, nausea, vomiting, blurred vision, tightness in chest, drooling and frothing of mouth and nose, convulsions, coma and death.
Skin contact:	Direct skin contact causes moderate irritation.
Eye contact:	Direct eye contact may cause moderate irritation.
Ingestion:	Causes symptoms similar to those listed for inhalation. This product presents an aspiration hazard. Aspiration into the lungs during ingestion could cause life-threatening lung injury.
Effects of long-term (chronic) exposure:	Prolonged or repeated overexposure may cause behavioral changes. Prolonged or repeated skin contact may cause drying and cracking of the skin (dermatitis). Prolonged or repeated overexposure may cause liver effects.

3: COMPOSITION AND INFORMATION ON INGREDIENTS

COMPONENT	CAS NUMBER	% (W/W)
Malathion	121-75-5	48.03 – 51.01
Solvent Naphtha (Petroleum)	64742-94-5	44.12 – 46.84
Heavy Aromatic		
Other ingredients:		4.75 – 5.25
Naphthalene	91-20-3	
1, 2, 4-Trimethylbenzene	95-63-6	

Ingredients not listed are proprietary or non-hazardous

4: FIRST AID MEASURES

In case of poisoning, call a physician or poison control centre IMMEDIATELY.

Inhalation:	Immediately remove victim to fresh air. If breathing has stopped, begin artificial respiration immediately. Transport to a clinic or hospital immediately.

Skin:	Immediately flush skin with running water for at least 15 minutes, while removing contaminated clothing and shoes. Obtain medical attention immediately. Thoroughly clean contaminated clothing before re-use.
Eyes:	Immediately flush eyes with running water for at least 30 minutes. Get medical attention immediately.
Ingestion:	If ingested, induce vomiting immediately, only as directed by medical personnel. Never give anything by mouth if victim is unconscious or convulsing. Transport to a clinic or hospital immediately.
Note to physician:	Malathion is a cholinesterase inhibitor affecting the central and peripheral nervous systems and producing respiratory and cardiac depression. Decontamination procedures such as whole body washing, gastric lavage and administration of activated charcoal are often required. Administer atropine sulphate in large doses. Two to four mg intravenously or intramuscularly as soon as cyanosis is overcome. Repeat at 5 to 10 minute intervals until signs of atropinization appear. Obidoxime chloride (Toxogonin), alternatively pralidoxime chloride (2-PAM), is a pharmacological antidote and may be administered as an adjunct to, but not a substitute for atropine, which is a symptomatic and often life-saving antidote. DO NOT GIVE MORPHINE OR TRANQUILIZERS. At first sign of pulmonary edema, the patient should be given supplemental oxygen and treated symptomatically. Continued absorption of Malathion may occur and relapse may occur after initial improvement. VERY CLOSE SUPERVISION OF THE PATIENT IS INDICATED FOR AT LEAST 48 HOURS.

5: FIRE-FIGHTING MEASURES

Unusual Fire & Explosion Hazards:	Toxic fumes under high temperature conditions. Contain water from fire fighting to prevent entry into water supplies...
Extinguishing Media:	Carbon Dioxide, Foam, Water Fog, and Dry Chemical
Special Oxidizing Material Hazards:	Not Established
Hazardous Combustion Products:	Hydrogen chloride, ethyl mercaptan, diethyl sulfide, carbon oxides, nitrogen oxides, sulfur oxides, various chlorinated solvents.
Special Fire Fighting Procedures:	Use water spray to cool fires exposed containers or structures. Use water spray to disperse vapours; re-ignition is possible. Use self-contained breathing apparatus and protective clothing.

6: ACCIDENTAL RELEASE MEASURES

In case of spillage, absorb with inert material and dispose of in accordance with applicable regulations.

7: HANDLING AND STORAGE

Store in a cool, well-ventilated area. Keep away from heat, sparks and filling of containers. Keep away from children; prevent contact with eyes, skin, and clothing. Do not store near fertilizers, foodstuffs, seed, insecticides or fungicides.

Do not contaminate irrigation ditches or domestic water supplies. If this happens notify police and local authorities.

8: EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:	
Malathion	
LD50-ORAL:	5500 mg/kg Rat
LD50-DERMAL:	> 2000 mg/kg Rabbit
T.L.V. (ACGIH):	10 mg/m^3
LC50:	> 4.36 mg/L (4 hrs) Rat
Solvent Naphtha (Petroleum), Heavy Aromatic	
LD50-ORAL:	> 3, 000 mg/kg Rat
LD50-DERMAL:	> 3160 mg/kg Rabbit
T.L.V. (ACGIH):	Total Hydrocarbons: 100 mg/m^3
LC50:	Not Established
Special Engineering Controls:	Local exhaust ventilation required.
Eye Protection:	CSA approved safety glasses with side shields or goggles.
Respiratory Protection:	A NIOSH/MSHA approved air-purifying respirator equipped with organic vapor cartridges near or below TLV. Air supplied respirator above TLV or unknown concentrations.
Hand and Arm:	PVC or rubber gloves.
Feet:	Rubber boots.
Body:	Coveralls.
Other Personal Protection:	Recommendations listed above indicate the type of equipment which will provide protection against overexposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.

9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State:	Liquid
Appearance & Odour:	Transparent yellow with mercaptan-like odour
Specific Gravity:	(@ 20^{0}c): 1.0410
Vapour density:	Solvent Naphtha (Petroleum), Heavy Aromatic: > 4.6 (Air =1)
Solubility in water:	Emulsifies
Solubility in liquids:	Not established
Freezing point:	< 5^{0}c
% volatile by volume:	Not applicable
Boiling point:	Solvent Naphtha (Petroleum), Heavy Aromatic: 184 - 205^{0}C
Odour threshold (ppm):	Not established
Coefficient of water/oil distribution:	Not applicable
Vapour pressure:	Solvent Naphtha (Petroleum), Heavy Aromatic: 0.40 Kpa @ 20°C
Evaporation rate:	Solvent Naphtha (Petroleum), Heavy Aromatic: < 0.06 (n-butyl acetate = 1)
pH: (1% Sol'n):	6.0
Viscosity:	5.0 cps at 20°C
Flash Point & Method:	(^{0}C): 64 (Tag Closed Cup)
Flammable Limits (% in air):	Lower: 1.8 Solvent Naphtha (Petroleum), Heavy Aromatic Upper: 11.4 Solvent Naphtha (Petroleum), Heavy Aromatic
Autoignition Temperature	Solvent Naphtha (Petroleum), Heavy Aromatic: 433°C

10: STABILITY AND REACTIVITY

Decomposition Temp:	Above 100^{0}C for the Malathion component of the formulation
Stability:	Stable under normal conditions.
Materials to Avoid:	Strong alkalies, amines and strong oxidizing compounds.
Hazardous Decomposition Products:	Hydrogen chloride, ethyl mercaptan, diethyl sulfide, carbon oxides, nitrogen oxides, sulfur oxides, various chlorinated solvents

Hazardous Polymerization or Condensation:	Will not occur.
Conditions to Avoid:	Avoid heating above 50°C. Product undergoes exothermic decomposition at approximately 100°C, which can lead to higher temperatures and violent decomposition if heat generated is not removed.

11: TOXICOLOGICAL INFORMATION

Skin Absorption:	Acute dermal LD50 (Rat)	> 2000 mg/kg.
Ingestion:	Acute oral LD50 (rat)	4302 mg/kg.
Inhalation:	LC50	2.16 mg/L (4 hr, nose-only exposure) Rat
T.W.A. (ACGIH):	Total Hydrocarbons:	100 mg/m^3
Chronic Health Hazards:	Prolonged or repeated exposure may lead to kidney or central nervous system symptoms.	
Mutagenicity Data:	None observed in test animals. This product does not contain any materials above reportable levels.	
Carcinogenicity Data:	This product does not contain any materials above reportable levels which are classified as carcinogenic by IARC, ACGIH, OSHA or NTP.	
Teratogenicity Data:	None observed in test animals. This product does not contain any materials above reportable levels.	
Reproductive Effects:	None observed in test animals. This product does not contain any materials above reportable levels.	

12: ECOLOGICAL INFORMATION

Data on Malathion:
96-Hour LC50 (mg/L): 0.18 (Rainbow Trout)
48-Hour EC50 (ug/L): 0.72 (Daphnia)
Oral LD50 (mg/kg): 359 (Bobwhite Quail)
Dietary LC50 (mg/kg): 1485 (Mallard Duck)
Oral LD50 (mg/mg): 0.38 (Bee)

Chemical Fate Information: The active ingredient, Malathion, is readily biodegradable. It undergoes rapid degradation in the environment and, without problems, in sewage treatment plants. No adverse effects are observed at concentrations up to 100 mg/L in waste water treatment plants. Degradation occurs both aerobically and anaerobically, and biologically as well as abiologically. Under normal conditions, Malathion is of medium mobility in soil, but is degraded rapidly. The product should not be allowed to enter drains or water courses or be deposited where it can affect ground or surface

13: DISPOSAL CONSIDERATIONS

Dispose of waste materials in an approved incinerator or waste treatment/disposal facility in accordance with applicable regulations. Do not dispose of wastes in local sewer or with normal waste

14: TRANSPORT INFORMATION

This product is Not Regulated under regulations of the Transport of Dangerous Goods Act.

15: REGULATORY INFORMATION

Pest Control Products Act
Registration Number: 5821
For Information Phone: 204-233-3461

In case of emergency call CANUTEC at 613-885-6666
Interprovincial Cooperative Ltd Information Phone: 204-233-3461
Effective Date: 01-Jan-2012
MSDS # 031 PCP# 5821 Page 4 of 5

MSDS Status/
Revised Sections:
Replaces MSDS Dated: September 01, 2009

16: OTHER INFORMATION

WHMIS Ratings: B3, D2A
Notice: The enclosed information is supplied as a customer service and is provided in good faith. Although it has been based on data drawn from sources deemed to be reliable, IPCO cannot guarantee its accuracy and assumes no responsibility for conditions resulting from its use.

MATERIAL SAFETY DATA SHEET — MALATHION 95% ULV PCP# 25638

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CALL DAY OR NIGHT 1-800-561-8273 or CHEMTREC 1-800-424-9300

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

MANUFACTURED FOR:

UNITED AGRI PRODUCTS CANADA, INC.
789 Dornybrook Drive • Dorchester, Ontario N0L 1G5

24-Hour Emergency Phone: 1-800-561-8273
Medical Emergencies (Prosar): 1-800-361-7976
Additional Emergency Phone (Canutec): 1-613-996-6666 (Collect)

CHEMICAL IDENTITY: Malathion: O-O-Dimethyl phosphorodithioate of diethyl mercaptosuccinate
PRODUCT USE: Insecticide – Group 1B
PCP REG. NO.: 25638
MSDS Number: 25638-09-UAP MSDS Revisions: All sections Date of Issue: 01/07/09 Supersedes: 01/07/05

2. HAZARDS IDENTIFICATION SUMMARY

KEEP OUT OF REACH OF CHILDREN – CAUTION - POISON – Hazardous if swallowed, inhaled, or absorbed through skin. Avoid contact with skin, eyes, or clothing. Avoid breathing spray mist. Avoid contamination of feed and foodstuffs. DO NOT treat dairy barns or apply to pastures while occupied by dairy animals. After using this product ventilate thoroughly before occupying enclosed spaces. Do not allow contact with treated surfaces until sprays have dried The product contains petroleum distillates.

This product is straw to amber coloured liquid with a slightly aromatic odor.

WARNING STATEMENTS:

NOTE TO PHYSICIAN: This product is an organophosphate (cholinesterase-inhibiting) insecticide. Atropine is antidotal and should be given in multiple doses as necessary until the patient is atropinized. In severe cases 2-PAM may be given provided therapy begins within 24 hours of exposure. Monitor serum and RBC cholinesterase. Administer intravenous fluids cautiously, if needed, to correct dehydration. Symptoms of cholinesterase inhibition include salivation, gastrointestinal hypermotility, abdominal cramping, nausea, diarrhea, sweating, miosis, tearing, blurred vision, headache, dizziness, ataxia, bradycardia, dyspnea, cyanosis, and muscle twitching or tremors. In extreme cases, tetany, mental confusion, incontinence, weakness, collapse, paralysis, convulsive seizures, and even death, can occur.

3. COMPOSITION, INFORMATION ON INGREDIENTS

Chemical Ingredients:	Percentage by Weight:	CAS No.	TLV (Units)
Malathion	95.00	121-75-5	15 mg/m^3 (skin)

4. FIRST AID MEASURES

If swallowed:	Call a poison control center or doctor immediately for treatment advice. Do not give any liquid to the person. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.
If inhaled:	Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.
If in eyes:	Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.
If on skin or clothing:	Take off contaminated clothing. Rinse skin with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.
NOTE TO PHYSICIAN:	This product causes cholinesterase inhibition. Atropine is antidotal. 2-PAM may be effective as an adjunct to Atropine. This product contains petroleum distillates. Vomiting may cause aspiration pneumonia.

FOR A MEDICAL EMERGENCY INVOLVING THIS PRODUCT CALL: 1-800-361-7976. Have the product container or label with you when calling a poison control center or doctor, or going for treatment.

5. FIRE FIGHTING MEASURES

FLASH POINT (°F/Test Method):	325.4°F / 163°C (PMCC)
FLAMMABLE LIMITS (LFL & UFL):	Not established
EXTINGUISHING MEDIA:	Foam, dry chemical, carbon dioxide, and water spray (fog).
HAZARDOUS COMBUSTION PRODUCTS:	Thermal decomposition products include dimethyl sulfide, sulfur dioxide, carbon monoxide, carbon dioxide, and phosphorus pentoxide.
SPECIAL FIRE FIGHTING PROCEDURES:	Wear self-contained breathing apparatus with full protective clothing. Fight fire from upwind and keep all non-essential personnel out of area. Avoid heavy hose streams.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	If water is used to fight fire or cool containers, contain runoff by diking to prevent contamination of water supplies. Containers in fire may burst or explode from excessive heat. Stay well back from fire area.

6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
For small spills, absorb with an absorbent material such as pet litter. Sweep up and transfer to containers for possible land application according to label use or for proper disposal. Check local or provincial regulations for proper disposal. Flush the area with water to remove any residue.
CAUTION: Keep spills and cleaning runoff out of municipal sewers and open bodies of water.

7. HANDLING AND STORAGE

HANDLING: Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

STORAGE: Store in a safe manner. Store in original container only. Keep container tightly closed when not in use. Store at temperatures not exceeding 77°F/25°C. KEEP AWAY FROM CHILDREN. Do not store diluted spray. Do not store near heat or open flame. Do not contaminate water, food, or feed by storage or disposal.

Personal Protective Equipment: Applicators and other handlers must wear: long sleeved shirt and long pants, chemical-resistant gloves, such as barrier laminate, butyl rubber, nitrile rubber or Viton®, shoes plus socks, and protective eyewear. Follow manufacturer's instructions for cleaning and maintaining PPE. If no instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Not normally required.
RESPIRATORY PROTECTION: Not normally required; if vapors or mists exceed acceptable levels, wear a NIOSH approved pesticide respirator.
EYE PROTECTION: Chemical goggles or shielded safety glasses.
SKIN PROTECTION: Wear protective clothing: long-sleeved shirts and pants, shoes with socks. Wear chemical-resistant gloves.

	OSHA PEL 8 hr TWA	ACGIH TLV-TWA
Malathion	15 mg/m^3 (skin)	1 mg/m^3 IV*

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOUR: Straw to amber coloured liquid with a slightly aromatic odor.
SOLUBILITY: Emulsifies
SPECIFIC GRAVITY (Water = 1): 1.23 g/ml **BULK DENSITY:** 1.23 kg/L **pH:** 3.7 - 3.8 (50% solution)
VAPOUR PRESSURE: 3.4 x 10^{-6} mmHg @ 25°C (77 °F) **BOILING POINT:** >300°F / >148.9°C
PERCENT VOLATILE (by volume): Not established **EVAPORATION RATE:** < 1
Note: These physical data are typical values based on material tested but may vary from sample to sample.
Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

10. STABILITY AND REACTIVITY

STABILITY: Stable
CONDITIONS TO AVOID: The active ingredient will decompose rapidly at temperatures above 100°C.
INCOMPATIBILITY: Strong alkalis, amines, and strong oxidizing compounds. The active ingredient can corrode iron, steel, tin plate, lead and copper.
HAZARDOUS DECOMPOSITION PRODUCTS: Dimethyl sulfide, sulfur dioxide, oxides of carbon, and phosphorous pentoxide from combustion.
HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Oral LD_{50} (rat): 1375 – 2800 mg/kg
Eye Irritation (rabbit): Slight irritation
Inhalation LC_{50} (male rat): >5.2 mg/L (4 HR)
Carcinogenic Potential: Nothing listed in OSHA, NTP, IARC, or ACGIH.
Acute Dermal LD_{50} (rabbit) : > 2000 mg/kg
Skin Irritation (rabbit): Slight irritation
Skin Sensitization (Guinea Pig): Not a sensitizer.

12. ECOLOGICAL INFORMATION

Malathion is toxic to fish, aquatic invertebrates, and aquatic life stages of amphibians. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to aquatic organisms in areas near the application site. Do not contaminate water by cleaning equipment or disposal of wash waters. Highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area.

13. DISPOSAL CONSIDERATIONS

Do not reuse containers for any purpose. This product is acutely hazardous. Container is recyclable, and is to be disposed of at a container collection site. Contact your local dealer/distributor for the location of the nearest collection site. Before taking container to the collection site: Triple or pressure-rinse the empty container, adding the rinsate to the spray tank. Make the empty container unsuitable for further use. If there is no container collection site in your area, dispose of the container in accordance with provincial requirements. For information on disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Do not contaminate water, food, or feed by storage or disposal.

14. TRANSPORT INFORMATION

USDOT / TDG Shipping Description: LESS THAN 10.2 GALLONS NOT REGULATED.
US DOT / TDG Shipping Description: RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S., 9, UN3082, III (MALATHION) MARINE POLLUTANT ERG GUIDE 171
U.S. Surface Freight Classification: INSECTICIDES, INSECT REPELLENTS, NOI, OTHER THAN POISON (NMFC 102120, CLASS: 60)
IMDG Shipping Description: RQ ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (MALATHION 95%), 9, UN3082, III, MARINE POLLUTANT, ERG GUIDE 171

Consult appropriate ICAO/IATA regulations for shipment requirements in the Air shipping modes.

15. REGULATORY INFORMATION

NFPA & HMIS Hazard Ratings:

NFPA			HMIS	
2	Health	0 Least	2	Health
2	Flammability	1 Slight	2	Flammability
0	Instability	2 Moderate	0	Reactivity
		3 High	1	PPE
		4 Severe		

SARA Hazard Notification/Reporting SARA Title III Hazard Category:

Immediate	Y	Fire	N	Sudden Release of Pressure	N
Delayed	Y	Reactive	N		

Reportable Quantity (RQ) under U.S. CERCLA: Malathion (CAS: 121-75-5): 100 pounds
SARA, Title III, Section 313: Malathion (CAS: 121-75-5) 95.00%
RCRA Waste Code: Not listed
CA Proposition 65: Not listed

16. OTHER INFORMATION

MSDS STATUS: All sections revised to 16-section format
PREPARED BY: Registrations and Regulatory Affairs
REVIEWED BY: Environmental Regulatory Services

®Viton is a registered trademark of DUPONT DOW ELASTOMERS L.L.C.

*TV: Measurable as inhalable fraction and vapour

Product: 655-777 Prentox® 5 Lb. Malathion Spray

Material Safety Data Sheet
U.S. Department of Labor (OSHA 29 CFR 1910.1200)

Manufacturer's Name: Prentiss Incorporated
C. B. 2000
Floral Park, NY 11001
Telephone Number: (516) 326-1919

Section 1: Chemical Identification

Product: 655-777	**Prentox® 5 Lb. Malathion Spray**
EPA Signal Word:	WARNING
Active Ingredient (%):	Malathion (57%) (CAS# 121-75-5)
Chemical Name:	*O,O*-dimethyl dithiophosphate of diethyl mercaptosuccinate
Chemical Class:	Organophosphate Insecticide Mixture

Section 2: Composition/Information on Ingredients

Material:	OSHA PEL	ACGIH TLV	NTP/IARC/OSHA Carcinogen
Malathion	10 mg/M³ (Skin) (TWA)	10 mg/M³ (Skin) (TWA)	No/No/No
Xylene Range Aromatic Solvent (CAS # 64742-95-6) (34%)		See below	
Contains the following regulated ingredients, by weight (typical):			
1,2,4-Trimethyl Benzene (CAS # 95-63-6)		32.0	(TWA) 25 ppm
Mixed Xylenes (CAS # 1330-20-7)		3.0	(TWA) 100 ppm
Cumene (CAS # 98-82-8)		1.5	(TWA) 50 ppm
Ethyl Benzene (CAS # 100-41-4)		0.5	(TWA) 100 ppm
Emulsifier (CAS # N/A) (6.0%)	N/D	N/D	

Section 3: Hazards Identification

Routes of Exposure:

Inhalation: Yes **Skin:** Yes **Ingestion:** Yes

Acute and Chronic Exposure: Causes severe but reversible eye damage. Malathion is a cholinesterase inhibitor of low mammalian toxicity. However, prolonged storage at temperatures exceeding 78 F (25 C) causes formation of the more toxic and synergistic contaminant isomalathion (LD_{50}, oral, rat, 89 mg/Kg). Acute exposure to malathion may cause death due to cholinesterase inhibition. Repeated exposure to cholinesterase inhibitors such as malathion may, without warning, cause increased susceptibility to doses of any cholinesterase inhibitor. Signs and symptoms of exposure include headache, nausea, vomiting, cramps, weakness, blurred vision, pinpoint pupils, tightness in chest, labored breathing, nervousness, sweating, watering of eyes, drooling or frothing of mouth and nose, muscle spasms and coma. **Note to Physician:** Malathion, upon repeated, prolonged or careless use may cause cholinesterase inhibition. Atropine is antidotal. **Toxicity of other components:** **Xylene Range Aromatic Solvent:** Inhalation: high vapor concentrations are irritating to the eyes and the respiratory tract, may cause headaches, dizziness, anesthesia, drowsiness, unconsciousness, and other central nervous system effects, including death. Skin contact: frequent or prolonged contact may irritate and cause dermatitis, low order of toxicity. Skin contact may aggravate an existing dermatitis condition. Eye contact: Slightly irritating but

does not injure eye. Ingestion: Small amounts aspirated into the respiratory system during ingestion or vomiting may cause mild to severe pulmonary injury, possibly progressing to death. Emulsifier: Eye contact: May cause irritation and burns. Skin contact: May cause irritation. Prolonged or repeated skin contact may cause defatting, drying, dermatitis. Inhalation: May cause irritation, coughing, headache, nausea, drowsiness. Prolonged or repeated overexposure by inhalation may cause central nervous system depression (CNS). Symptoms of early to moderate CNS depression include giddiness, dizziness, confusion, drunken behavior, headache, nausea, diarrhea, vomiting, tiredness and drowsiness. In extreme cases, CNS depression may cause stupor, convulsions, unconsciousness, coma and even death. Ingestion: May cause nausea, vomiting, diarrhea, aspiration (breathing) of liquid, mist or vomitus into lungs may cause aspiration pneumonia, hemorrhaging, lung damage and even death. Symptoms of aspiration pneumonia include coughing, labored breathing and bluish skin.
Carcinogenicity: Malathion is not listed by NTP, IARC or regulated by OSHA as a carcinogen.
Medical Conditions Generally Aggravated by Exposure: Repeated exposures to cholinesterase inhibitors such as this product may, without warning, cause increased susceptibility to doses of any cholinesterase inhibitor.

Section 4: First Aid

Call a physician, Poison Control Center, or the National Pesticide Information Center at 1-800-858-7378 for treatment advice.
If swallowed: Do not induce vomiting unless told to do so by a physician or Poison Control Center. Do not give anything by mouth to an unconscious or convulsing person. **If on skin or clothing:** Take off contaminated clothing. Rinse skin immediately with water for 15-20 minutes. **If inhaled:** Move person to fresh air. If person is not breathing call 911 or an ambulance, then give artificial respiration, preferably mouth to mouth, if possible. **If in eyes:** Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
Note to physician: Malathion upon repeated, prolonged or careless use may cause cholinesterase inhibition. Atropine is antidotal.

Section 5: Fire Fighting Measures

Flash Point (Method Used): 113° F. closed cup.
Flammable Limits: LEL: 1.9 UEL: 12.6 (Solvent - approximate)
Extinguishing Media: Dry chemical, CO_2, foam or water spray. Avoid heavy hose streams to prevent spread of contaminated runoff.
Special Fire Fighting Procedures: Keep containers cool by spraying with water if exposed to fire. Fight fires from upwind. This pesticide is toxic to aquatic invertebrates and aquatic life stages of amphibians. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or public waters. Do not use heavy streams of water in order to prevent spread of contaminated runoff. Wear self contained breathing apparatus.
Unusual Fire and Explosion Hazards: Malathion decomposes when heated above 100° C. Explosions of sealed containers may occur. May give off dimethyl sulfoxide, sulfur dioxide, CO, CO_2 and phosphorus pentoxide upon exposure to high temperatures.

Section 6: Accidental Release Measures

Wear long sleeved shirt and long pants, chemical resistant gloves, such as barrier laminate, or Viton®, protective eyewear such as goggles and shoes plus socks. In enclosed areas wear suitable respiratory protection to prevent inhalation of vapors. Cover the spilled material with generous amounts of absorbent material, such as clay, diatomaceous earth, sand or sawdust. Sweep up the contaminated absorbent onto a shovel and put the sweepings into a salvage drum. Dispose of wastes as below. Place any leaking container into a similar drum or glass container.

Waste disposal method: Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

Container disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities.

Section 7: Handling and Storage

Precautions for handling and storage: Do not contaminate water, food or feed. Wash hands, arms and face with soap and water after use and before eating or smoking. Remove contaminated clothing and wash with soap and hot water before reuse.

Other precautions: Harmful if swallowed. Avoid breathing of vapors. Avoid contact with skin. Avoid contamination of water, feed or foodstuffs. Periodically inspect stored materials.

Section 8: Exposure Controls/Personal Protection

Respiratory protection: Use an approved pesticide respirator protecting against organophosphorus vapors.

Ventilation:

Local Exhaust: As required to meet TLV values.
Special: None.
Mechanical: As required to meet TLV values.
Other: None.

Protective Gloves: Chemical resistant such as barrier laminate or Viton®

Eye Protection: Safety glasses or goggles.

Other protective clothing or equipment: Wear long sleeved shirt, long pants, shoes and socks.

Work/Hygienic practices: Wash thoroughly after handling and before eating or smoking. Persons working with this product for long periods of time, or on a frequent basis, should have frequent blood tests of their cholinesterase levels. If the cholinesterase falls below the critical point, no further exposure should be allowed until it has been determined by means of blood tests the cholinesterase levels have returned to normal. Before removing gloves, wash them with soap and water. As soon as possible, wash thoroughly and change into clean clothing.

Section 9: Physical and Chemical Properties

Boiling Point:	N/D
Specific Gravity (H_2O = 1):	1.0604
Vapor Pressure (mmHg):	N/D
Melting Point:	N/D

Vapor Density (Air = 1):	N/D
Evaporation Rate (Butyl Acetate = 1):	N/D
Solubility in Water:	Emulsifies.
Appearance and Odor:	Water white to yellow liquid, mercaptan like odor.

Section 10: Stability and Reactivity

Stability:	Stable.
Conditions to avoid for stability:	Avoid storage at temperatures in excess of 78° F. for best stability.
Incompatibility:	Alkalies, iron and strong oxidizers.
Hazardous Decomposition or Byproducts:	CO, CO_2, phosphorus pentoxide, malaoxon, dimethyl sulfide, sulfur dioxide, and oxides of nitrogen.
Hazardous Polymerization:	Will not occur.
Conditions to avoid for Hazardous Polymerization:	None.

Section 11: Toxicological Information

Acute Toxicity (Malathion, except where noted):

Ingestion:	Oral LD_{50} (Rat)	5,500 mg/Kg
Dermal:	Dermal LD_{50} (Rat)	>2,000 mg/Kg
Inhalation:	Inhalation LC_{50} (Rat)	>5.2 mg/L/ 4 hour
Eye Contact:	This product is a severe eye irritant	
Skin Contact:	This product is a moderate primary skin irritant	
Skin Sensitization:	Not a skin sensitizer	

Carcinogenicity: IARC evaluation: the available data provide no evidence that malathion is likely to present a carcinogenic risk to humans.

Reproductive Effects: No effects on reproduction are found for malathion in rats and rabbits at maternal non toxic doses.

Teratogenicity: No indications of teratogenic effects of malathion are found.

Mutagenicity: Malathion is not mutagenic.

Section 12: Ecological Information

Malathion is biodegradable. It undergoes rapid degradation in the environment and in waste water treatment plants. No adverse effects are observed at concentrations up to 100 mg/L in waste water treatment plants. Degradation occurs both aerobically and anaerobically, biologically as well as abiologically. Under normal conditions malathion is of medium mobility in soil, but is degraded rapidly. Malathion is toxic to fish, aquatic invertebrates, and aquatic life stages of amphibians. Malathion is highly toxic to bees.

Acute toxicity:

Fish	96-h LC_{50}, Rainbow Trout	0.200 mg/L
Invertebrates	48-h LC_{50}, *daphnia magna*	1.0 ig/L
Birds	LD_{50}, Bobwhite Quail	400 mg/Kg
Honeybee	24-h LD_{50}, topical	0.27 ig/bee
	24-h LD_{50}, oral	0.38 ig/bee

Section 13: Disposal Considerations

Waste disposal method – follow label instructions for disposal of wastes generated during use in compliance with FIFRA product label. Container disposal: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities.

Section 14: Transport Information

DOT Classification:	COMBUSTIBLE LIQUID, N.O.S. (PETROLEUM NAPHTHA), NA1993, PGIII, RQ* (MALATHION)
Freight Classification:	INSECTICIDES; OTHER THAN POISON, NMFC ITEM 102120
International Transportation:	Not available.

Section 15: Regulatory Information

OSHA Status: This product is hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200.

TSCA Status: This product is exempt from TSCA regulation under FIFRA Section 3 (2) (B) (ii) when used as a pesticide.

SARA Title III Classification:

Section 302, Extremely Hazardous Substances:

Ethyl Benzene
Mixed Xylenes

Section 311/312: Acute health hazard, chronic health hazard, fire hazard

Section 313 chemicals:

Malathion (57%)	(CAS# 121-75-5)
1,2,4-Trimethyl Benzene (10.88%)	(CAS # 95-63-6)
Mixed Xylenes (1.02%)	(CAS # 1330-20-7)
Cumene (0.51%)	(CAS # 98-82-8)
Ethyl Benzene (0.0017%)	(CAS # 100-41-4)

This product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III and of 40 CFR 372. Any copies or redistribution of this MSDS must include this notice.

CERCLA Reportable Quantity: 175.4 lb. of this formula which contains 100 lb. of malathion

RCRA Status: This product does not contain any RCRA listed hazardous wastes

Section 16: Other Information

NFPA Hazard Ratings: Health: 2 **Flammability:** 2 **Reactivity:** 1

Date Prepared: December 3, 2002 **Supersedes:** December 19, 1994 **Reason:** Complete reformat/revision

MATERIAL SAFETY DATA SHEET

SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

Product identifier: **METHYL PARATHION 4 EC**

Product use: Insecticide.

Supplier's name and address:

Cheminova Inc.
1700 Route 23, Suite 300
Wayne, NJ, USA
07470
Phone #: (973) 305-6600 (8 AM to 5:00 PM EST, Monday to Friday)
Emergency Telephone #: 1-866-303-6950 (Medical Emergencies)
1-800-424-9300 (24 Hr. Chemtrec Number)
MSDS Prepared by: Cheminova Inc.
MSDS Preparation date: August 18, 2003
Revision date: March 29, 2005

Manufacturer's name and address:

Refer to supplier.

SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients	CAS #	% (weight)	ACGIH TLV (mg/m^3)	OSHA PEL (mg/m^3)
Parathion-methyl	298-00-0	30 – 60	0.2	N/Av
Aromatic solvent naphtha	64742-94-5	30 – 60	N/Av	N/Av
Xylene	1330-20-7	7 – 13	100 ppm	100 ppm
Valeric acid	109-52-4	0.5 – 1.5	N/Av	N/Av

This material is classified as hazardous under OSHA regulations (29CFR 1910.1200).

SECTION 3 — HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Amber liquid, rancid odor.

Danger! Flammable liquid and vapor. Dangerous exothermic decomposition may occur at temperatures greater than 212°F / 100°C. May be fatal if inhaled or swallowed. Can enter lungs and cause damage. Harmful if absorbed through the skin. Contains a material which can cause nervous system damage. May be dangerous for the environment. This material is toxic to birds, bees and aquatic invertebrates. In case of fire, use water fog, dry chemical, CO_2 or 'alcohol' foam. Water may be ineffective.

POTENTIAL HEALTH EFFECTS

Target organs: Eyes, skin, respiratory system, digestive system, nervous system.

Signs and symptoms of short-term (acute) exposure:

Inhalation: Methyl parathion is a very dangerous poison through inhalation. This material can cause rapid organophosphorous poisoning. Symptoms of poisoning may include headache, nausea, vomiting, blurred vision, tightness in chest, drooling and frothing of mouth and nose, convulsions, coma and death.

Skin contact: Direct skin contact may cause slight irritation. Methyl parathion can be rapidly absorbed through all skin surfaces. Causes symptoms similar to those listed for inhalation.

Eye contact: Direct eye contact may cause slight irritation. Methyl parathion can be rapidly absorbed through all skin and eye surfaces. Causes symptoms similar to those listed for inhalation.

Ingestion: Methyl parathion is a very dangerous poison through ingestion. Causes symptoms similar to those listed for inhalation. This product presents an aspiration hazard. Aspiration into the lungs may cause life-threatening lung injury.

Effects of long-term (chronic) exposure: Prolonged or repeated overexposure may cause behavioural changes. Prolonged or repeated skin contact may cause drying and cracking of the skin (dermatitis). Prolonged or repeated overexposure may cause liver effects.

SECTION 3 — HAZARDS IDENTIFICATION CONTINUED

Carcinogenicity: See TOXICOLOGICAL INFORMATION (Section 11).

Other important hazards: Cholinesterase inhibitor. May cause Central Nervous System depression. May cause damage to the peripheral nervous system. See TOXICOLOGICAL INFORMATION (Section 11).

Potential environmental effects: This material is highly toxic to fish and wildlife. See ECOLOGICAL INFORMATION (Section 12).

SECTION 4 — FIRST AID MEASURES

Inhalation: Immediately remove victim to fresh air. If breathing has stopped, begin artificial respiration immediately. Transport to a clinic or hospital immediately.

Skin: Immediately flush skin with running water for at least 15 minutes, while removing contaminated clothing and shoes. Obtain medical attention immediately. Thoroughly clean contaminated clothing before re-use.

Eyes: Immediately flush eyes with running water for at least 30 minutes. Get medical attention immediately.

Ingestion: If ingested, induce vomiting immediately, only as directed by medical personnel. Be aware that the product contains petroleum distillates which can cause aspiration. Never give anything by mouth if victim is unconscious or convulsing. Transport to a clinic or hospital immediately.

Note to physician: Methyl parathion is a cholinesterase inhibitor affecting the central and peripheral nervous systems and producing respiratory and cardiac depression. Decontamination procedures such as whole body washing, gastric lavage and administration of activated charcoal are often required. Administer atropine sulphate in large doses. Two to four mg intravenously or intramuscularly as soon as cyanosis is overcome. Repeat at 5 to 10 minute intervals until signs of atropinization appear. 2-PAM chloride is a pharmacological antidote and may be administered as an adjunct to, but not a substitute for atropine, which is a symptomatic and often life-saving antidote. DO NOT GIVE MORPHINE OR TRANQUILIZERS. At first sign of pulmonary edema, the patient should be given supplemental oxygen and treated symptomatically. Continued absorption of Methyl parathion may occur and relapse may occur after initial improvement. VERY CLOSE SUPERVISION OF THE PATIENT IS INDICATED FOR AT LEAST 48 HOURS.

SECTION 5 — FIRE FIGHTING MEASURES

Fire hazards/conditions of flammability: Flammable liquid. This material will burn when exposed to extreme heat, flame and other ignition sources. Material may decompose rapidly when exposed to heat and flame. Heat of decomposition may cause closed containers to build up pressure and explode.

Flammability classification (OSHA 29 CFR 1910.1200): Class II Combustible Liquid.

Flash point (Method): 122°F / 50°C (PMCC).

Lower flammable limit (% by volume): 1.0 (Xylene)
0.7 (Aromatic solvent naphtha)

Upper flammable limit (% by volume): 7.0 (Xylene)
7.0 (Aromatic solvent naphtha)

Explosion data:
Sensitivity to mechanical impact: Not sensitive.
Sensitivity to static discharge: Not expected to be sensitive to static discharge.

Auto-ignition temperature: 928°F (496°C) (Xylene)
830°F (443°C) (Aromatic solvent naphtha)

Suitable extinguishing media: For small fires, use dry chemical or carbon dioxide. For large fires, use water spray or foam.

Special fire-fighting procedures/equipment: Firefighters should wear proper chemically protective equipment and self-contained breathing apparatus operated in positive pressure mode. Move containers from fire area if it can be done without risk. Dike area to prevent water run-off. Water spray may be useful in cooling equipment and containers. Avoid spreading burning material with water jet.

Hazardous combustion products: Carbon oxides, nitrogen oxides, phosphorous oxides, sulfur oxides.

SECTION 6 — ACCIDENTAL RELEASE MEASURES

Personal precautions: Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. All persons dealing with clean-up should wear the appropriate chemically protective equipment. Refer to Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION, for additional information on acceptable personal protective equipment.

Environmental precautions: Ensure spilled product does not enter drains, sewers, waterways, or confined spaces. Dike far ahead of the spill for later recovery or disposal.

SECTION 6 — ACCIDENTAL RELEASE MEASURES CONTINUED

Spill response/Cleanup: Eliminate all sources of heat, sparks and flame. Ventilate area of release. Stop leak if you can do so without risk. For spills on the floor or other impervious surfaces, absorb spill with inert, non-combustible absorbent material, such as hydrated lime, Fuller's earth or other absorbent clays. Scoop up and place contaminated absorbent material into suitable containers for later disposal (see Section 13). Rinse spill area with soda lye. Do not flush to sewer or allow to enter confined spaces. Large spills that soak into the ground should be dug up, placed in suitable containers and disposed of appropriately (see Section 13). Notify the appropriate authorities.

Prohibited materials: None known.

Special spill response procedures: If a spill/release in excess of EPA reportable quantity is made into the environment, immediately notify the national response center (phone: 1-800-424-8802).

EPA/CERCLA Reportable quantity: **Methyl parathion** (RQ 100 lbs.)
Xylene (RQ 100 lbs.)
The additional chemical listed below is believed to be at trace levels or is a trace component of the Aromatic solvent naphtha (CAS # 64742-94-5):
Naphthalene, CAS # 91-20-3 (100 lbs.).

SECTION 7 — HANDLING AND STORAGE

Safe handling procedures: This material is a toxic liquid. Wear full chemically protective equipment during handling. Use only in well ventilated area. Avoid all contact with eyes, skin and clothing. Do not inhale vapors or mists. Keep away from all unprotected persons and children. Do not use near sources of heat, flame or direct sunlight. Methyl Parathion 4EC should never be heated above 131°F / 55°C and also local heating above this temperature should be avoided. Keep away from alkalies and incompatibles. Use caution when opening containers. Keep container tightly closed when not in use. Wash thoroughly after handling.

Storage recommendations: Store in a cool, dry, well ventilated area away from incompatibles. Avoid storage above 77°F / 25°C for prolonged periods of time. Protect container from physical damage. No smoking in the area. Inspect containers periodically for damage or leaks.

Special packaging materials: Always keep in containers made of the same materials as the supply container.

SECTION 8 — EXPOSURE CONTROLS AND PERSONAL PROTECTION

Ventilation and engineering controls: If handled indoors, provide mechanical exhaust ventilation to keep concentrations below specified TLV's and PEL's.

Respiratory protection: Respiratory protection is required. Wear a pesticide respirator jointly approved by the MSHA and NIOSH. Advice should be sought from respiratory protection specialists.

Protective gloves: Wear impervious chemical gloves, such as barrier laminate, butyl rubber, nitrile rubber or viton. Advice should be sought from glove suppliers.

Eye protection: Wear chemical splash goggles to prevent splashes from entering the eyes.

Other protective equipment: Wear impervious chemical apron and protective clothing (water-proof pants, coat, hat or rubber boots) to prevent skin contact. Other protective equipment, such as an eyewash station and safety shower, may be required depending on exposure and on workplace standards.

Permissible exposure levels: See Section 2.

General hygiene considerations: Do not breathe vapors or mists. Avoid contact all contact with eyes, skin and clothing. Before removing gloves, wash them with soap and water. Always wash hands, face and arms with soap and water before smoking, eating or drinking. After work, take off all protective equipment, work clothes and shoes, and wash with soap and water. Respirator should be cleaned and filter replaced according to manufacturer's instructions. Wear only clean, uncontaminated clothes when leaving place of work. Persons working with this product for a longer period should have frequent blood tests for cholinesterase levels. If the cholinesterase levels fall below a

critical point, no further exposure should be allowed until it has been determined, by means of blood tests, that cholinesterase levels have returned to normal.

SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES

Physical state, odor and appearance: Amber liquid, rancid odor.
Odor threshold: N/Av
Specific gravity (water = 1): 1.06 g/mL.
Solubility in water: 55-60 mg/L @ 68°F/20°C (Methyl parathion)
<0.1% @ 68°F/20°C (Aromatic solvent naphtha)
pH: N/Av.
Melting/freezing point: <63°F / 17°C.
Boiling point: 228°F / 109°C @ 1 mmHg (Methyl parathion)
280-291°F / 138-144°C (Xylene)
347-419°F / 175-215°C (Aromatic solvent naphtha)
Vapour pressure: Methyl parathion: 1.72 x 10^{-4} mmHg @ 77°F / 25°C
21.8 x 10-5 mmHg @ 113°F / 45°C
Aromatic solvent naphtha: 3.8 mmHg @ 100°F / 38°C
9.8 mmHg @ 131°F / 55°C
Xylene: 7 mmHg @ 77°F / 25°C
Vapour density (Air=1.0): N/Av
Percent Volatile by Weight: N/Av
Evaporation rate (n-BuAc=1.0): N/Ap
Coefficient of n-Octanol/water distribution: 3300 (Methyl parathion)

SECTION 10 — REACTIVITY AND STABILITY DATA

Stability and reactivity: Stable if handled below 131°F / 55°C and stored below 77°F / 25°C. At higher temperatures decomposition may take place and lower the quality of the product. The released heat from decomposition can raise the temperature further and accelerate decomposition. Chlorpyrifos can corrode iron, steel, tin plate and copper. It can be hydrolysed in water by heating and adjusting the pH (alkaline).
Hazardous polymerization: Methyl parathion will decompose rapidly when heated to temperatures above 212°F / 100°C, significantly increasing the risk of inducing explosions. The decomposition is to a considerable extent dependant on time as well as temperature due to exothermic and autocatalytic reactions. The reactions involve rearrangements and polymerisation releasing volatile, malodorous and inflammable compounds such as diethyl sulfide.
Conditions to avoid: Avoid heat, flame and direct sunlight.
Materials to avoid (incompatibles): Strong alkalies, strong oxidizing compounds.
Hazardous decomposition products: None known. Refer to 'Hazardous combustion products', Section 5.

SECTION 11 — TOXICOLOGICAL INFORMATION

Routes of exposure: Skin contact, skin absorption, eye contact, inhalation, and ingestion.
Toxicological data: LC_{50} (mg/L/4 hrs) = 0.119
LD_{50}, oral, rat (mg/kg) = 13
LD_{50}, dermal, rat (mg/kg) = 662
Carcinogenicity: This product does not contain any materials above reportable levels which are classified as carcinogenic by IARC, ACGIH, OSHA or NTP.
Teratogenicity, mutagenicity, other reproductive effects: None observed in test animals. This product does not contain any materials above reportable levels which are considered to be Teratogenic, mutagenic or reproductive effectors.
Sensitization to material: None known. This product does not contain any materials above reportable levels which are considered to be respiratory or skin sensitizers.
Synergistic materials: Not available.
Conditions aggravated by exposure: Repeated exposures to cholinesterase inhibitors, such as Methyl parathion, may without warning cause increased susceptibility to doses of any cholinesterase inhibitor.

SECTION 12 — ECOLOGICAL INFORMATION

Chemical fate information: The product should not be allowed to enter drains or water courses or be deposited where it can affect ground or surface waters. Do not discharge product unmonitored into the environment. This material is highly toxic to fish and wildlife. The active ingredient, Methyl parathion, is readily biodegradable. It undergoes rapid degradation in the environment and, without problems, in sewage treatment plants. No adverse effects are observed at concentrations up to 100 mg/L in waste water treatment plants. Degradation occurs both aerobically and anaerobically, and biologically as well as abiologically.

SECTION 12 — ECOLOGICAL INFORMATION CONTINUED

Ecotoxicological information: Methyl parathion is toxic to birds, bees and aquatic invertebrates. The acute toxicity is:

Fish – 96-Hr LC_{50} (95% CI), Rainbow trout *(Salmo gairdneri)* = 3.70 mg/L.
Invertebrates – 48-Hr EC_{50}, Daphnids *(Daphnia magna)* = 7.3 µg/L.
Birds – LD_{50}, Mallard = 10.0 mg/kg.
Bees - 24-Hr LD_{50}, worker honey-bees *(Apis mellifera)*, acute oral = 0.013 µg/bee.
24-Hr LD_{50}, worker honey-bees *(Apis mellifera)*, topical = 0.04 µg/bee

SECTION 13 — DISPOSAL CONSIDERATIONS

Handling for disposal: Handle waste according to recommendations in Section 7.

Methods of disposal: Do not contaminate water, foodstuffs, feed or seed by storage or disposal. Please contact the Manufacturer for information on returnable / refillable containers. For non-refillable containers, triple rinse (or equivalent) containers, then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill. Disposal must be in accordance with all applicable federal, state and local regulations. Contact your local, state or federal environmental agency for specific rules.

SECTION 14 — TRANSPORTATION INFORMATION

US 49 CFR information:

Proper Shipping Name: Organophosphorous pesticides, liquid, toxic, flammable (Methyl parathion, Aromatic solvent naphtha).
Primary Hazard Class: 6.1.
Label Codes: 6.1, 3.
Identification Number: UN3017
Packing Group: II.
Reportable Quantity: 100 lb
Marine Pollutant: Severe (PP).

Canadian Transportation of Dangerous Goods Clear Language (CLR) information:

Shipping description: ORGANOPHOSPHOROUS PESTICIDE, LIQUID, TOXIC, FLAMMABLE (Methyl parathion, Aromatic solvent naphtha), Class 6.1(3), UN3017, PGII.

SECTION 15 — REGULATORY INFORMATION

Canada:

WHMIS information: This product is a Pest Control Product and is not regulated as a Controlled Product under the Hazardous Products Act (HPA). However, for reference purposes only, this product would have the following WHMIS Classification if it were regulated as a Controlled Product under the HPA: **Class B3** *(Combustible Liquids)*; **Class D1A** *(Materials causing immediate and serious toxic effects, Very Toxic Material)*, **Class F** *(Dangerously Reactive Material)*.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and this MSDS contains all the information required by the CPR.

United States:

EPA/CERCLA Reportable Quantity (RQ): 100 lbs. (Methyl parathion).
100 lbs. (Xylene, CAS # 1330-20-7)
The additional chemicals listed below are believed to be at trace levels or are trace components.
100 lbs. (Naphthalene, CAS # 91-20-3).

SECTION 15 — REGULATORY INFORMATION CONTINUED

SARA TITLE III: *Sec. 313, Toxic Chemicals Notification, 40 CFR 372:* This material may be subject to the TSCA notification requirements, since it may contains Methyl parathion (CAS# 298-00-0) and Xylene (CAS # 1330-20-7) Toxic Chemical constituents. All of the additional Toxic Chemical constituents listed below are believed to be at trace levels or are trace components.

Chemical name	CAS Number
Napthalene	91-20-3
Trimethylbenzene	95-63-6

SECTION 16 — OTHER INFORMATION

HMIS Rating: *3 Health; 2 Flammability; 1 Reactivity

Legend:
ACGIH – American Conference of Governmental Industrial Hygienists
CAS - Chemical Abstract Service
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR – Code of Federal Regulations
EPA – Environmental Protection Agency
HMIS – Hazardous Materials Identification System
IARC – International Agency for Research on Cancer
Inh – Inhalation
MSHA – Mine Safety and Health Administration
N/Ap – Not Applicable
N/Av – Not Available
NIOSH – National Institute for Occupational Safety and Health
NTP – National Toxicology Program
OEHHA – Office of Environmental Health Hazard Assessment
OSHA – Occupational Safety and Health Act
PEL - Permissible Exposure Limit
PMCC – Pensky Martins Closed Cup
SARA - Superfund Amendments & Reauthorization Act
TLV – Threshold Limit Value
TSCA – Toxic Substances Control Act
TWA - Time Weighted Average
WHMIS – Workplace Hazardous Materials Information System

References:

1. ACGIH, Threshold Limit Values and Biological Exposure Indices for 2003.
2. Canadian Centre for Occupational Health and Safety, CCInfoWeb databases, 2003 (Chempendium and RTECs).
3. Material Safety Data Sheet from manufacturer.
4. International Agency for Research on Cancer Monographs, Supplement 7, 1988.
5. US EPA Title III List of Lists – October 2001 version.
6. California's OEHHA Proposition 65 List – July 11, 2003 version.

Prepared by: Chemtrova Inc.
Telephone #: (973) 305-6600 (8 AM to 5:00 PM EST, Monday to Friday)
Preparation date: August 18, 2003
Revision date: March 29, 2005

Parathion (cas 56-38-2) MSDS

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifiers

Product name : Parathion

Product Number : 45607
Brand : Fluka
Index-No. : 015-034-00-1
CAS-No. : 56-38-2

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

Identified uses : Laboratory chemicals, Manufacture of substances

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Acute toxicity, Inhalation (Category 2)
Acute toxicity, Oral (Category 2)
Acute toxicity, Dermal (Category 3)
Specific target organ toxicity - repeated exposure (Category 1)
Acute aquatic toxicity (Category 1)
Chronic aquatic toxicity (Category 1)

Classification according to EU Directives 67/548/EEC or 1999/45/EC
Toxic in contact with skin. Toxic: danger of serious damage to health by prolonged exposure if swallowed. Very toxic by inhalation and if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]
Pictogram

Signal word: Danger

Hazard statement(s)

H300	Fatal if swallowed.
H311	Toxic in contact with skin.
H330	Fatal if inhaled.
H372	Causes damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash hands thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing.
P284	Wear respiratory protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.

Supplemental Hazard Statements: none

According to European Directive 67/548/EEC as amended.
Hazard symbol(s)

R-phrase(s)

R24	Toxic in contact with skin.
R26/28	Very toxic by inhalation and if swallowed.
R48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

S-phrase(s)

S28	After contact with skin, wash immediately with plenty of soap and water.

S36/37	Wear suitable protective clothing and gloves.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S60	This material and its container must be disposed of as hazardous waste.
S61	Avoid release to the environment. Refer to special instructions/ Safety data sheets.

2.3 **Other hazards** - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 **Substances**

Synonyms : Parathion-ethyl
Ethylparathione
O,O-Diethyl O-(4-nitrophenyl) phosphorothioate

Formula : C10H14NO5PS

Molecular Weight : 291,25 g/mol

Component	Concentration
Parathion	
CAS-No. 56-38-2	-
EC-No. 200-271-7	
Index-No. 015-034-00-1	

4. FIRST AID MEASURES

4.1 **Description of first aid measures**

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 **Most important symptoms and effects, both acute and delayed**
Cholinesterase inhibitors can cause heavy salivation and secretion in the lungs, lachrymation, blurred vision, involuntary defecation, diarrhea, tremor, ataxia, sweating, hypothermia, lowered heart rate, and/or a fall in blood pressure as a result of their action at cholinergic nerve sites., Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer., Salivation, Coma., Tremors, Incoordination., Blurred vision, Lowered blood pressure, Diarrhoea, Headache, Nausea, Vomiting, Dizziness, Drowsiness, Confusion., Weakness, Unconsciousness, Palpitation, Anorexia., Cough, chest pain, Difficulty in breathing, Ataxia., Convulsions, sweating, Muscle cramps/spasms., Change in pupil size.

4.3 **Indication of any immediate medical attention and special treatment needed**
no data available

5. FIREFIGHTING MEASURES

5.1 **Extinguishing media**

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 **Special hazards arising from the substance or mixture**
Sulphur oxides, Phosphorous oxides
Nature of decomposition products not known.
Carbon oxides, nitrogen oxides (NOx), Sulphur oxides, Oxides of phosphorus

5.3 **Advice for firefighters**
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 **Further information**
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 **Personal precautions, protective equipment and emergency procedures**
Wear respiratory protection. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

6.2 **Environmental precautions**
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 **Methods and materials for containment and cleaning up**
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 **Reference to other sections**
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 **Precautions for safe handling**
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

7.2 **Conditions for safe storage, including any incompatibilities**
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature: 2 - 8 °C

7.3 **Specific end uses**
no data available

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 **Control parameters**

Components with workplace control parameters

8.2 **Exposure controls**

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 **Information on basic physical and chemical properties**

a)	Appearance	Form: liquid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	no data available
e)	Melting point/freezing point	no data available
f)	Initial boiling point and boiling range	157 - 162 °C at 0,8 hPa
g)	Flash point	120 °C - closed cup
h)	Evaporation rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower	no data available

flammability or explosive limits

k)	Vapour pressure	< 1 hPa at 25 °C
l)	Vapour density	no data available
m)	Relative density	1,270 g/cm3
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 3,8
p)	Autoignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 **Other safety information**
no data available

10. STABILITY AND REACTIVITY

10.1 **Reactivity**
no data available

10.2 **Chemical stability**
no data available

10.3 **Possibility of hazardous reactions**
no data available

10.4 **Conditions to avoid**
no data available

10.5 **Incompatible materials**
Bases

10.6 **Hazardous decomposition products**
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

11.1 **Information on toxicological effects**

Acute toxicity
LD50 Oral - cat - 0,93 mg/kg

LD50 Oral - dog - 3 mg/kg

LD50 Oral - guinea pig - 8 mg/kg

LDLO Oral - Human - 0,171 mg/kg

LDLO Oral - Human - female - 2.984,5 mg/kg
Remarks: Behavioral:Coma. Cardiac:Pulse rate increased without fall in BP. Respiratory disorder

LD50 Oral - rabbit - 10 mg/kg

LD50 Oral - rat - 2 mg/kg
Remarks: Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels:True cholinesterase.

LD50 Oral - Human - 3 mg/kg

LD50 Oral - Mammal - 49 mg/kg
Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Behavioral:Ataxia.

LD50 Oral - Bird (wild) - 1,33 mg/kg

LD50 Oral - duck - 2,1 mg/kg

LD50 Oral - Pigeon - 1,33 mg/kg

LD50 Oral - Quail - 4,04 mg/kg

LD50 Oral - chicken - 10 mg/kg

LC50 Inhalation - rat - 4 h - 84 mg/m3
Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Lungs, Thorax, or Respiration:Dyspnea.

LD50 Dermal - rat - 6,8 mg/kg

Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Behavioral:Excitement.

LD50 Dermal - rabbit - 18 mg/kg

LD50 Dermal - mouse - 19 mg/kg

LD50 Dermal - guinea pig - 45 mg/kg

LD50 Dermal - Bird (wild) - 1,8 mg/kg

LD50 Dermal - Duck - 28 mg/kg

LDLO Dermal - Human - 7,14 mg/kg

LD50 Intramuscular - mouse - 7,200 mg/kg

LD50 Intraperitoneal - rat - 2 mg/kg

LD50 Intraperitoneal - mouse - 3 mg/kg

Remarks: Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels:True cholinesterase.

LD50 Intraperitoneal - cat - 3 mg/kg

Remarks: Behavioral:Somnolence (general depressed activity). Behavioral:Tremor. Respiratory disorder

LD50 Intraperitoneal - dog - 12 mg/kg

Remarks: Behavioral:Somnolence (general depressed activity). Behavioral:Tremor. Respiratory disorder

LD50 Intraperitoneal - guinea pig - 12 mg/kg

LD50 Intratracheal - rat - 6,200 mg/kg

LD50 Intramuscular - rat - 6 mg/kg

LD50 Intraperitoneal - Chicken - 2,500 mg/kg

LDLO Intratracheal - Human - 0,714 mg/kg

LD50 Intravenous - rat - 3,800 mg/kg

Remarks: Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels: Other esterases.

LD50 Intravenous - mouse - 13 mg/kg

LD50 Intravenous - cat - 3 mg/kg

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

LD50 Intravenous - dog - 12 mg/kg

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Ataxia. Lungs, Thorax, or Respiration:Respiratory stimulation.

Parenteral: Peripheral Nerve and Sensation:Flaccid paralysis without anesthesia (usually neuromuscular blockage). Behavioral:Altered sleep time (including change in righting reflex). Lungs, Thorax, or Respiration:Other changes.

LD50 Subcutaneous - rabbit - 30 mg/kg

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Muscle contraction or spasticity. Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels:True cholinesterase.

LD50 Subcutaneous - rat - 9 mg/kg

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Muscle contraction or spasticity. Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels:True cholinesterase.

LD50 Subcutaneous - mouse - 10 mg/kg

LD50 Subcutaneous - guinea pig - 10 mg/kg

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Muscle contraction or spasticity. Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels:True cholinesterase.

Skin corrosion/irritation
Skin - rabbit - Mild skin irritation

Serious eye damage/eye irritation
Eyes - rabbit - Mild eye irritation

Respiratory or skin sensitization
no data available

Germ cell mutagenicity

Genotoxicity in vitro - rat - negative
Unscheduled DNA synthesis

Genotoxicity in vitro - Human - negative
Cytogenetic analysis

Genotoxicity in vitro - Hamster - ovary
Sister chromatid exchange

Genotoxicity in vitro - Ames test - Not mutagenic in Ames Test.

Genotoxicity in vitro - Human - lymphocyte
Sister chromatid exchange

Genotoxicity in vitro - Human - fibroblast
Unscheduled DNA synthesis

Genotoxicity in vivo - rat - Oral
DNA damage

Genotoxicity in vivo - mouse - Oral
DNA damage

Carcinogenicity

Carcinogenicity - rat - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Endocrine:Adrenal cortex tumors.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Parathion)

Reproductive toxicity

Reproductive toxicity - rat - Oral
Maternal Effects: Uterus, cervix, vagina.

Reproductive toxicity - rat - Oral
Effects on Newborn: Biochemical and metabolic. Effects on Newborn: Other postnatal measures or effects.

Developmental Toxicity - rat - Intraperitoneal
Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Maternal Effects: Other effects.

Developmental Toxicity - rat - Subcutaneous
Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - rat - Intraperitoneal
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
Ingestion - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
no data available

Potential health effects

Inhalation	May be fatal if inhaled. May cause respiratory tract irritation.
Ingestion	May be fatal if swallowed.
Skin	May be fatal if absorbed through skin. May cause skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure
Cholinesterase inhibitors can cause heavy salivation and secretion in the lungs, lachrymation, blurred vision, involuntary defecation, diarrhea, tremor, ataxia, sweating, hypothermia, lowered heart rate, and/or a fall in blood pressure as a result of their action at cholinergic nerve sites., Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer., Salivation, Coma., Tremors, Incoordination., Blurred vision, Lowered blood pressure, Diarrhoea, Headache, Nausea, Vomiting, Dizziness, Drowsiness, Confusion., Weakness, Unconsciousness, Palpitation, Anorexia., Cough, chest pain, Difficulty in breathing, Ataxia., Convulsions, sweating, Muscle cramps/spasms., Change in pupil size.

Additional Information
RTECS: TF4550000

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Cyprinodon variegatus (sheepshead minnow) - 0,01 - 0,07 mg/l - 96,0 h
	LC50 - Lepomis macrochirus (Bluegill) - 0,03 mg/l - 96,0 h
Toxicity to daphnia and other aquatic invertebrates	mortality LOEC - Daphnia magna (Water flea) - 0,25 µg/l - 48 h
	EC50 - Daphnia magna (Water flea) - 0,002 mg/l - 48 h

Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 3,6 mg/l - 72 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential
Bioaccumulation Pimephales promelas (fathead minnow) - 260 d -24,6 µg/l
Bioconcentration factor (BCF): 115

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
no data available

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

14.1 UN number
ADR/RID: 3278 IMDG: 3278 IATA: 3278

14.2 UN proper shipping name
ADR/RID: ORGANOPHOSPHORUS COMPOUND, TOXIC, LIQUID, N.O.S. (Parathion)
IMDG: ORGANOPHOSPHORUS COMPOUND, TOXIC, LIQUID, N.O.S. (Parathion)
IATA: Organophosphorus compound, toxic, liquid, n.o.s. (Parathion)

14.3 Transport hazard class(es)
ADR/RID: 6.1 IMDG: 6.1 IATA: 6.1

14.4 Packaging group
ADR/RID: I IMDG: I IATA: I

14.5 Environmental hazards
ADR/RID: no IMDG Marine pollutant: yes IATA: no

14.6 Special precautions for user
no data available

15. REGULATORY INFORMATION

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
no data available

15.2 Chemical Safety Assessment
no data available

16. OTHER INFORMATION

Further information
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information this document is based on the resent state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. guidechem shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

MATERIAL SAFETY DATA SHEET — PERMETHRIN

FOR CHEMICAL EMERGENCY, SPILL, LEAK, FIRE, EXPOSURE OR ACCIDENT, CALL CHEMTREC - DAY OR NIGHT 1-800-424-9300

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

FORMULATED FOR:

Loveland Products, Inc.
P.O. Box 1286 • Greeley, CO 80632-1286

24-Hour Emergency Phone: 1-800-424-9300
Medical Emergencies: 1-800-301-7976
U.S. Coast Guard National Response Center: 1-800-424-8802

PRODUCT NAME: PERMETHRIN
CHEMICAL NAME: Permethrin (3-Phenoxyphenyl) methyl (±) cis-trans-3- (2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate*
CHEMICAL FAMILY: Pyrethroid Insecticide
EPA REG. NO.: 34704-873
MSDS Number: 000873-05-LPI MSDS Revisions: New Date Of Issue: 03/11/05 Supersedes: New

2. HAZARDS IDENTIFICATION SUMMARY

KEEP OUT OF REACH OF CHILDREN – CAUTION - AVISO – Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle (If you do not understand the label, find someone to explain it to you in detail.) Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Avoid contact with eyes, skin or clothing. Wash thoroughly after handling.

This product is amber liquid with an aromatic solvent odor.

3. COMPOSITION, INFORMATION ON INGREDIENTS

Chemical Ingredients:	Percentage by Weight:	CAS No.	TLV (Units):
Permethrin	38.40	52645-53-1	not listed
Inert Ingredients, Including:	61.60		
Aromatic Hydrocarbons		64742-95-6	not listed

4. FIRST AID MEASURES

If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a poison control center or doctor for further treatment advice.

If on skin or clothing: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

If swallowed: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

NOTE TO PHYSICIAN: Vomiting should be supervised by a physician or the professional staff because of the possible pulmonary damages by aspiration of the solvent.

FOR A MEDICAL EMERGENCY INVOLVING THIS PRODUCT CALL: 1-800-301-7976. Have the product label or container with you when calling a poison control center or doctor, or going for treatment.

5. FIRE FIGHTING MEASURES

FLASH POINT (°F/Test Method): 105°F/42.2°C (CC)
FLAMMABLE LIMITS (LFL & UFL): None established
EXTINGUISHING MEDIA: Foam, CO_2, or dry chemical. Soft stream water fog only if necessary.
HAZARDOUS COMBUSTION PRODUCTS: Carbon monoxide and/or carbon dioxide. Chlorine and hydrogen chloride may be formed.
SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus with full protective clothing. Fight fire from upwind and keep all non-essential personnel downwind and out of area.
UNUSUAL FIRE AND EXPLOSION HAZARDS: If water is used to fight fire and cool the containers, contain run-off by diking to prevent contamination of water supplies. Containers in fire may burst or explode from excessive heat. Vapors may travel a considerable distance to source of ignition and flash back along vapor trail.

6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

For small spills, absorb with an absorbent material such as pet litter. Sweep up and transfer to containers for possible land application according to label use or for proper disposal. Wash the spill with water containing a strong detergent, absorb with pet litter or other absorbent material, sweep up and place in a chemical container and handle in an approved manner. Check local, state and federal regulations for proper disposal. Flush the area with water to remove any residue. For large spills: contain liquid by diking the area, keep product out of water supplies. Large spills that soak into ground should be dug up to a depth of 1 to 2 inches, placed in drums and disposed of in accordance with instructions provide under DISPOSAL, section 13 of this MSDS. Any recovered spilled liquid should be similarly collected and disposed of.

CAUTION: Keep spills and cleaning runoff out of municipal sewers and open bodies of water.

7. HANDLING AND STORAGE

HANDLING: Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

STORAGE: Do not store below 18°F/-12.2°C. Do not use or store near heat or open flame. Keep out of reach of children and animals. Store in original containers only. Store in a cool dry place and avoid excessive heat. Carefully open containers. After partial use, replace lids and close tightly. Do not contaminate other pesticides, fertilizers, water, food or feed by storage or disposal.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Not normally required.

RESPIRATORY PROTECTION: Not normally required; if vapors or mists become excessive, wear a NIOSH approved pesticide respirator with cartridges for pesticide vapors.

EYE PROTECTION: Chemical goggles or shielded safety glasses.

SKIN PROTECTION: Wear protective clothing: long-sleeved shirts and pants, shoes plus socks. Wear rubber or chemical-resistant gloves.

	OSHA PEL 8 hr TWA	ACGIH TLV-TWA
Xylene (mixed isomers)	435 mg/m^3	434 mg/m^3
Ethyl benzene	435 mg/m^3	434 mg/m^3
Trimethylbenzene	not listed	123 mg/m^3
Cumene	245 mg/m^3 (Skin)	245 mg/m^3

Personal Protective Equipment (PPE): Applicators and other handlers must wear: long sleeved shirt and long pants, chemical-resistant gloves, such as barrier laminate or Viton®, and shoes plus socks. Follow manufacturer's instructions for cleaning and maintaining PPE. If no instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR: Amber liquid with an aromatic solvent odor.

SOLUBILITY: Emulsifiable

SPECIFIC GRAVITY (Water = 1): 1.002 g/ml

BULK DENSITY: 8.35 lbs/gal.

pH: 5.0-5.5 (1% solution)

VAPOR PRESSURE: Not applicable

BOILING POINT: Not established

PERCENT VOLATILE (by volume): Not applicable

EVAPORATION RATE: Not applicable

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

10. STABILITY AND REACTIVITY

STABILITY: Stable

CONDITIONS TO AVOID: Excessive heat and fire.

INCOMPATIBILITY: Not established.

HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide and/or carbon dioxide, chlorine and hydrogen chloride may be formed in a fire situation.

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Acute Oral LD_{50} (rat): 1,030 mg/kg

Acute Dermal LD_{50} (rabbit): >2000 mg/kg

Eye Irritation (rabbit): Moderate eye irritant

Skin Irritation (rabbit): Not established

Inhalation LC_{50} (rat): 25.7 mg/L (4 hr).

Skin Sensitization (guinea pig): Not established.

Carcinogenic Potential: Ethyl benzene is listed as a Class 2B carcinogen (limited evidence for carcinogenicity in humans) by the International Agency for Research on Cancer (IARC). Ethyl benzene was found to be possibly carcinogenic to humans by NTP. Not listed by OSHA or ACGIH.

12. ECOLOGICAL INFORMATION

This pesticide is extremely toxic to fish and aquatic invertebrates. For terrestrial uses, do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply when weather conditions favor drift from target areas. Do not contaminate water by cleaning equipment or disposal of wastes. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow to drift to blooming crops if bees are visiting the treatment area.

13. DISPOSAL CONSIDERATIONS

Metal containers: Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or by other procedures approved by state and local regulations. Plastic Jugs: Triple rinse (or equivalent), then offer for recycling at an ACRC site (go to http://www.agrecycle.com/ for locations) or by reconditioning, or dispose of in a sanitary landfill, or, incineration, or, if allowed by state and local regulations, by burning. If burned, stay out of smoke. Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law.

14. TRANSPORT INFORMATION

DOT Shipping Description: LESS THAN 119 GALLONS NOT REGULATED BY USDOT FOR SURFACE (GROUND) TRANSPORTATION.
U.S. Surface Freight Classification: INSECTICIDES OR FUNGICIDES, INSECT OR ANIMAL REPELLENTS, NOI, OTHER THAN POISON (NMFC 102120; CLASS: 60)

Consult appropriate ICAO/IATA and IMDG regulations for shipment requirements in the Air and Maritime shipping modes. Packaging and classification for these modes of transportation are more stringent.

15. REGULATORY INFORMATION

NFPA & HMIS Hazard Ratings:

NFPA		HMIS	
2	Health	2	Health
2	Flammability	2	Flammability
1	Instability	1	Reactivity
		H	PPE

0 Least
1 Slight
2 Moderate
3 High
4 Severe

SARA Hazard Notification/Reporting
SARA Title III Hazard Category:

Immediate	Y	Fire	Y	Sudden Release of Pressure	N
Delayed	Y	Reactive	N		

Reportable Quantity (RQ) under U.S. CERCLA: Xylene (mixed isomers) (CAS: 1330-20-7) 100 pounds; Cumene (CAS: 98-82-8) 5000 pounds; Ethylbenzene (CAS: 100-41-1) 1000 pounds
SARA, Title III, Section 313: Permethrin (CAS: 52645-53-1) 36.40%; 1,2,4 Trimethylbenzene (CAS: 95-63-6): =17.0%; Xylene (mixed isomers) (CAS: 1330-20-7) = 2.0%; Cumene (CAS: 98-82-8) = 1.0%; Ethylbenzene (CAS: 100-41-1) =1.0%
RCRA Waste Code: Not listed.
CA Proposition 65: Not listed.

16. OTHER INFORMATION

MSDS STATUS: New

PREPARED BY: Registrations and Regulatory Affairs REVIEWED BY: Environmental/ Regulatory Services

®Viton is a registered trademark of DUPONT DOW ELASTOMERS L.L.C.

This product is a Restricted Use Pesticide (Toxic to Fish and Aquatic Organisms)

U.S. Patent No. 4,024,163

**cis/trans ratio: Max. 55% (+) cis and min. 45% trans*

Permethrin

sc-201319

Material Safety Data Sheet

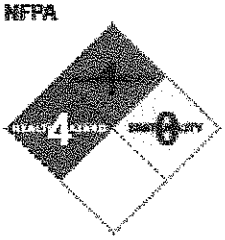
Hazard Alert Code Key: EXTREME | HIGH | MODERATE | LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Permethrin

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

NFPA



SUPPLIER
Santa Cruz Biotechnology, Inc.
2145 Delaware Avenue
Santa Cruz, California 95060
800.457.3801 or 831.457.3800
EMERGENCY:
ChemWatch
Within the US & Canada: 877-715-9305
Outside the US & Canada: +800 2436 2255
(1-800-CHEMCALL) or call +613 9573 3112

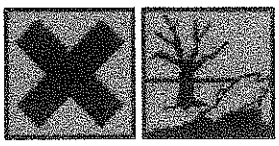
SYNONYMS
C21-H20-Cl2-O3, "cyclopropanecarboxylic acid, 3-(2, 2-dichlorovinyl)-2, 2-dimethyl, ", "3-phenoxybenzyl ester, (+/-)-, (cis, trans)-", "3-phenoxybenzyl (+/-)-3-(2, 2-dichlorovinyl)-2, 2-", dimethylcyclopropanecarboxylate, "3-phenoxybenzyl d-cis/trans-3-(2, 2-dichlorovinyl)-2, 2-dimethyl-1-", cyclopropane, -carboxylate, "(3-phenoxyphenyl)methyl-3-(2, 2-dichloroethenyl)-2, 2-dimethylcyclopropane", -carboxylate, Ambush, "Kestrel, "Talcord, Ambushtrin, "Outlaw, "Tornade, Coopex, "Peregin, "Perigen, Corsair, "Picket, Dragnet, "Pounce, Ectoban, "Prelmex, Exmin, "Qamlin, Exsmin, "Stockade, Kafil, "Stomosin, pyrethrum/pyrethroid /pyrethrin

Section 2 - HAZARDS IDENTIFICATION

CHEMWATCH HAZARD RATINGS

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

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



CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK

May cause SENSITISATION by skin contact.
Harmful by inhalation, in contact with skin 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

■ Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.

EYE

■ Although the material is not thought to be an irritant, direct contact with the eye may cause transient discomfort characterized by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.

SKIN

■ Skin contact with the material may be harmful; systemic effects may 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.
■ 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 be harmful.
■ 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.
■ This material, like natural pyrethrins, may cause central stimulation with nausea, vomiting, stomach upset, diarrhea, hypersensitivity, inco-ordination, tremors, muscle paralysis, convulsion, coma and respiratory failure. There may be aggressive behavior, tremor and weakness.
■ Inhalation of pyrethrins may produce nausea, vomiting, sneezing, serious nasal discharge, nasal stuffiness and asthma. High concentrations may produce hyperexcitability, incoordination, tremors, muscular paralysis and death (due to respiratory failure).
There have been some reports of transient facial tingling (paraesthesia) which lasts a few hours after exposure.

CHRONIC HEALTH EFFECTS

■ Skin contact with the material is more likely to cause a sensitization reaction in some persons compared to the general population.
There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment.
Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems.
There is some evidence that inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population.
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.
Chronic poisoning by natural pyrethrins may result in convulsion, tetanic paralysis, rapid and uneven heart beat, liver and kidney damage, or death.
The natural pyrethrins may produce hypersensitivity, especially following previous sensitising exposure. In general, repeated exposures over 2 or 3 years are required to elicit a response and involve exposure to pyrethrum rather than its individual components (including pyrethrins). The sesquiterpene lactone (pyrethrosin) and the pyrethrum glycoproteins account for the immediate and delayed hypersensitivity seen in guinea pigs following a single injection of ground chrysanthemum in Freud's adjuvant. Mild erythematic vesicular dermatitis (with papules), pruritus, localized oedema (particularly of the face, lips and eyelids), rhinitis, tachycardia, pallor and sweating are the most common syndromes. An initial skin sensitisation can progress to marked dermal oedema and skin cracking. Pyrethrum dermatitis appears to increase in hot weather or under conditions where heavy perspiration is produced. The active ingredients of pyrethrum (except pyrethrin II) are inactive in patch tests. Those patients allergic to ragweed pollen are particularly sensitive to pyrethrin.
Rats fed on a diet of pyrethrins for 5000 ppm for 2 years showed some signs of tissue damage including liver lesions, bile duct proliferation and focal necrosis of the liver cells. A no-effect level of 1000 ppm found in animal experiments correspond to a daily dose of 3500 mg/man.
One long-term mouse study provided evidence of oncogenicity in the lungs at high dose levels. Toxicological evidence from mutagenicity studies and from long-term mouse and rat studies suggest that permethrins oncogenic potential is low, is limited to female mice and is

probably epigenetic.
Oral administration in rats produced a marginal increase in pulmonary adenomas in males.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

NAME	CAS RN	%
permethrin	52645-53-1	100
being a mixture of trans and cis-isomers		
(typically 60:40) as		
trans-permethrin	51877-74-8	
cis-permethrin	61949-76-6	

Section 4 - FIRST AID MEASURES

SWALLOWED
- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY. - Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:

EYE
If this product comes in contact with the eyes: - Wash out immediately with fresh running water. - Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.

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

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

NOTES TO PHYSICIAN
For chronic or short term repeated exposures to pyrethrum and synthetic pyrethroids: Mammalian toxicity of pyrethrum and synthetic pyrethroids is low, in part because of poor bioavailability and a large first pass extraction by the liver. The most common adverse reaction results from the potent sensitizing effects of pyrethrins.

Section 5 - FIRE FIGHTING MEASURES

Vapour Pressure (mmHG):	Negligible.
Upper Explosive Limit (%):	Not available
Specific Gravity (water=1):	1.190-1.272
Lower Explosive Limit (%):	Not available

EXTINGUISHING MEDIA
- Foam.
- Dry chemical powder.

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

GENERAL FIRE HAZARDS/HAZARDOUS COMBUSTIBLE PRODUCTS
- Combustible 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.
Combustion products include: carbon monoxide (CO), carbon dioxide (CO_2), hydrogen chloride, phosgene, other pyrolysis products typical of burning organic material.

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

PERSONAL PROTECTION
Glasses:
Chemical goggles.
Gloves:
Respirator:

Particulate

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

Environmental hazard - contain spillage.

MAJOR SPILLS

■ Environmental hazard - contain spillage.

Moderate hazard.
- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING
- Avoid all personal contact, including inhalation.
- Wear protective clothing when risk of exposure occurs.

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

■ Glass container.
- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

■ Observe manufacturer's storing and handling recommendations.

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE CONTROLS

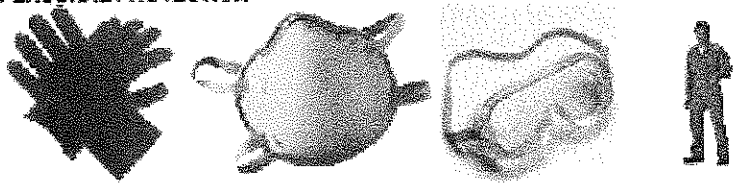
Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
Canada - Alberta Occupational Exposure Limits	permethrin (Pyrethrum)		5						
Canada - British Columbia Occupational Exposure Limits	permethrin (Pyrethrum)		5						S
US NIOSH Recommended Exposure Limits (RELs)	permethrin (Pyrethrum)		5						
US OSHA Permissible Exposure Levels (PELs) - Table Z1	permethrin (Pyrethrum)		5						
US ACGIH Threshold Limit Values (TLV)	permethrin (Pyrethrum)		5						TLV Basis: liver damage; lower respiratory

						tract irritation
US - Minnesota Permissible Exposure Limits (PELs)	permethrin (Pyrethrum)		5			
US - Vermont Permissible Exposure Limits Table Z-1-A Transitional Limits for Air Contaminants	permethrin (Pyrethrum)		5			
US - Vermont Permissible Exposure Limits Table Z-1-A Final Rule Limits for Air Contaminants	permethrin (Pyrethrum)		5			
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	permethrin (Pyrethrum)		5			
US - California Permissible Exposure Limits for Chemical Contaminants	permethrin (Pyrethrum)		5			
US - Idaho - Limits for Air Contaminants	permethrin (Pyrethrum)		5			
Canada - Quebec Permissible Exposure Values for Airborne Contaminants (English)	permethrin (Pyrethrum)		5			
US - Hawaii Air Contaminant Limits	permethrin (Pyrethrum)		5		10	
US - Alaska Limits for Air Contaminants	permethrin (Pyrethrum)		5			
Canada - Saskatchewan Occupational Health and Safety Regulations - Contamination Limits	permethrin (Pyrethrum)		5		10	
Canada - Yukon Permissible Concentrations for Airborne Contaminant Substances	permethrin (Pyrethrum)	-	5	-	10	
US - Washington Permissible exposure limits of air contaminants	permethrin (Pyrethrum)		5		10	

US - Michigan Exposure Limits for Air Contaminants	permethrin (Pyrethrum)	5		
Canada - Prince Edward Island Occupational Exposure Limits	permethrin (Pyrethrum)	5		TLV Basis: liver damage; lower respiratory tract irritation
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	permethrin (Pyrethrum)	5		
Canada - Nova Scotia Occupational Exposure Limits	permethrin (Pyrethrum)	5		TLV Basis: liver damage; lower respiratory tract irritation
US - Oregon Permissible Exposure Limits (Z-1)	permethrin (Pyrethrum)	5		
Canada - Northwest Territories Occupational Exposure Limits (English)	permethrin (Pyrethrum)	5	10	

ENDOELTABLE

PERSONAL PROTECTION



RESPIRATOR

Particulate

Consult your EHS staff for recommendations

EYE

- Safety glasses with side shields.
- Chemical goggles.

HANDS/FEET

NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.

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.
Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present.
- polychloroprene
- nitrile rubber
- butyl rubber
- fluorocaoutchouc
- polyvinyl chloride
Gloves should be examined for wear and/ or degradation constantly.

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

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.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.
Does not mix with water.
Sinks in water.

State	Divided solid	Molecular Weight	391.31
Melting Range (°F)	95-	Viscosity	Not Applicable
Boiling Range (°F)	428	Solubility in water (g/L)	Partly miscible
Flash Point (°F)	Not available	pH (1% solution)	Not applicable
Decomposition Temp (°F)	Not available.	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available.	Vapour Pressure (mmHG)	Negligible.
Upper Explosive Limit (%)	Not available	Specific Gravity (water=1)	1.190-1.272
Lower Explosive Limit (%)	Not available	Relative Vapor Density (air=1)	13.5
Volatile Component (%vol)	Negligible	Evaporation Rate	Not available

PERMETHRIN

log Kow (Sangster 1997): 6.5

APPEARANCE
Colourless crystals at temperatures below melting point, or a pale yellow viscous liquid. Soluble or miscible with organic solvents, except ethylene glycol. Exists as two isomers, the alpha cis isomer is more active against insects and arthropods. Usually transported as an emulsifiable racemic concentrate. The material is rapidly degraded in soil and biodegraded in mammals.

log Kow 3.48-6.5

Material	Value

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY
- Presence of incompatible materials.
- Product is considered stable.

STORAGE INCOMPATIBILITY
ie Pyrethrins and permethrins:
- are unstable in the presence of light, heat, moisture and air
- are hydrolysed by oxygen and/ or sunlight
- may react with strong oxidisers to produce fire and explosions
- are incompatible with alkalis.
- Avoid strong acids, bases.
Avoid reaction with oxidizing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

PERMETHRIN

TOXICITY AND IRRITATION
■ Unless otherwise specified data extracted from RTECS - Register of Toxic Effects of Chemical Substances.
■ The substance is classified by IARC as Group 3:
NOT classifiable as to its carcinogenicity to humans.
Evidence of carcinogenicity may be inadequate or limited in animal testing.
PERMETHRIN:

TOXICITY	IRRITATION
Oral (rat) LD50: 363 mg/kg	Skin (rabbit): 500 mg/24h - Mild
Inhalation (rat) LC50: 485 mg/m³	
Dermal (rat) LD50: 1750 mg/kg	
Dermal (mouse) LD50: >10000 mg/kg	
Oral (rabbit) LD50: 4000 mg/kg	
Dermal (rabbit) LD50: >2000 mg/kg	
Oral (guinea pig) LD50: 4000 mg/kg	
Oral (rat) LD50: 6000 mg/kg *	
cis/trans (None) ratio: 25:75: In corn oil	

■ [* The Pesticides Manual, Incorporating The Agrochemicals Handbook, 10th Edition, Editor Clive Tomlin, 1994, British Crop Protection Council].
Oral (rat) LD50: 430-4000 mg/kg *
Oral (mouse) LD50: 540-2960 mg/kg *
cis/trans ratio: 40:60
cis/trans ratio: 20:80
ADI: 0.05 mg/kg for nominal cis-trans 40:60 and 25:75 isomers only

TOXICITY	IRRITATION
TRANS-PERMETHRIN:	
Oral (mouse) LD50: 3100 mg/kg	Nil Reported
Intraperitoneal (mouse) LD50: 1000 mg/kg	
Subcutaneous (frog) LD50: 7.5 mg/kg	
CIS-PERMETHRIN:	
Intraperitoneal (mouse) LD50: 108 mg/kg	Nil Reported
Intravenous (mouse) LD50: 17 mg/kg	

CARCINOGEN

PERMETHRIN	US Environmental Defense Scorecard Suspected Carcinogens	Reference(s)	OPP-CAN

Section 12 - ECOLOGICAL INFORMATION

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

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
permethrin	HIGH		HIGH	LOW

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.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.

Section 14 - TRANSPORTATION INFORMATION

DOT:
Symbols: G Hazard class or Division: 9
Identification Numbers: UN3077 PG: III
Label Codes: 9 Special provisions: 6, 146,
335, B54,
IB8, IP3,
N20, T1,
TP33
Packaging: Exceptions: 155 Packaging: Non- bulk: 213
Packaging: Exceptions: 155 Quantity limitations: No limit
Passenger aircraft/rail:
Quantity Limitations: Cargo No limit Vessel stowage: Location: A
aircraft only.
Vessel stowage: Other: None
Hazardous materials descriptions and proper shipping names:
Environmentally hazardous substance, solid, n.o.s

Air Transport IATA:
ICAO/IATA Class: 9 ICAO/IATA Subrisk: None
UN/ID Number: 3077 Packing Group: III
Special provisions: A97
Cargo Only
Packing Instructions: 911 Maximum Qty/Pack: 400 kg
Passenger and Cargo Passenger and Cargo
Packing Instructions: 911 Maximum Qty/Pack: 400 kg
Passenger and Cargo Limited Quantity Passenger and Cargo Limited Quantity
Packing Instructions: Y911 Maximum Qty/Pack: 30 kg G
Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID,
N.O.S. *(CONTAINS PERMETHRIN)

Maritime Transport IMDG:
IMDG Class: 9 IMDG Subrisk: None
UN Number: 3077 Packing Group: III
EMS Number: F-A , S-F Special provisions: 179 274 335 909

Limited Quantities: 5 kg Marine Pollutant: Yes
Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.

Section 15 - REGULATORY INFORMATION

permethrin (CAS: 52645-53-1,54774-45-7,57608-04-5,93388-66-0,63364-00-1,60018-94-2,75497-64-2) is found on the following regulatory lists;
"Canada - Saskatchewan Environmental Persistent or Chronic Hazardous Substances","OSPAR: Substances removed from the List of Substances of Possible Concern","US - Massachusetts Oil & Hazardous Material List","WHO Guidelines for Drinking-water Quality - Chemicals for which guideline values have not been established"

Regulations for ingredients

trans-permethrin (CAS: 51877-74-8) is found on the following regulatory lists;
"Canada - Saskatchewan Environmental Persistent or Chronic Hazardous Substances","US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List","US - Massachusetts Oil & Hazardous Material List","US - Pennsylvania - Hazardous Substance List","US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act"

cis-permethrin (CAS: 61949-76-6) is found on the following regulatory lists;
"Canada - Saskatchewan Environmental Persistent or Chronic Hazardous Substances","US - California Occupational Safety and Health Regulations (CAL/OSHA) - Hazardous Substances List","US - Massachusetts Oil & Hazardous Material List","US - Pennsylvania - Hazardous Substance List","US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","US List of Lists - Consolidated List of Chemicals Subject to EPCRA, CERCLA and Section 112(r) of the Clean Air Act"

Section 16 - OTHER INFORMATION

ND
Substance CAS Suggested codes cis- permethrin 61949- 76- 6

Ingredients with multiple CAS Nos
Ingredient Name CAS permethrin 52645-53-1, 54774-45-7, 57608-04-5, 93388-66-0, 63364-00-1, 60018-94-2, 75497-64-2

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

■ Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.
A list of reference resources used to assist the committee may be found at:
www.chemwatch.net/references.

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

Issue Date: Oct-22-2009
Print Date:Dec-22-2010

Gowan

MATERIAL SAFETY DATA SHEET

Imidan 2.5-EC

Agricultural Insecticide

Product:

Formulator: Gowan Company
P.O. Box 5569
Yuma, Arizona 85366-5569
(928) 783-8844

Emergency Phone: (928) 783-3803

For 24-Hour Emergency Assistance (Spill, Leak, Fire, or Exposure), Call CHEMTREC®: Inside the U.S.: (800) 424-9300
Outside the U.S.: (703) 527-3887

For MEDICAL Emergency: (888) 478-0798

1. CHEMICAL IDENTIFICATION

Product:	Imidan 2.5 EC		
EPA Signal Word:	Warning	**EPA Registration No.:**	10163-215
Active Ingredient:	Phosmet (27.5%)	**CAS No.:**	732-11-6
Chemical Name:	N-(Mercaptomethyl)phthalimide, S-(O,O-dimethyl phosphorodithioate)		
Chemical Class:	Organophosphorous Pesticide		

2. COMPOSITION/INFORMATION ON INGREDIENTS

INGREDIENT NAME	OSHA – PEL	ACGIH – TLV	OTHER	NTP/IARC/OSHA CARCINOGEN
Phosmet (27.5%)	None	None	Not established	No
Naphthalenes (8.4%) CAS# 91-20-3	10 PPM	10 ppm	Not established	No

3. HAZARDS IDENTIFICATION

Physical Properties

Appearance: Slight yellow liquid
Odor: Aromatic solvent odor

Symptoms of Acute Exposure

The active ingredient is an organophosphate, which, produces cholinesterase inhibition in experimental animals. Symptoms of cholinesterase inhibition include salivation, sweating, headache, nausea, muscle twitching, tremors, incoordination, blurred vision, tears, abdominal cramps, diarrhea, and chest discomfort.

Medical Conditions Likely to be Aggravated by Exposure

No specific medical conditions are known which may be aggravated by exposure to the active ingredient in this product; however, any disease, medication, or prior exposure which reduces normal cholinesterase activity may increase susceptibility to the toxic effects of the active ingredient.

Primary Routes of Exposure

Harmful if ingested, inhaled, absorbed into skin or if it comes into contact with the eyes.

Hazardous Decomposition Products

Burning can form carbon monoxide.

Unusual Fire, Explosion, and Reactivity Hazards

High heat, sparks, open flame, or strong oxidizers may ignite this material.

4. FIRST AID MEASURES

If poisoning is suspected, immediately contact a physician, the nearest hospital, or the nearest Poison Control Center. Tell the person contacted the complete product name, and the type and amount of exposure. Describe any symptoms and follow the advice given.

Ingestion: Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger or if available by administering syrup of ipecac. If person is unconscious, do not give anything by mouth and do not induce vomiting.

Inhalation: Remove to fresh air. If not breathing, clear victim's airway and start mouth-to-mouth artificial respiration. If breathing is difficult, give oxygen, preferably with a physician's assistance.

Eye Contact: Immediately flush eyes with plenty of water. Get medical attention if irritation persists.

Skin Contact: Flush all affected areas with plenty of water for several minutes. Seek medical attention if skin irritation occurs.

Note to Physician

May cause cholinesterase depression. Atropine sulfate is antidotal. 2-PAM is also antidotal and may be administered in conjunction with atropine. Administer atropine sulfate in large therapeutic doses. Repeat as necessary to the point of tolerance. Compound inhibits cholinesterase, resulting in stimulation of the central nervous system, the parasympathetic nervous system and the somatic motor nerves. Do not give morphine. Watch for pulmonary edema, which may develop in serious cases of poisoning even after 24-48 hours. At first sign of pulmonary edema, the patient should be placed in an oxygen tent and treated symptomatically.

FOR MEDICAL EMERGENCIES INVOLVING THIS PRODUCT, CALL TOLL FREE: (888) 478-0798

5. FIRE FIGHTING MEASURES

Flashpoint (test method): Minimum 200°F (93°C) TCC

Appropriate Extinguishing Media

Use water spray, CO_2, foam, and dry chemical.

Fire Fighting Guidance

The active ingredient in this formulation is a cholinesterase inhibitor. Refer to Section 4 – First Aid Measures for additional information regarding overexposure. Products of combustion are irritating to the respiratory tract and may cause breathing difficulty and pulmonary edema. Symptoms may be delayed several hours or longer depending upon the extent of exposure. As in any fire, prevent human exposure to fire, smoke, fumes, or products of combustion. Evacuate nonessential personnel from the fire area. Fire fighters should wear full-face self-contained breathing apparatus and impervious protective clothing. Use standard fire fighting techniques to extinguish fires involving this material - use water spray, dry chemicals, or carbon dioxide. Use of high-pressure water hose may spread product from broken containers increasing contamination hazard. Contaminated buildings, areas, and equipment must not be used until they are properly decontaminated.

Unusual Fire, Explosion, and Reactivity Hazards

High heat, sparks, open flame, or strong oxidizers may ignite this material.

6. ACCIDENTAL RELEASE MEASURES

In Case of Spills or Leaks

Eliminate all ignition sources; notify spill response personnel; stop the leakage; ventilate the area if appropriate. Dike a large spill; transfer to tank. Use suitable absorbent for a small spill; shovel into containers. Make sure all personnel involved in the spill cleanup follow good industrial hygiene practices. Any person entering either a significant spill area or an unknown concentration of a gas, vapor, or dust should use a NIOSH-approved pesticide respirator. Small spills can be handled routinely. Use adequate ventilation and/or wear a NIOSH-approved pesticide respirator to prevent inhalation exposure. Wear protective clothing to prevent inhalation exposure. Wear protective clothing to prevent skin and eye contact.

7. HANDLING AND STORAGE

May be harmful if swallowed, inhaled or absorbed through the skin. Avoid breathing spray mist. Avoid contact with skin, eyes, or clothing. Do not contaminate water, food or feed by storage or disposal. Store in the original container and keep closed. Store containers in a cool, dry place.

Precautions in Storing

Class IIIB combustible liquid storage is required by OSHA (CFR 1910.106). Protect against physical damage; store separate from oxidizing materials. Do not store within reach of children. Containers should be stored in a cool, dry, well-ventilated area away from flammable materials and sources of heat or flame. Exercise caution to prevent damage due to leakage from the container. Keep food and animal feed in separate areas away from the storage or use location..

Storage

Store in a cool, dry place and in such a manner as to prevent cross contamination with other pesticides, fertilizers, food and feed.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Control

This product is intended for use outdoors where engineering controls are not necessary. If use conditions are different (e.g. product reformulation or repackaging), employee exposure should be minimized using traditional techniques such as enclosed system design and/or local exhaust ventilation.

Personal Protection

Eye/Face	Wear protective eyewear such as chemical safety glasses, goggles, or a face shield.
Skin Protection	Applicators and other handlers should wear long-sleeved shirt and long pants, chemical-resistant gloves such as Barrier Laminate or Viton ≥ 14 mils, shoes plus socks.
Respiratory Protection	Not required; but to avoid inhalation of excess vapors wear a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C).
Additional Protection Information	Have eyewash and safety shower easily accessible to the work area. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining personal protective equipment (PPE). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.
Applicators/Handlers	Applicators and other handlers should wear long-sleeved shirt and long pants, chemical-resistant gloves such as Barrier Laminate or Viton ≥ 14 mils, shoes plus socks.
User Safety Recommendations:	Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Slight yellow liquid
Odor:	Aromatic solvent odor
Specific Gravity/ Density:	1.1 / 9.12 lbs./gal.
Solubility in H_2O	
Phosmet	Negligible
Vapor Pressure	
Phosmet	4.5E-07 mm Hg

10. STABILITY AND REACTIVITY

Stability:	Stable under normal storage conditions
Hazardous Polymerization:	Will not occur
Decomposition Products:	Burning can form carbon monoxide..
Hazardous Mixtures:	Not determined
Conditions To Avoid:	High heat, sparks, and open flames.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity/Irritation Studies

Oral:	Acute Oral LD_{50} (rat):	179 mg/kg (combined sexes)
Inhalation:	Acute Inhalation LC_{50} (rat)	0.99 mg/L (combined sexes), 4 hours
Dermal:	Acute Dermal LD_{50} (rabbit-male):	>2000 mg/kg (combined sexes)
Eye Contact:	Moderate to severe, reversible irritation	
Skin Contact:	Moderate, reversible irritation	
Skin Sensitizer:	Dermal sensitizer	

12. ECOLOGICAL INFORMATION

Summary of Effects

Phosmet

This material is extremely toxic to fish and wildlife. Do not contaminate water by cleaning of equipment or by disposal of wastes. Untreated effluent should not be discharged where it will drain into lakes, streams, or ponds.

13. DISPOSAL CONSIDERATION

Pesticide Disposal

Pesticide waste are toxic. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal law. If these waste cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional office for guidance.

Container Disposal

Triple rinse (or equivalent) the empty container. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by State and local authorities.

14. TRANSPORT INFORMATION

DOT Classification

Organophosphorus Pesticide, Liquid, Toxic, 6.1, UN 3018, PGIII

International Maritime Organization

Organophosphorus Pesticide, Liquid, Toxic, 6.1, UN 3018, PGIII, Marine Pollutant

International Civil Aviation Organization

Organophosphorus Pesticide, Liquid, Toxic, 6.1, UN 3018, PGIII, Marine Pollutant

15. REGULATORY INFORMATION

SARA Title III Classification

Section 302/304:	Not applicable
Section 311/312:	Immediate (acute) health hazard Fire hazard
Section 313 chemical(s):	Not applicable

Extremely Hazardous Substance (EHS)
Not applicable

Proposition 65
Not applicable

CERCLA Reportable Quantity (RQ)
130 gals product (100 lbs. Napthalene)

RCRA Classification
If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste.

TSCA Status
Exempt from TSCA

16. OTHER INFORMATION

NFPA Hazard Ratings

Health:	2
Flammability:	1
Reactivity:	0

0	Least
1	Slight
2	Moderate
3	High
4	Severe

Notice: The information and recommendations contained herein are provided in good faith and are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information herein.

Prepared By:
Gowan Company
(928) 783-8844

Imidan® is a registered trademark of Gowan Company, L.L.C.

Gowan
CANADA

MATERIAL SAFETY DATA SHEET

1. PRODUCT AND COMPANY IDENTIFICATION

Gowan Company
P.O. Box 5569
Yuma, Arizona 85366-5569
(800) 883-1844

Emergency telephone number: (928) 783-3803

For 24-hour emergency assistance (spill, leak, fire, or exposure), call CHEMTREC®:
Inside the U.S.: (800) 424-9300
Outside the U.S.: (703) 527-3887

For medical emergency: (888) 478-0798

Product:	**Imidan® 50-WP Instapak®**		
Signal Word:	DANGER	**PCP Registration No.:**	23006
Active Ingredient:	Phosmet (50%)	**CAS No.:**	732-11-6
Chemical Name:	*N*-(Mercaptomethyl)phthalimide, *S*-(*O*,*O*-dimethyl phosphorodithioate)		
Chemical Class:	Organophosphorous Pesticide		

2. HAZARDS IDENTIFICATION

Physical Properties
Appearance: Tan powder
Odour: Mercaptan odour

Symptoms of Acute Exposure
The active ingredient is an organophosphate, which produces cholinesterase inhibition in experimental animals. Symptoms of cholinesterase inhibition include salivation, sweating, headache, nausea, muscle twitching, tremors, incoordination, blurred vision, tears, abdominal cramps, diarrhoea and chest discomfort. Exposure to high concentrations of dust may result in symptoms related to cholinesterase inhibition.

Medical Conditions Likely to be Aggravated by Exposure
No specific medical conditions are known which may be aggravated by exposure to the active ingredient in this product; however, any disease, medication or prior exposure which reduces normal cholinesterase activity may increase susceptibility to the toxic effects of the active ingredient.

Primary Routes of Exposure
Harmful if ingested, inhaled, absorbed into skin or if it comes into contact with the eyes.

3. COMPOSITION/INFORMATION ON INGREDIENTS

	Component	CAS No.	% by weight
Active Ingredient:	Phosmet	732-11-6	50%

Only the identities of the active ingredient(s) and any hazardous inert ingredients are listed. Specific information on all of this product's ingredients can be obtained by the treating medical professional or spill emergency responder for the management of exposures, spills, or safety assessments.

4. FIRST AID MEASURES

Ingestion may result in poisoning.

1. Keep airways open. Use artificial respiration, if necessary.
2. If ingested and patient is conscious, induce vomiting. Do not induce vomiting if patient is unconscious or in a convulsive state.
3. Call physician or poison control centre.
4. Wash skin of material and vomitus.
5. Save suspected agent and vomitus, if container is available, for disposal by physician.
6. In case of contact with skin, wash immediately with soap and water.
7. If in eyes, flush with clean water.

Take container, label, or product name and Pest Control Product Registration Number with you when seeking medical attention.

Emergency Medical Care

1. Induce vomiting or lavage stomach.
2. Phosmet is a cholinesterase inhibitor. Symptoms of poisoning include nausea, headache, weakness, impaired vision, sweating, tightness in the chest, convulsions.

Atropine is antidotal. 2-PAM (pralidoxime) also is antidotal when administered early and in conjunction with atropine. **Consult your local poison control centre for additional information.**

FOR MEDICAL EMERGENCIES INVOLVING THIS PRODUCT, CALL TOLL FREE: (888) 478-0798

5. FIRE FIGHTING MEASURES

Flashpoint (test method):	Not applicable
Flammable Limits (% in air):	Not applicable
Autoignition Temperature:	Not available

Fire Fighting Procedures

The active ingredient in this formulation is a cholinesterase inhibitor. Refer to Section 4 FIRST AID MEASURES for additional information regarding overexposure. Products of combustion are irritating to the respiratory tract and may cause breathing difficulty and pulmonary oedema. Symptoms may be delayed several hours or longer depending upon the extent of exposure. As in any fire, prevent human exposure to fire, smoke, fumes, or products of combustion. Evacuate nonessential personnel from the fire area. Fire fighters should wear full-face self-contained breathing apparatus and impervious protective clothing. Use standard fire fighting techniques to extinguish fires involving this material: use water spray, dry chemicals or carbon dioxide. Use of high-pressure water hose may spread product from broken containers increasing contamination hazard. Contaminated buildings, areas, and equipment must not be used until they are properly decontaminated.

Extinguishing Media

In case of fire, use water spray (fog), dry chemical or carbon dioxide (CO_2).

Hazardous Decomposition Products

Combustion products and toxic materials.

Unusual Fire, Explosion, and Reactivity Hazards

Not defined as flammable or combustible. However, under fire conditions, the product may support combustion and decompose to give off toxic materials.

6. ACCIDENTAL RELEASE MEASURES

In Case of Spills or Leaks

Make sure all personnel involved in the spill cleanup follow good industrial hygiene practices. Small spills can be handled routinely. Any person entering a significant spill area, areas with inadequate ventilation, or an area with an unknown concentration of a gas, vapour or dust should use an air-supplied respirator to prevent inhalation exposure. Wear protective clothing and eye protection to prevent skin and eye contact. Sweep up spilled material, being careful not to create dust. Place sweepings in an open drum. Generously cover the contaminated area with a common, powdered household detergent. Using a stiff brush and small amounts of water, work the detergent into the spill material forming a slurry. Do not splatter on one's self or bystanders, and completely avoid skin or eye contact with this material. Brush the slurry into cracks and crevices and allow to stand for 2-3 minutes. Spread a suitable absorbent such as clay, sawdust, or kitty litter on the slurried liquid. Shovel absorbed material into an open drum. Repeat if necessary. Flush area with water while observing proper environmental considerations. Seal drum and dispose of contaminated material in an approved pesticide landfill. Large spills must be handled according to a predetermined plan. For assistance in developing a plan, contact Gowan Company.

7. HANDLING AND STORAGE

Handling

Water-soluble sachets are contained in a protective container. Do not open sachets or allow sachets to become wet prior to adding to the spray tank. Harmful if swallowed, inhaled or absorbed through the skin. Do not get in eyes or on skin, or on clothing. Wear protective clothing, including rubber gloves and goggles, during mixing, loading and spraying. Do not breathe spray mist. Wash all contaminated clothing with soap and hot water before reuse. Do not contaminate feed or food. Wear clean clothes. Avoid drift to adjoining food and forage crops.

Storage

DO NOT contaminate water, food or feed by storage or disposal. Follow procedures specified in the National Fire Protection Association Codes and Standards for handling combustible dusts. Maintain good housekeeping to avoid dust build-up. Do not store within the reach of children. Containers should be stored in a well-ventilated area away from flammable materials and sources of heat or flame.

End-users can store this product at temperatures below 0°C provided handling is minimal. Warehouse storage and handling, and shipping must be at temperatures above 0°C. At temperatures below 0°C, soluble film packaging becomes susceptible to cracking and breakage due to handling and shipping. Keep water-soluble sachets in their protective container and store in a cool, dry place. Do not store at temperatures above 40°C.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal Protection

Eye/face protection: Protective eyewear is not required; however to avoid eye contact with the material, choose protective eyewear appropriate to exposure potential.

Skin protection: Applicators and other handlers must wear a long-sleeved shirt and long pants, waterproof gloves, shoes plus socks, and chemical-resistant headgear for overhead exposure.

Respiratory protection: Use a dust/mist filtering respirator.

Applicators/handlers: Applicators and other handlers must wear a long-sleeved shirt and long pants, waterproof gloves, shoes plus socks, and chemical-resistant headgear for overhead exposure.

Additional protection information: Have eyewash and safety shower easily accessible to the work area. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining personal protective equipment (PPE). If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

Engineering Control

This product is intended for use outdoors where engineering controls are not necessary. If use conditions are different (e.g. product reformulation or repackaging), employee exposure should be minimized using traditional techniques such as enclosed system design and/or local exhaust ventilation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Tan powder
Odour:	Mercaptan odour
Melting Point:	Not applicable
Boiling Point:	Not applicable
Specific Gravity/Density:	15 lbs./ft^3
Solubility in H_2O	
Phosmet:	Not applicable
Vapour Pressure	
Phosmet:	Not applicable

10. STABILITY AND REACTIVITY

Stability:	Stable under normal storage conditions.
Hazardous Polymerization:	Will not occur.
Decomposition Products:	Combustion products; toxic materials.
Hazardous Mixtures:	Relatively non-reactive. Non-corrosive to materials commonly used in the construction of process equipment, storage and shipping containers.
Conditions to Avoid:	Excessive heat.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity/Irritation Studies

Oral LD_{50} (rat):	377 mg/kg (male), 275 mg/kg (female)
Dermal LD_{50} (rabbit):	>2000 mg/kg (sexes combined)
Inhalation LC_{50} (rat):	>20.5 mg/L (sexes combined, 4 hours)
Eye Contact (rabbit):	Mild irritation
Skin Contact (rabbit):	Mild irritation
Skin Sensitization (guinea pig):	Not a skin sensitizer

12. ECOLOGICAL INFORMATION

Summary of Effects – Phosmet

This pesticide is extremely toxic to fish. Do not apply directly to water, to area where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash water. This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops while bees are actively visiting the treatment areas.

13. DISPOSAL CONSIDERATIONS

Observe all labelled safeguards until container is cleaned, reconditioned or destroyed. Completely empty container into transfer or application equipment. Do not reuse container. Triple or jet rinse the container then offer for recycling or reconditioning. If offering for reconditioning, contact the manufacturer. If offering for recycling, remove all caps, labels and booklets and take to a pesticide container depot. Recycling sites are identified on the CropLife Canada (Clean Farms) website at: www.croplife.ca. For information on the disposal of unused, unwanted product, contact the manufacturer or the provincial regulatory agency. Contact the manufacturer or the provincial regulatory agency in case of spill, and for clean-up of spills.Pesticide Disposal

14. TRANSPORT INFORMATION

TDG Classification
UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., (phosmet), 9, PG III

International Maritime Organization
UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., (phosmet), 9, PG III, MARINE POLLUTANT

International Civil Aviation Organization
UN3077, ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S., (phosmet), 9, PG III

15. REGULATORY INFORMATION

WHMIS Classification
This product is registered under the Pest Control Products Act and has been prepared in accordance with the WHMIS requirements..

16. OTHER INFORMATION

NFPA Hazard Ratings

Health:	2
Flammability:	0
Reactivity:	0

0	Least
1	Slight
2	Moderate
3	High
4	Severe

Prepared by:
Gowan Company
(800) 883-1844

Notice: The information and recommendations contained herein are provided in good faith and are based upon data believed to be correct. However, no guarantee or warranty of any kind, expressed or implied, is made with respect to the information herein.

Resmethrin

sc-202312

Material Safety Data Sheet

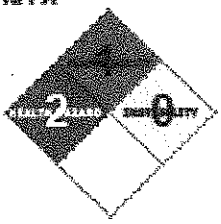
Hazard Alert Code Key: EXTREME | HIGH | MODERATE | LOW

Section 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME
Resmethrin

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
Resmethrin is used mainly for the control of household and public health insects. Formulations are generally in the form of emulsifiable concentrates, may also be prepared with synergists.

SYNONYMS
C22-H26-O3, "cyclopropanecarboxylic acid, 2, 2-dimethyl-3-(2-methylpropenyl)-", "cyclopropanecarboxylic acid, 2, 2-dimethyl-3-(2-methylpropenyl)-", (5-benzyl-3-furyl)methylester, (5-benzyl-3-furyl)methylester, 5-benzyl-3-furylmethyl-(+/-)-cis-trans-chrysanthemate, 5-benzyl-3-furylmethyl-(+/-)-cis-trans-chrysanthemate, "(5-benzyl-3-furyl)methyl-2, 2-dimethyl-3-(2-methylpropenyl)-", "(5-benzyl-3-furyl)methyl-2, 2-dimethyl-3-(2-methylpropenyl)-", cyclopropanecarboxylate, "dimethyl 3-(2-methyl-1-propenyl)cyclopropanecarboxylate", "dimethyl 3-(2-methyl-1-propenyl)cyclopropanecarboxylate", Chrysron, Chrysron, ENT-27474, FMC-17370, For-Syn, Nia-17370, NRDC-104, NSC-195022, OMS-1206, Premgard, Pynosect, Pyrethrin, SBP-1382, "S.B. Penick 1382", Synthrin, pyrethroid/pyrethrum/pyrethrin

Section 2 - HAZARDS IDENTIFICATION

CANADIAN WHMIS SYMBOLS

EMERGENCY OVERVIEW

RISK
Harmful by inhalation, in contact with skin 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

- Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
- Rats fed resmethrin in the diet at levels up to 6000 mg/kg for 14 days showed tremor and reduced body weight at levels of 1500 mg/kg and mortalities at the highest levels. The maximum no-observed-adverse-effect dietary level was 188 mg/kg.

EYE

- Although the material is not thought to be an irritant, direct contact with the eye may cause transient discomfort characterized by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result. The material may produce foreign body irritation in certain individuals.

SKIN

- Skin contact with the material may be harmful; systemic effects may 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.
- 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.
- No significant resmethrin-related dermal effects were observed when applied twice weekly for 3 weeks (0.247 mg/cm2) to the skin of rabbits.

INHALED

- Inhalation of vapors, aerosols (mists, fumes) or dusts, generated by the material during the course of normal handling, may be harmful.
- 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.
- Rats and rabbits inhaling aerosolised resmethrin for 5 h/day on 5 consecutive days at levels of 2.9-3.2 mg active ingredient/litre air showed rapid breathing and nasal discharge. There were no compound-related effects on body-weight and histopathological findings.
- This material, like natural pyrethrins, may cause central stimulation with nausea, vomiting, stomach upset, diarrhea, hypersensitivity, inco-ordination, tremors, muscle paralysis, convulsion, coma and respiratory failure. There may be aggressive behavior, tremor and weakness. Synthetic pyrethrins, unlike natural species, rarely cause allergic responses in humans. The above symptoms are sometimes collectively called "Type I Syndrome".

CHRONIC HEALTH EFFECTS

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

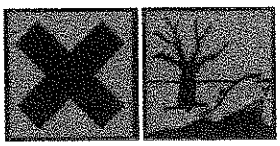
There is some evidence that inhaling this product is more likely to cause a sensitization reaction in some persons compared to the general population.
There is limited evidence that, skin contact with this product is more likely to cause a sensitization reaction in some persons compared to the general population.
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.
Chronic poisoning by natural pyrethrins may result in convulsion, tetanic paralysis, rapid and uneven heart beat, liver and kidney damage, or death.
The natural pyrethrins may produce hypersensitivity, especially following previous sensitising exposure. In general, repeated exposures over 2 or 3 years are required to elicit a response and involve exposure to pyrethrum rather than its individual components (including pyrethrins). The sesquiterpene lactone (pyrethrosin) and the pyrethrum glycoproteins account for the immediate and delayed hypersensitivity seen in guinea pigs following a single injection of ground chrysanthemum in Freud's adjuvant. Mild erythematic vesicular dermatitis (with papules), pruritus, localized oedema (particularly of the face, lips and eyelids), rhinitis, tachycardia, pallor and sweating are the most common syndromes. An initial skin sensitisation can progress to marked dermal oedema and skin cracking. Pyrethrum dermatitis appears to increase in hot weather or under conditions where heavy perspiration is produced. The active ingredients of pyrethrum (except pyrethrin II) are inactive in patch tests. Those patients allergic to ragweed pollen are particularly sensitive to pyrethrin.
Rats fed on a diet of pyrethrins for 5000 ppm for 2 years showed some signs of tissue damage including liver lesions, bile duct proliferation and focal necrosis of the liver cells. A no-effect level of 1000 ppm found in animal experiments correspond to a daily dose of 3600 mg/man.
Resmethrin fed to rats at levels up to 5000 mg/kg over 112 weeks was determined not to be oncogenic. The no-observed-adverse-effect-level of 500 mg/kg for toxic effects was considered to be the lowest effect level for hypertrophy of hepatocytes which was not considered a definite toxic.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARD RATINGS

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

Min/Max
Low=1
Moderate=2
High=3
Extreme=4



NAME	CAS RN	%
resmethrin	10453-86-8	>98
contains		
bioresmethrin	28434-01-7	

[redacted]	35764-59-1
[redacted]	33911-26-3

Section 4 - FIRST AID MEASURES

SWALLOWED

- IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
- Where Medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:
- For advice, contact a Poisons Information Center or a doctor.
- Urgent hospital treatment is likely to be needed.
- If conscious, give water to drink.
- INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

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

- 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:
- 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.
- If pain persists or recurs seek medical attention.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN

- If skin contact occurs:
- Immediately remove all contaminated clothing, including footwear
- Flush skin and hair with running water (and soap if available).
- Seek medical attention in event of irritation.

INHALED

- If fumes or combustion products are inhaled remove from contaminated area.
- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital, or doctor.

NOTES TO PHYSICIAN

- For chronic or short term repeated exposures to pyrethrum and synthetic pyrethroids: Mammalian toxicity of pyrethrum and synthetic pyrethroids is low, in part because of poor bioavailability and a large first pass extraction by the liver. The most common adverse reaction results from the potent sensitizing effects of pyrethrins. Clinical manifestations of exposure include contact dermatitis (erythema, vesiculation, bullae); anaphylactoid reactions (pallor, tachycardia, diaphoresis) and asthma [Ellenhorn Barceloux] In cases of skin contact, it has been reported that topical application of Vitamin E Acetate (alpha-tocopherol acetate) has been found to have high therapeutic value, eliminating almost all skin pain associated with exposure to synthetic pyrethroids. [Incitec].

Section 5 - FIRE FIGHTING MEASURES

Vapor Pressure (mmHg):	11.251 x 10-7 -30C
Upper Explosive Limit (%):	Not applicable.
Specific Gravity (water=1):	1.050 @ 20 C
Lower Explosive Limit (%):	Not applicable.

EXTINGUISHING MEDIA

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

FIRE FIGHTING

- Alert Emergency Responders and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves for fire only.
- 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

- Solid which exhibits difficult combustion or is difficult to ignite.
- 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 (CO_2), other pyrolysis products typical of burning organic material.

FIRE INCOMPATIBILITY

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

PERSONAL PROTECTION

Glasses:
Chemical goggles.
Gloves:
Respirator:
Type A-P Filter of sufficient capacity

Section 6 - ACCIDENTAL RELEASE MEASURES

MINOR SPILLS

- Remove all ignition sources.
- Clean up all spills immediately.
- Avoid contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable, labelled container for waste disposal.

Environmental hazard - contain spillage.

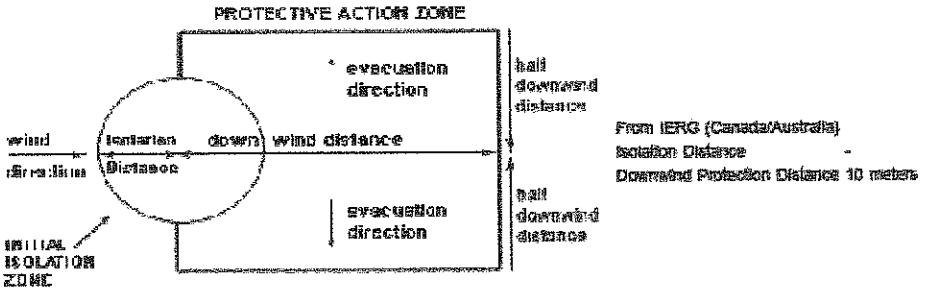
MAJOR SPILLS

- Environmental hazard - contain spillage.

Moderate hazard.

- CAUTION: Advise personnel in area.
- Alert Emergency Responders and tell them location and nature of hazard.
- Control personal contact by wearing protective clothing.
- Prevent, by any means available, spillage from entering drains or water courses.
- Recover product wherever possible.
- IF DRY: Use dry clean up procedures and avoid generating dust. Collect residues and place in sealed plastic bags or other containers for disposal. IF WET: Vacuum/shovel up and place in labelled containers for disposal.
- ALWAYS: Wash area down with large amounts of water and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

PROTECTIVE ACTIONS FOR SPILL



FOOTNOTES

1 PROTECTIVE ACTION ZONE is defined as the area in which people are at risk of harmful exposure. This zone assumes that random changes in wind direction confines the vapour plume to an area within 30 degrees on either side of the predominant wind direction, resulting in a crosswind protective action distance equal to the downwind protective action distance.
2 PROTECTIVE ACTIONS should be initiated to the extent possible, beginning with those closest to the spill and working away from the site in the downwind direction. Within the protective action zone a level of vapour concentration may exist resulting in nearly all unprotected persons becoming incapacitated and unable to take protective action and/or incurring serious or irreversible health effects.
3 INITIAL ISOLATION ZONE is determined as an area, including spillage of the material, 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 (barrels 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.

§ Guide 171 is taken from the US DOT emergency response guide book.
§ IERG information is derived from CANUTEC - Transport Canada.

ACUTE EXPOSURE GUIDELINE LEVELS (AEGL) (in ppm)

AEGL 1: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.
AEGL 2: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.
AEGL 3: The airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

Section 7 - HANDLING AND STORAGE

PROCEDURE FOR HANDLING

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

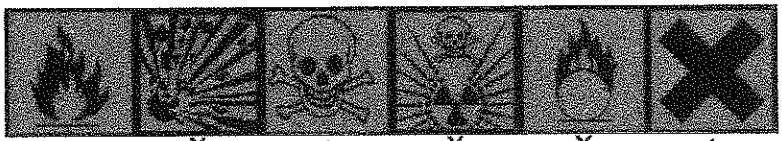
RECOMMENDED STORAGE METHODS

- Polyethylene or polypropylene container.
- Check all containers are clearly labelled and free from leaks.

STORAGE REQUIREMENTS

- Observe manufacturer's storing and handling recommendations.

SAFE STORAGE WITH OTHER CLASSIFIED CHEMICALS



+	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

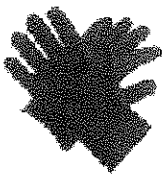
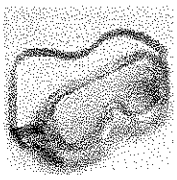
Source	Material	TWA ppm	TWA mg/m³	STEL ppm	STEL mg/m³	Peak ppm	Peak mg/m³	TWA F/CC	Notes
Canada - Alberta Occupational Exposure Limits	resmethrin (Turpentine and selected monoterpenes)	20	111						
US - Oregon Permissible Exposure Limits (Z3)	resmethrin (Inert or Nuisance Dust: (d) Total dust)		10						*
US OSHA Permissible Exposure Levels (PELs) - Table Z3	resmethrin (Inert or Nuisance Dust: (d) Respirable fraction)		5						

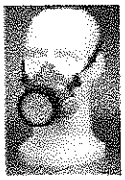
US OSHA Permissible Exposure Levels (PELs) - Table Z3	resmethrin (Inert or Nuisance Dust: (d) Total dust)		15
US - Hawaii Air Contaminant Limits	resmethrin (Particulates not other wise regulated - Total dust)		10
US - Hawaii Air Contaminant Limits	resmethrin (Particulates not other wise regulated - Respirable fraction)		5
US - Oregon Permissible Exposure Limits (Z3)	resmethrin (Inert or Nuisance Dust: (d) Respirable fraction)		5
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	resmethrin (Particulates not otherwise regulated Respirable fraction)		5
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	resmethrin (Particulates not otherwise regulated (PNOR)(T)- Respirable fraction)		5
US - Michigan Exposure Limits for Air Contaminants	resmethrin (Particulates not otherwise regulated, Respirable dust)		5
Canada - Alberta Occupational Exposure Limits	bioresmethrin (Turpentine and selected monoterpenes)	20	111
Canada - Alberta Occupational Exposure Limits	cisresmethrin (Turpentine and selected monoterpenes)	20	111
US - Oregon Permissible Exposure Limits (Z3)	(-)-trans-resmethrin (Inert or Nuisance Dust: (d) Total dust)		10
US OSHA Permissible Exposure Levels (PELs) - Table Z3	(-)-trans-resmethrin (Inert or Nuisance Dust: (d) Respirable fraction)		5
US OSHA Permissible Exposure Levels (PELs) - Table Z3	(-)-trans-resmethrin (Inert or Nuisance Dust: (d) Total dust)		15
US - Hawaii Air Contaminant Limits	(-)-trans-resmethrin (Particulates not other wise regulated - Total dust)		10
US - Hawaii Air Contaminant Limits	(-)-trans-resmethrin (Particulates not other wise regulated - Respirable fraction)		5
US - Oregon Permissible Exposure Limits (Z3)	(-)-trans-resmethrin (Inert or Nuisance Dust: (d) Respirable fraction)		5
US - Tennessee Occupational Exposure Limits - Limits For Air Contaminants	(-)-trans-resmethrin (Particulates not otherwise regulated Respirable fraction)		5
US - Wyoming Toxic and Hazardous Substances Table Z1 Limits for Air Contaminants	(-)-trans-resmethrin (Particulates not otherwise regulated (PNOR)(T)- Respirable fraction)		5
US - Michigan Exposure Limits for Air Contaminants	(-)-trans-resmethrin (Particulates not otherwise regulated, Respirable dust)		5

MATERIAL DATA

(-)-TRANS-RESMETHRIN:
BIORESMETHRIN:
CISRESMETHRIN:
RESMETHRIN:
■ For pyrethrum and its active components:
IDLH Level: 5000 mg/m3
Pyrethrum and/or its active components, the pyrethrins, cause dermatitis and sensitisation. Ingestion of massive doses can induce convulsions, vomiting and bradycardia. Animals exhibit liver damage and death through respiratory failure. The recommended TLV-TWA is equivalent to an occupational dose of 0.7 mg/kg/day and is thought to minimise the potential for systemic effects. The TLV may NOT prevent the development of hypersensitisation, particularly among those with pre-existing allergies to pollen and related agents.
Synthetic pyrethrins (pyrethroids) often produce a range of toxic effects resembling pyrethrum; in the absence of a regulated exposure limit prudence dictates that the value for pyrethrum serves as a reference.
RESMETHRIN:
An acceptable daily intake (ADI) was established by the US EPA at 0.125 mg/kg per day. Food additive tolerance has been established by the US EPA permitting resmethrin residues up to 3 ppm, in or on food commodities.
BIORESMETHRIN:
An acceptable daily intake (ADI) was established by the US EPA at 0.125 mg/kg per day. Food additive tolerance has been established by the US EPA permitting resmethrin residues up to 3 ppm, in or on food commodities.
(-)-TRANS-RESMETHRIN:
An acceptable daily intake (ADI) was established by the US EPA at 0.125 mg/kg per day. Food additive tolerance has been established by the US EPA permitting resmethrin residues up to 3 ppm, in or on food commodities.

PERSONAL PROTECTION



Consult your EHS staff for recommendations

EYE

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

HANDS/FEET

Wear chemical protective gloves, eg. PVC.
Wear safety footwear or safety gumboots, eg. Rubber.
NOTE: The material may produce skin sensitization in predisposed individuals. Care must be taken, when removing gloves and other protective equipment, to avoid all possible skin contact.
Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

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

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

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

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturiser is recommended.

OTHER

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

- 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

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.

Breathing Zone Level ppm (volume)	Maximum Protection Factor	Half-Face Respirator	Full-Face Respirator
1000	10	A-1 P	-
1000	50	-	A-1 P
5000	50	Airline*	-
5000	100	-	A-2 P
10000	100	-	A-3 P
	100+		Airline* *

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

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.
- 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
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:
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 metres distant from the extraction point. Other mechanical considerations, producing performance deficits within the extraction apparatus, make it essential that theoretical air velocities are multiplied by factors of 10 or more when extraction systems are installed or used.

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Solid.
Does not mix with water.
Sinks in water.

State	Divided solid	Molecular Weight	338.45
Melting Range (°F)	109.4- 116.4	Viscosity	Not Applicable
Boiling Range (°F)	356 (0.01 mm Hg)	Solubility in water (g/L)	Immiscible
Flash Point (°F)	Not applicable.	pH (1% solution)	Not applicable.
Decomposition Temp (°F)	Not Available	pH (as supplied)	Not applicable
Autoignition Temp (°F)	Not available.	Vapor Pressure (mmHg)	11.251 x 10-7 -30C
Upper Explosive Limit (%)	Not applicable.	Specific Gravity (water=1)	1.050 @ 20 C
Lower Explosive Limit (%)	Not applicable.	Relative Vapor Density (air=1)	Not Applicable
Volatile Component (%vol)	Negligible	Evaporation Rate	Not Applicable

APPEARANCE

Waxy, colourless solid; does not mix with water (solubility <1 mg/l). Soluble in methanol (61 g/kg), hexane (220 g/kg), xylene (>1 kg/kg), kerosene 910%). A synthetic pyrethroid which chemically it is an ester of chrysanthemic acid. It is a racemic mixture of 4 optical isomers. The [1R, trans]-isomer is called bioresmethrin and the [1R,cis]-isomer is cismethrin

Section 10 - CHEMICAL STABILITY

CONDITIONS CONTRIBUTING TO INSTABILITY

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

STORAGE INCOMPATIBILITY

Pyrethrins and permethrins:

- are unstable in the presence of light, heat, moisture and air
- are hydrolysed by oxygen and/ or sunlight
- may react with strong oxidisers to produce fire and explosions
- are incompatible with alkalis
- Avoid strong acids, bases.

Avoid reaction with oxidizing agents.

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

Section 11 - TOXICOLOGICAL INFORMATION

resmethrin

TOXICITY AND IRRITATION

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

TOXICITY	IRRITATION
Oral (rat) LD50: 1244 mg/kg	Nil Reported
Dermal (rat) LD50: >3040 mg/kg	
Oral (mouse) LD50: 99 mg/kg	
Dermal (rabbit) LD50: 2500 mg/kg	

■ For resmethrin:

Acute effects: Resmethrin is moderately toxic by ingestion and slightly toxic through the skin . Dermal exposure may lead to numbness, itching, burning, tingling sensations. Symptoms of exposure by any route may include incoordination, twitching, loss of bladder control, and seizures . Resmethrin may cause eye irritation if failed to cause allergic skin reactions in guinea pigs, but may cause skin irritation

Chronic effects: In a chronic feeding study with rats, the lowest dose tested (500 ppm or 25 mg/kg/day) caused liver enlargement. At 2,500 ppm (125 mg/kg/day), there were pathological liver changes in addition to increased liver weights. Doses of 5,000 ppm (250 mg/kg/day) caused increased thyroid weight and thyroid cysts. The NOEL in a chronic feeding study with dogs was 10 mg/kg/day . In a 90-day inhalation study with rats, 0.1 mg/l, the lowest dose tested, produced behavioral changes, decreased blood glucose levels in males, and decreased boy weights and increased serum urea levels in females

Reproductive Effects: A 3-generation study with rats showed a slight increase in premature stillbirths and a decrease in pup weight at 25 mg/kg, the lowest dose tested.

Teratogenic Effects: No birth defects were observed in the offspring of rabbits given doses as high as 100 mg/kg . Skeletal aberrations were seen in the offspring of rats given doses higher than 40 mg/kg/day.

Mutagenic Effects: Resmethrin was not mutagenic in a test performed with the bacterium, Salmonella typhimurium .

Carcinogenic Effects: No evidence of tumor formation was observed in a 2-year rat feeding study with doses as high as 250 mg/kg/day, nor in an 85-week study with mice given doses as high as 50 mg/kg/day .

Organ Toxicity: Pyrethroids may cause adverse effects on the central nervous system. Long-term feeding studies have shown increased liver and kidney weights and adverse changes in liver tissues in test animals. However, EPA reports that resmethrin was not neurotoxic to rats at doses of 62.5 mg/kg for 32 weeks, 250 mg/kg for 30 days, or 632 mg/kg for 7 days . In a 2-year feeding study with rats fed up to 250 mg/kg of resmethrin, increases in liver weight and liver lesions occurred at 125 mg/kg . Increased liver weights occurred in dogs fed 30 mg/kg/day for 180 days. The NOEL in this study was 10 mg/kg/day.

Fate in Humans and Animals: When oral doses of 10 mg/kg radio-labeled resmethrin were given to laying hens, 90% of the dose was eliminated in urine and feces within 24 hours in another study with hens given the same treatment, radioactive residues were low in hens sacrificed 12 hours after the treatment, with the highest levels found in the liver and kidneys. Low levels of radioactivity were found in the hens' eggs, with levels peaking on 1 day after treatment in the whites and 4 to 5 days after treatment in the yolks.

ADI: 0.1 mg/kg/day

NOEL: 10 mg/kg/day

CARCINOGEN

Non-arsenical insecticides (occupational exposures in spraying and application of)	International Agency for Research on Cancer (IARC) - Agents Reviewed by the IARC Monographs	Group 2A

Section 12 - ECOLOGICAL INFORMATION

Refer to data for ingredients, which follows:

BIORESMETHRIN:

CISRESMETHRIN:

(-)-TRANS-RESMETHRIN:

RESMETHRIN:

■ DO NOT discharge into sewer or waterways.

■ 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, skl 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, 6MHO, 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, pinoaldehyde, 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	[illegible], limonene, methyl vinyl ketone
Photocopier toner, printed paper, styrene polymers	Styrene	Formaldehyde, benzaldehyde
Environmental tobacco smoke	Styrene, acrolein, nicotine	Formaldehyde, benzaldehyde, hexanal, glycoal, 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, 6-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, phonic 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 Helath Perspectives, Vol 114, October 2006.
■ Synthetic pyrethroids are examples of optimized insecticidal activity, selectivity and tailored environmental persistence. Through modifications of both acid and alcohol portions of the ester, compounds of desired residual activity have been synthesized whilst maintaining a biodegradable ester linkage. These compounds are generally very toxic to crustaceans and fish in laboratory bioassays. Under field conditions, however the residues are tightly bound in sediment, and ingested residues are readily metabolized. Their toxicity in natural systems are generally less than laboratory test data might indicate. They are generally non-persistent in the environment.
■ for resmethrin:
Environmental fate:
Resmethrin breaks down in the presence of light and humidity. Its half-life in the environment is 15 minutes . Degradation end-products reported for resmethrin are chrysanthemic acid, benzaldehyde, benzyl alcohol, benzoic acid, phenylacetic acid, and various esters .
Breakdown of Chemical in Surface Water: In pond waters and in laboratory degradation studies, pyrethroid concentrations decrease rapidly due to sorption to sediment, suspended particles and plants. Microbial and photodegradation also occur .
Ecotoxicity:
Acute Bird LD50: Californian quail >2000 mg/kg (slightly toxic)
Fish LC50: mosquito fish 0.007 ppm (highly toxic); bluegill sunfish 0.75-2.6 ug/l; rainbow trout 0.28-2.4 ug/l.
The LC50 for resmethrin synergised with piperonyl butoxide in red swamp crawfish, Procambarus clarkii, is 0.00052 ppm
Bee LD50: 0.063 ug/bee (highly toxic).
■ 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.
BIORESMETHRIN:
CISRESMETHRIN:
RESMETHRIN:
■ Very toxic to aquatic organisms.
BIORESMETHRIN:
RESMETHRIN:
■ 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 B, Table 1
Compiler's Guide for the Preparation of International Chemical Safety Cards: 1993 Commission of the European Communities.
RESMETHRIN:

■ Fish LC50 (96hr.) (mg/l):	2.75.0E- 06

/53
Degradation Biological: by soil microflora 2 days
BIORESMETHRIN:
/53
CISRESMETHRIN:
(-)-TRANS-RESMETHRIN:
■ Toxic to aquatic organisms.

Ecotoxicity

Ingredient	Persistence: Water/Soil	Persistence: Air	Bioaccumulation	Mobility
resmethrin	HIGH		LOW	LOW

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 waters from cleaning equipment to enter drains. Collect all wash water for treatment before disposal.

- Recycle wherever possible.
- Consult manufacturer for recycling options or consult Waste Management Authority for disposal if no suitable treatment or disposal facility can be identified.
- Dispose of by: Burial in a licensed land-fill or incineration in a licensed apparatus (after admixture with suitable combustible material)
- Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.

Section 14 - TRANSPORTATION INFORMATION

DOT:

Symbols:	G	Hazard class or Division:	9
Identification Numbers:	UN3077	PG:	III
Label Codes:	9	Special provisions:	8, 146, 335, B54, IB8, IP3, N20, T1, TP33
Packaging: Exceptions:	155	Packaging: Non-bulk:	213
Packaging: Exceptions:	155	Quantity limitations: Passenger aircraft/rail:	No limit
Quantity Limitations: Cargo aircraft only:	No limit	Vessel stowage: Location:	A
Vessel stowage: Other:	None		

Hazardous materials descriptions and proper shipping names:
Environmentally hazardous substance, solid, n.o.s

Air Transport IATA:

ICAO/IATA Class:	9	ICAO/IATA Subrisk:	無
UN/ID Number:	3077	Packing Group:	III
Special provisions:	A97		

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. *(CONTAINS RESMETHRIN)

Maritime Transport IMDG:

IMDG Class:	9	IMDG Subrisk:	None
UN Number:	3077	Packing Group:	III
EMS Number:	F-A,S-F	Special provisions:	274 969 944
Limited Quantities:	5 kg		

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.(contains resmethrin)

Section 15 - REGULATORY INFORMATION

resmethrin (CAS: 10453-86-8) is found on the following regulatory lists;
"Canada Domestic Substances List (DSL)","US - California Proposition 65 - Carcinogens","US - California Proposition 65 - Priority List for the Development of MADLs for Chemicals Causing Reproductive Toxicity","US - California Proposition 65 - Reproductive Toxicity","US - Maine Chemicals of High Concern List","US EPCRA Section 313 Chemical List","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"
Regulations for ingredients
bioresmethrin (CAS: 28434-01-7) is found on the following regulatory lists;
"Canada - Saskatchewan Environmental Persistent or Chronic Hazardous Substances","US - California Occupational Safety and Health Regulations (CALOSHA) - Hazardous Substances List","US - Massachusetts Oil & Hazardous Material List","US - Pennsylvania - Hazardous Substance List","US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","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"
cisresmethrin (CAS: 35764-59-1) is found on the following regulatory lists;
"Canada - Saskatchewan Environmental Persistent or Chronic Hazardous Substances","US - California Occupational Safety and Health Regulations (CALOSHA) - Hazardous Substances List","US - Massachusetts Oil & Hazardous Material List","US - Pennsylvania - Hazardous Substance List","US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous

Substances","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","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"

(-)-trans-resmethrin (CAS: 33911-28-3) is found on the following regulatory lists;

"Canada - Saskatchewan Environmental Persistent or Chronic Hazardous Substances","US - California Occupational Safety and Health Regulations (CALOSHA) - Hazardous Substances List","US - Massachusetts Oil & Hazardous Material List","US - Pennsylvania - Hazardous Substance List","US CWA (Clean Water Act) - Reportable Quantities of Designated Hazardous Substances","US Department of Transportation (DOT) List of Hazardous Substances and Reportable Quantities - Hazardous Substances Other Than Radionuclides","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"

Section 16 - OTHER INFORMATION

LIMITED EVIDENCE

- Cumulative effects may result following exposure*.
- Possible respiratory and skin sensitizer*.

* (limited evidence).

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

- Classification of the 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.

Issue Date: Aug-3-2006
Print Date:Apr-21-2010

Product Safety Assessment
Spinosad

Select a Topic:

Names
Product Overview
Manufacture of Product
Product Description
Product Uses
Exposure Potential
Health Information
Environmental Information
Physical Hazard Information
Regulatory Information
Additional Information
References

Names

- Spinosad (a mixture of spinosyn A and spinosyn D)
- Spinosyn A
- CAS No. 131929-60-7
- 2-((6-Deoxy-2,3,4-tri-O-methyl-α-L-mannopyranosyl)oxy)-13-((5-(dimethylamino)tetrahydro-6-methyl-2H-pyran-2-yl)oxy)-9-ethyl-2,3,3a,5a,5b,6,9,10,11,12,13,14,16a,16b-tetradecahydro-14-methyl-1H-as-indaceno(3,2-d)oxacyclododecin-7,15-dione (IUPAC)
- Spinosyn D
- CAS No. 131929-63-0
- 2-((6-Deoxy-2,3,4-tri-O-methyl-α-L-mannopyranosyl)oxy)-13-((5-(dimethylamino)tetrahydro-6-methyl-2H-pyran-2-yl)oxy)-9-ethyl-2,3,3a,5a,5b,6,9,10,11,12,13,14,16a,16b-tetradecahydro-4,14-dimethyl-1H-as-indaceno(3,2-d)oxacyclododecin-7,15-dione (IUPAC)

Trade Names

- Audienz® insect control
- Biospin® insect control
- Boomerang® insect control
- Caribstar® insect control
- Conserve® SC turf and ornamental insect control
- Entrust® Naturalyte® insect control
- Flipper®
- GF-120® NF Naturalyte fruit fly bait
- Laser® insect control
- MS Superspin® insect control
- Mozkill® insect control
- Musdo Gold® insect control
- Naturalure® Naturalyte fruit fly bait
- Olgami® insect control
- Spinoace® insect control
- SpinTor® 2SC Naturalyte insect control
- SpY® Granular Bait
- Success® Naturalyte insect control
- Syneis® Appat Insect Control
- Tracer® Naturalyte insect control

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Product Overview

- Spinosad is the active ingredient in a series of insecticide products formulated by Dow AgroSciences, a wholly owned subsidiary of The Dow Chemical Company. Spinosad is formulated using various formulation technologies such as a suspension concentrate (SC), water dispersible granule (WG), wettable powder (WP), bait concentrates and numerous solid insect baits. Liquid formulations have solid spinosad in suspension in propylene glycol

(CAS# 57-55-6). Spinosad-containing formulations are sold under many trade names around the globe such as Audienz®, Biospin®, Boomerang®, Caribstar®, Conserve® insect control, Entrust® insect control, Flipper, GF-120® NF Naturalyte® Fruit Fly Bait, Laser®, MS Superspin®, Mozkill®, Musdo Gold®, Naturalure® Naturalyte®, SpinTor® insect control , SpY®, Success® insect control , Syneis® and Tracer® insect control. Spinosad was accepted for review and registered under the U.S. Environmental Protection Agency (EPA) Reduced Risk Pesticide Program.[1,2,3] See Product Description.

- Spinosad is a broad-spectrum insecticide used to control Lepidoptera larvae (caterpillars), Diptera (flies), Thysanoptera (thrips), Coleoptera (beetles) and many other crop-damaging pests. Spinosad is registered for use in over 82 countries for more than 250 crops including uses in turf, tree farms, ornamental plants and trees, plantations, greenhouses, commercial aquatic plants, and control of fire ants.[4,5] See Product Uses.
- Spinosad is certified by USDA National Organic Standards Board, Mayacert, BCS Öko-Garantie GmbH, and others; certain formulations are listed for use by the Organic Materials Research Institute (OMRI) for organic use in the US and various other countries. Formulations certified for organic use in certain countries include, Entrust® Naturalyte® insect control for organic agriculture, GF 120® NF Naturalyte Fruit Fly Bait, Success® 0.02 CB and Conserve® Pro fire ant bait.
- Eye contact with spinosad in powder formulations may cause slight irritation or pain disproportionate to the level of irritation to eye tissues, but corneal injury is unlikely. Eye contact with spinosad liquid formulations may cause slight temporary irritation. Prolonged skin contact with spinosad may cause slight irritation with local redness and is not likely to result in absorption of harmful amounts. Inhalation of spinosad vapor from powder formulations is unlikely. Prolonged inhalation of spinosad liquid formulations is not expected to cause adverse effects.[6,7] See Health Information.
- Occupational exposure to spinosad could occur in manufacturing or formulating operations during maintenance, sampling, testing, or other procedures. Agricultural workers or groundskeepers could be exposed during field application. Workers using spinosad must wear proper protective equipment and follow label instructions carefully. Consumers could be exposed from dietary sources (food and drinking water), contact with treated turf or nursery stock, or home use of spinosad insecticides.[8] See Exposure Potential.
- Spinosad is stable at typical use and storage temperatures.[9,10] See Physical Hazard Information.

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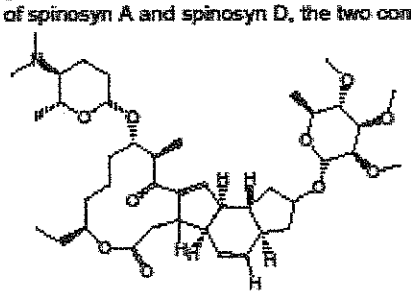
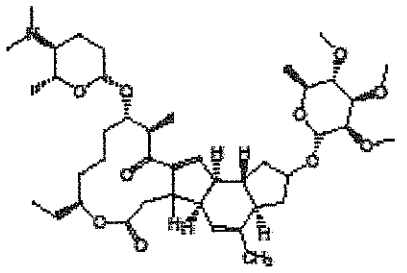
Manufacture of Product

- **Capacity** – Dow AgroSciences is the sole producer of spinosad.
- **Process** – Spinosad is manufactured at Dow AgroScience's facility in Harbor Beach, Michigan, using a fermentation process in which *Saccharopolyspora spinosa* colonies are grown using natural products such as soybean and cottonseed meal. The chemical structures of spinosyn A and spinosyn D, the two components of spinosad, are shown below.



Spinosyn A



Spinosyn D

®™ Trademark of Dow AgroSciences LLC

Product Description[11]

Spinosad is the active ingredient in series of insecticide products formulated by Dow AgroSciences LLC, a subsidiary of The Dow Chemical Company. Spinosad is a mixture of spinosyn A and spinosyn D, two naturally occurring metabolites from the soil bacterium, *Saccharopolyspora spinosa*. Spinosad is formulated as a solid or liquid. These formulations are sold under the trade names Audienz®, Biospin®, Boomerang®, Caribstar®, Conserve® insect control, Entrust® insect control, Flipper, GF-120® Naturalyte® Fruit Fly Bait, Laser®, MS Superspin®, Mozkill®, Musdo Gold®, Naturalure® Naturalyte®, SpinTor® insect control, SpY®, Success® insect control, Syneis® and Tracer® insect control. Liquid formulations have various concentrations of the solid spinosad in suspension in propylene glycol (CAS# 57-55-6). Liquid and certain solid spinosad formulations are typically mixed with water and applied to foliage as a spray. Because of its high efficacy, use rates for spinosad are generally low, in the ounces per acre or grams/hectare range. Spinosad has contact activity on virtually all life stages of a pest including egg, larvae and adult. Eggs must be sprayed directly but larvae and adults can be effectively dosed through contact with treated surfaces. Spinosad is most effective when eaten by insect pests. Foliar formulations of spinosad are not highly systemic, however, translaminar activity is evident in some crops. In general, more movement and penetration is seen with younger and rapidly growing leaves. Limited root uptake may also occur under certain conditions and environments. Spinosad residue on plant foliage appears to be harmless to foraging honeybees once dry and has minimal impact on most other beneficial insects. Under labeled use patterns, phytotoxicity is not a concern with spinosad.

Spinosad was accepted for review and registration under the U.S. Environmental Protection Agency (EPA) Reduced Risk Pesticide Program. Spinosad is classified as an organic substance by the USDA National Organic Standards Board.

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Product Uses[12,13]

Applications for spinosad insecticide include:

- **Commercial crops**—control of crop-damaging pests such as Lepidoptera larvae (worms or caterpillars), leafminers, fruit flies, leaf-chewing beetles, thrips, and others. Spinosad is used globally on more than 250 crops encompassing most of the crop groupings such as **row crops**, e.g. cotton, soybean, rice; **tree fruits**, e.g. pome, stone and citrus; **tree nuts** e.g. walnut, almond; **small fruits**, e.g. grape, strawberry; **leafy and brassica vegetables**, e.g. lettuce, cole crop; **fruiting vegetables**, e.g. tomato, pepper; **cucurbits**, e.g. cucumber, melon; **bulb, root and tuber vegetables**, e.g. onion, carrot, potato; **legumes**, e.g. dry and succulent peas and beans; **forages**, e.g. alfalfa, forage grasses and pastures; **other**, e.g. coffee, tea, plantation
- **Turf and ornamental**—turf, trees, and ornamentals in nurseries and greenhouses, and commercial aquatic plants
- **Stored grain**
- **Fire ant control**
- **Home and garden uses**

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Exposure Potential

Based on the uses for spinosad, the public could be exposed through:

- **Workplace exposure** – Exposure can occur in a spinosad manufacturing facility or facilities using spinosad to formulate insecticide products. Workers could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing and formulating facility should have a thorough training program for employees and appropriate work processes and safety equipment in place to limit unnecessary exposure. Agricultural workers and groundskeepers could be exposed to spinosad during field application. Wearing proper

protective equipment and following label instructions will reduce exposure risk.[14,15] See Health Information.

- **Consumer exposure to products containing spinosad** – Consumers could be exposed to spinosad from dietary sources (food and water), contact with treated turf or nursery stock, or from home use of spinosad products. Spinosad exposure has been evaluated by the U.S. Environmental Protection Agency (EPA) among other regulatory authorities. The EPA evaluated combined dietary and residential exposure risk, both short term and long term, as well as aggregate cancer risk. Based on these risk assessments, the EPA concludes that "there is reasonable certainty that no harm will result to the general population and to infants and children from aggregate exposure to spinosad residues."[16] See Health Information.
- **Environmental releases**[17,18] – For small spills of spinosad powder, sweep up the material and place it in a container suitable for disposal. For a small liquid spill of spinosad, use a non-reactive absorbent such as sand, sawdust, or dirt. Collect the material in a container suitable for disposal. Wash exposed body areas thoroughly after handling. Consult the relevant (M)SDS or product label for more information about protective equipment and procedures. See Environmental, Health and Physical Hazard Information.
- **Large release** – In the event of a large liquid spill of spinosad, dike spill area to prevent the material from reaching sewers, drains, streams, or waterways. Personnel engaged in clean up of spills should wear appropriate protective equipment. Apply nonreactive absorbent material such as earth or sand. Collect material and contain in appropriate containers for disposal. Report large spills to Dow AgroSciences at 800-992-5994. Consult the relevant (M)SDS or product label for more information about protective equipment and procedures.

  In case of fire, self-contained breathing apparatus (SCBA) and full protective clothing must be worn. Isolate the area and deny unnecessary entry. Fight fire with foam, carbon-dioxide, dry-chemical, or water-fog fire extinguishers. Do not allow water from fire-fighting to enter water supplies or drainage systems. Consult the (M)SDS. See Environmental, Health and Physical Hazard Information.

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Health Information[19,20]

Eye and Skin Contact—Eye contact with spinosad in powder formulations may cause slight irritation or pain disproportionate to the level of irritation to eye tissues. The dust may irritate eyes, but corneal injury is unlikely. Eye contact with spinosad liquid formulations may cause slight temporary irritation. Prolonged skin contact with spinosad formulations may cause slight irritation with local redness, although it is not likely to result in absorption of harmful amounts.

Ingestion—Spinosad has very low toxicity if swallowed.

Inhalation—In solid formulations, inhalation of spinosad vapor is unlikely due to the material's physical properties. Prolonged inhalation of spinosad liquid formulation is not expected to cause adverse effects.

Cancer and Birth Defect Information—Spinosad did not cause cancer in laboratory animals. In laboratory studies, spinosad did not cause birth defects or other effects in the fetus even at doses toxic to the mother.

For specific health information, review the (M)SDS.

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Environmental Information[21,22]

The bioconcentration potential for spinosad is low, meaning spinosad is not likely to accumulate in the food chain. Spinosad is highly toxic to marine mollusks on an acute basis and slightly to moderately toxic to fish on an acute basis. Spinosad is practically nontoxic to birds on an acute

and dietary basis. Based on Organization for Economic Cooperation and Development (OECD) test guidelines, spinosad is not considered to be readily biodegradable. However, spinosad does degrade from exposure to sunlight (photolysis) and microbial breakdown in the soil.

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Physical Hazard Information[23,24]

Spinosad is stable under normal use and storage conditions.

Additional physical hazard information for spinosad is available on the (M)SDS.

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Regulatory Information

Regulations exist that govern the manufacture, sale, transportation, use, and/or disposal of spinosad. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant (M)SDS.

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Additional Information

- Safety Data Sheet (http://www.dowagro.com/label/index.htm).
- Dow AgroSciences website: (www.dowagro.com).
- *Spinosad Technical Bulletin*, Dow AgroSciences LLC, Form No. Y45-000-001 (01/01) CBK, January 2001, (http://www.dowagro.com/PublishedLiterature/dh_0064/0901b803800047cc.pdf?filepath=/PublishToInternet/InternetDOWAGRO/usag/pdfs/noreg/010-80032&fromPage=BasicSearch)
- *Conserve® SC Turf and Ornamental Insect Control Specimen Label*, Dow AgroSciences LLC, Label Code: D02-090-010, Revised March 15, 2007, EPA Reg. No. 62719-291, (http://www.cdms.net/ldat/ld24P005.pdf).
- *Entrust® Naturalyte® Insect Control Specimen Label*, Dow AgroSciences LLC, Labe Code: D02-184-006, Revised November 10, 2006, EPA Reg. No. 62719-282, (http://www.cdms.net/ldat/ld62B023.pdf).
- *Spinosad Pesticide Tolerance*, U.S. Environmental Protection Agency, *Federal Register* Docket ID No. DOCID:fr21mr07-4, 72 Fed. Reg. 13168 (Mar. 21, 2007), (http://www.epa.gov/EPA-PEST/2007/March/Day-21/p4760.htm).
- Thompson, Gary D., Hutchins, Scott H., Sparks, Thomas C., Dow AgroSciences LLC, *Development of Spinosad and Attributes of a New Class of Insect Control Products*, Radcliff's IPM World Textbook Website, University of Minnesota, January 23, 1999, (http://ipmworld.umn.edu/chapters/hutchins2.htm).

For more business information about spinosad, visit the Dow AgroSciences website: http://www.dowagro.com/.

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References

[1] *Spinosad Technical Bulletin*, Dow AgroSciences LLC, Form No. Y45-000-001 (01/01) CBK, January 2001. See Overview and Regulatory Information sections.
[2] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, pages 1 and 2.
[3] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005884, June 24, 2004, pages 1 and 2.

[4] *Conserve® SC Turf and Ornamental Insect Control Specimen Label*, Dow AgroSciences LLC, Label Code: D02-090-010, March 15, 2007, EPA Reg. No. 62719-291, pages 1 and 4–8.
[5] *Entrust® Naturalyte® Insect Control Specimen Label*, Dow AgroSciences LLC, Labe Code: D02-184-006, November 10, 2006, EPA Reg. No. 62719-282, pages 1, 2, 5–15.
[6] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, pages 2 and 3.
[7] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005864, June 24, 2004, pages 2 and 3.
[8] *Spinosad Pesticide Tolerance*, U.S. Environmental Protection Agency, *Federal Register* Docket ID No. DOCID:fr21mr07-4, *Federal Register*: March 21, 2007 (Volume 72, Number 54), Rules and Regulations pages 13170–13171.
[9] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005864, June 24, 2004, pages 1 and 2.
[10] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, pages 1 and 2.
[11] *Spinosad Technical Bulletin*, Dow AgroSciences LLC, Form No. Y45-000-001 (01/01) CBK, January 2001, See Overview, Biological Activity, Safety to Beneficials, and Regulatory Information sections.
[12] *Conserve® SC Turf and Ornamental Insect Control Specimen Label*, Dow AgroSciences LLC, Label Code: D02-090-010, March 15, 2007, EPA Reg. No. 62719-291, pages 1 and 4–8.
[13] *Entrust® Naturalyte® Insect Control Specimen Label*, Dow AgroSciences LLC, Labe Code: D02-184-006, November 10, 2006, EPA Reg. No. 62719-282, pages 1, 2, and 5–15.
[14] *Conserve® SC Turf and Ornamental Insect Control Specimen Label*, Dow AgroSciences LLC, Label Code: D02-090-010, March 15, 2007, EPA Reg. No. 62719-291, pages 1 and 2.
[15] *Entrust® Naturalyte® Insect Control Specimen Label*, Dow AgroSciences LLC, Labe Code: D02-184-006, November 10, 2006, EPA Reg. No. 62719-282, pages 1 and 2.
[16] *Spinosad Pesticide Tolerance*, U.S. Environmental Protection Agency, *Federal Register* Docket ID No. DOCID:fr21mr07-4, *Federal Register*: March 21, 2007 (Volume 72, Number 54), Rules and Regulations, page 13172.
[17] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005864, June 24, 2004, page 1.
[18] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, page 1.
[19] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005864, June 24, 2004, pages 2 and 3.
[20] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, pages 2 and 3.
[21] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005864, June 24, 2004, pages 2 and 3.
[22] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, page 3.
[23] *Conserve® SC Turf and Ornamental Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS:005864, June 24, 2004, page 2.
[24] *Entrust® Naturalyte® Insect Control Material Safety Data Sheet*, Dow AgroSciences LLC, MSDS: 007516, June 6, 2007, page 2.

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NOTICES:

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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Form No. 233-00381-0808-MM

Material Safety Data Sheet

RAVAP® EC

Version: Original | Date Issued: 2/06/08 | MSDS No. 6148350

SECTION 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

COMPANY:	KMG-Bernuth, Inc. 10611 Harwin, Suite 402 Houston, Texas 77036
PHONE NUMBER:	800-922-8177
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
NAME USED ON LABEL:	RAVAP EC
PRODUCT USE:	Livestock, Poultry and Premise Insecticide Spray

® Ravap is a registered Trademark of KMG-Bernuth, Inc.

SECTION 2: COMPOSITION/INFORMATION ON INGREDIENTS

IDENTITY	CAS NUMBER	TYPICAL %	OTHER INFORMATION
Tetrachlorvinphos (z)-2-Chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl phosphate	22248-79-9	23.0 %	Active Ingredient
Dichlorvos 2,2-Dichlorovinyl dimethyl phosphate	62-73-7	5.3 %	Active Ingredient
Phenol	108-95-2	14.0 %	Inert Ingredient

Ingredients not precisely identified are proprietary or non-hazardous. Values are not product specifications.

SECTION 3: HAZARDS IDENTIFICATION

PHYSICAL HAZARDS: Combustible. Do not use, pour, spill or store near heat or open flame. Do not use with thermal foggers or heat-generating devices.

HEALTH HAZARDS: DANGER- Corrosive. Causes irreversible eye damage or skin burns. Harmful if swallowed or absorbed through skin. Do not get in eyes (including animals), on skin, or on clothing. Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash clothing before reuse.

SECTION 4: FIRST AID MEASURES

IF IN EYES: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.

IF ON SKIN OR CLOTHING: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not give anything by mouth to an unconscious person. Do not induce vomiting unless told to by a poison control center or doctor.

MATERIAL SAFETY DATA SHEET
RAVAP® EC

SECTION 4: FIRST AID MEASURES, CONTINUED

HOTLINE NUMBER: Contains an organophosphate that inhibits cholinesterase. Have the product container or label with you when calling a poison control center or doctor, or going for treatment. Contact 1-800-922-8177 for emergency medical treatment.

NOTE TO PHYSCIAN: This product is a cholinesterase inhibitor. If symptoms of cholinesterase inhibition are present, atropine sulfate by injection is antidotal. 2-PAM is also antidotal and may be administered, but only in conjunction with atropine. Product may cause aspiration pneumonia. Probable mucosal damage may contraindicate the use of gastric lavage.

SECTION 5: FIREFIGHTING MEASURES

FLASH POINT: 67.8°C (154°F) ASTM D 93-02a

AUTOIGNITION TEMPERATURE: Not available.

FLAMMABLE LIMITS (STP): Not available. Product is Combustible

EXTINGUISHING MEDIA: For small fire, use dry chemical, carbon dioxide, water spray or foam. For large fire, use water spray, fog or foam. Cool containing vessels with water in order to prevent pressure build-up, auto-ignition or explosion. Contain run-off to prevent contamination of surface waters.

PROTECTIVE EQUIPMENT: Self-contained breathing apparatus with full facepiece and protective clothing.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Combustible. Noxious fumes (carbon monoxide and hydrogen chloride) may be emitted under fire conditions.

HMIS RATING: Health 2 Fire 3 Reactivity 0 PPE I

NFPA RATING: 0 Least; 1 Slight; 2 Moderate; 3 High; 4 Severe
Health 2 Fire 3 Reactivity 0

SECTION 6: ACCIDENTAL RELEASE MEASURES

In Case of Spill or Leak: Wear long-sleeved shirt and long pants, rubber boots over shoes and socks, chemical resistant waterproof gloves, protective chemical safety goggles and a NIOSH-approved pesticide respirator or Air-supplied respirator. For small spills, absorb on absorbent material, sweep up and place in an approved chemical container. Use non-sparking tools and remove ignition sources.

Wash the spill area with a solution of water and household bleach (1:2), absorb on absorbent material, sweep up and place in a disposal container. Wash area with detergent and absorb liquid and sweep up and place into container. Seal the container and handle in an approved manner.

Flush the area with water to remove any residue. Contain any washwaters. Do not allow washwaters to contaminate surface waters and dike not flush to sewer systems.

For disposal, refer to Section 13, Disposal Considerations.

MATERIAL SAFETY DATA SHEET
RAVAP® EC

SECTION 7: HANDLING AND STORAGE

DO NOT contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Store in original container only. Store at temperatures above 32°F. Combustible. Do not use, pour, spill or store near open flame. Do not store diluted product.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

DANGER

Corrosive. Causes irreversible eye damage or skin burns. Harmful if swallowed or absorbed through skin. Do not get in eyes (including mimics), on skin, or on clothing. Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash clothing before reuse.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Some materials that are chemical-resistant to this product are butyl rubber, neoprene and polyvinyl chloride (PVC). If you want more options, follow the instructions for category A on an EPA chemical-resistance category selection chart.

Mixers, loaders, applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks
- Chemical resistant gloves for mixers and loaders supporting applications and all handlers supporting or using backpack or low pressure spray applications.
- Protective eyewear
- Chemical resistant apron when cleaning equipment, mixing or loading.
- Double layer clothing and gloves are required when handling enclosed devices.

USER SAFETY REQUIREMENTS

Follow manufacturer's instructions for cleaning/maintaining PPE. If no wash instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

USER SAFETY RECOMMENDATIONS

Users should:

Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing. Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.

Do not enter or allow others to enter the treated areas until sprays have dried.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application.

OCCUPATIONAL EXPOSURE LIMITS:

AEL Recommended	5 mg/m³
ACGIH TLV	100 ppm
OSHA PEL	100 ppm

OCCUPATIONAL EXPOSURE STANDARDS: Not established

MATERIAL SAFETY DATA SHEET
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SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION - CONTINUED

VENTILATION: Provide exhaust ventilation or other engineering controls to keep exposure to airborne contaminants below the exposure limit.

EYE PROTECTION: See **PERSONAL PROTECTIVE EQUIPMENT (PPE)** above.

BODY PROTECTION: See **PERSONAL PROTECTIVE EQUIPMENT (PPE)** above.

RESPIRATORY PROTECTION: None required but recommend MSHA-NIOSH approved respirator for organic vapors and mists.

OTHER PROTECTIVE EQUIPMENT: Eyewash station and safety shower in work area.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

FORMULATION:	Emulsifiable Concentrate
PHYSICAL STATE:	Liquid
COLOR:	Clear Amber
ODOR:	Aromatic odor
BOILING POINT:	>350°F
MELTING POINT:	Not applicable
FREEZING TEMPERATURE:	Not available
VAPOR PRESSURE:	Not available
VAPOR DENSITY:	Not available
EVAPORATION RATE:	Not available
SPECIFIC GRAVITY:	1.055 (Water = 1.0)
BULK DENSITY:	8.84 lbs/gal
SOLUBILITY IN WATER:	Miscible
pH VALUE:	Not available
% VOLATILES, 1 Hr @ 230°F:	58.98

SECTION 10: STABILITY AND REACTIVITY

CHEMICAL STABILITY:	Stable
CONDITIONS TO AVOID:	Excessive heat and sunlight
MATERIALS TO AVOID:	Strong acids
HAZARDOUS DECOMPOSITION PRODUCTS:	Oxides of carbon and phosphorus and hydrochloric acids. Incomplete combustion may lead to formation of carbon monoxides and/or other asphyxiates.
HAZARDOUS POLYMERIZATION:	Will not occur.

MATERIAL SAFETY DATA SHEET
RAVAP® EC

SECTION 11: TOXICOLOGICAL INFORMATION

ACUTE ORAL LD_{50} (RAT):	500 mg/kg
ACUTE DERMAL LD_{50} (RABBIT):	>2000 mg/kg
ACUTE INHALATION (RAT – 4 HR LC_{50}):	2.16 mg/l (no deaths)
PRIMARY EYE IRRITATION (RABBIT):	Irritant
PRIMARY DERMAL IRRITATION (RABBIT):	Irritant
DERMAL SENSITIZATION:	May cause sensitization in some individuals.

Not a Known Carcinogen

EFFECTS OF OVEREXPOSURE:

Acute overexposure may cause irreversible eye damage or skin burns. Harmful if swallowed or absorbed through skin. Do not get in eyes (including animals), on skin, or on clothing. Prolonged or frequently repeated skin contact may cause allergic reaction in some individuals. May result in acute cholinesterase depression. Symptoms of cholinesterase inhibition are burning of skin and mouth, headache, dizziness, blurred vision, pin-point pupils, nausea, stomach cramps, muscle twitching. In extreme cases, unconsciousness, convulsions and severe respiratory depression may occur.

Chronic overexposure:

TCVP - According to the USEPA (RED, 1995), Tetrachlorvinphos did not cause organophosphate induced delayed neurotoxicity in hens(OPIDN) in the hen following single or multiple (21 days) exposures. Following single oral doses to rats, transient neurotoxic effects were observed in both sexes on day one two highest (925 and 650 mg/kg); these effects were consistent with cholinesterase inhibition. All rats were normal by day 14 with no indication of any permanent behavioral changes or of any adverse neuropathological effects. Subchronic and chronic oral exposure in rats and dogs resulted in decreased plasma cholinesterase activity and reduced red blood cells. The carcinogenic potential of tetrachlorvinphos as been classified as a group C (possible human) carcinogen by the USEPA Carcinogenity Peer Review Committee of the Agency's Office of Pesticide Programs.

DDVP – According to the USEPA (RED 2006), Dichlorvos did not cause organophosphate induced delayed neurotoxicity (OPIDN) in the hen following single or multiple (28 days) exposures. Following a single oral dose to rats, dichlorvos was associated with a variety of neurological and physiological changes. Subchronic and chronic oral exposures in rats and dogs as well as chronic inhalation exposure in rats resulted in significant decreases in plasma, red blood cell and/or brain cholinesterase activity. The carcinogenic potential of dichlorvos has been classified as "suggestive" under the 1999 Draft Agency Cancer Guidelines and no quantitative assessment of cancer risk is required. There was no evidence of increased susceptibility following in utero exposures to rats and rabbits as well as pre/post-natal exposure to rats. Also, there was no evidence of abnormalities in the development of the fetal nervous system in the lifetime neurotoxicity studies submitted to the Environmental Protection Agency.

SECTION 12: ECOLOGICAL INFORMATION

This product is toxic to fish, birds, and other wildlife. Drift and runoff may be hazardous to aquatic organisms in adjacent areas. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when cleaning equipment or when disposing of equipment wash waters.

MATERIAL SAFETY DATA SHEET
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SECTION 13: DISPOSAL CONSIDERATIONS

PESTICIDE DISPOSAL: Pesticide wastes are acutely toxic. Improper disposal of excess pesticide, spray mixture or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by use according to label instructions, contact your state pesticide or environmental control agency or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

CONTAINER DISPOSAL: DO NOT reuse empty container. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or incinerate, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

SECTION 14: TRANSPORT INFORMATION

Follow the precautions indicated in the Handling and Storage Section, Section 7 of this MSDS

DOT PROPER SHIPPING NAME:
For containers 1 gallon (4L) or less: CONSUMER COMMODITY, ORM-D PER 49 CFR 172.153(C)
For containers 2.5 – 5 gallons : UN3018, ORGANOTHOSPHORUS PESTICIDE, LIQUID, TOXIC (TETRACHLORVINPHOS, DICHLORVOS), 6.1, III, MARINE POLLUTANT (DICHLROVOS)
For containers 21-110 gallons : UN3018, ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC (TETRACHLORVINTHOS, DICHLORVOS), 6.1, III, MARINE POLLUTANT (DICHLROVOS), RQ (DICHLROVOS)

IATA/ICAO CLASSIFICATION:
UN3018, ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC, COMBUSTIBLE (TETRACHLOROVINSPHOS, DICHLROVOS), 6.1, (3), III

IMO CLASSIFICATION:
UN3018, ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC, COMBUSTIBLE (TETRACHLOROVINPHOS, DICHLORVOS), 6.1, (3), III, MARINE POLLUTANT (DICHLROVOS), FP 67.8 C cc, EMS F-A, S-D

SECTION 15: REGULATORY INFORMATION

UNITED STATES EPA: EPA Reg. No. 61483-5C
EPA Signal Word – DANGER

OTHER:
SARA Hazard Notification/Reporting
Immediate Y Fire Y Sudden Release of Pressure N
Delayed Y Reactive N

SARA 302-304 (40CFR 350): Dichlorvos 62-73-7, extremely hazardous substance (EHS)
SARA 313, TOXIC CHEMICALS: Dichlorvos – 62-73-7, 1000 pounds; Phenol – 108-95-2 1000 pounds
REPORTABLE QUANTITIES: Dichlorvos – 62-73-7 10 lbs., Phenol 108-95-2 1000 lbs.
CALIFORNIA PROPOSITION 65: This product contains ingredients known to the State of CA to cause cancer or reproductive toxicity.

MATERIAL SAFETY DATA SHEET
RAVAP® EC

SECTION 16: OTHER INFORMATION

Reason for MSDS Revision: New Formulation

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof KMG-Bernuth, Inc. (Company), makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

MSDS No.: 6148350
Revision No.: Original
Supersedes: N/A
Date: Feb 6, 2008
Prepared by Hubert R. O'Neal
Approved by Scott Hathorn III

VALENT BIOSCIENCES CORPORATION

Material Safety Data Sheet

Tetramethrin Technical 95%

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Tetramethrin Technical 95%
EPA REGISTRATION NUMBER: 73049-145
CHEMICAL DESCRIPTION: tetramethrin
SYNONYM(S): Neo Pynamin (SCC)
PRODUCT DESCRIPTION: This product is intended for formulation use only. Insecticide.

MANUFACTURER
Valent BioSciences Corporation
870 Technology Way
Libertyville, IL 60048

EMERGENCY TELEPHONE NUMBERS
HEALTH EMERGENCY OR SPILL (24 hr):
Within the United States: (877) 315-9819
Outside the United States: (651) 632-6184

PRODUCT INFORMATION
ENVIRONMENTAL SCIENCE PRODUCTS:
(866) 822-3731
www.valentbiosciences.com

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

CAUTION

- Harmful if swallowed, inhaled or absorbed through skin
- Avoid breathing vapor or dust
- Highly toxic to fish
- Combustible
- Keep out of reach of children

POTENTIAL HEALTH EFFECTS

Acute Toxicity (Primary Routes of Exposure): Inhalation, eye and skin contact

Signs and Symptoms of Systemic Effects: Based on animal studies, symptoms of overexposure to this product include diarrhea, yellow nasal discharge, and activity decrease.

Acute Eye Contact: Slightly irritating.

Acute Ingestion: Harmful if swallowed.

Acute Inhalation: This product may be harmful if inhaled.

Potentially Aggravated Medical Conditions: None known

For complete discussion of the toxicology data from which this evaluation was made, refer to Section 11. For Ecotox/Environmental Information, refer to Section 12. For Regulatory Information, refer to Section 15.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS Number	Weight/ Percent	Purpose
Tetramethrin * [(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl 2,2-dimethyl-3-(2-methyl-1-propenyl) cyclopropanecarboxylate]	7696-12-0	95	Active Ingredient
Others	VARIOUS CAS NO.	5	Other Ingredients

Other ingredients, which are maintained as trade secrets, are any substances other than an active ingredient contained in this product. Some of these may be hazardous, but their identity is withheld because they are considered trade secrets. The hazards associated with the other ingredients are addressed in this document. Specific information on other ingredients for the management of exposures, spills, or safety assessments can be obtained by a treating physician or nurse by calling **(877) 315-9819** (within the United States) or **(651) 632-6184** (outside the United States) at any time.

4. FIRST AID MEASURES

EYE CONTACT:
Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a poison control center or doctor for treatment advice.

SKIN CONTACT:
Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. Call a poison control center or doctor for treatment advice.

INGESTION:
Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. DO NOT induce vomiting unless told to do so by the poison control center or doctor. Do not give anything by mouth to an unconscious person.

INHALATION:
Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. Call a poison control center or doctor for further treatment advice.

NOTES TO PHYSICIAN:
This product contains a Pyrethroid pesticide. If a small amount is ingested (or if treatment is delayed) oral administration of large amounts of activated charcoal and a cathartic is probably sufficient therapy. If large amounts are ingested and vomiting has not occurred emesis should be induced with supervision. Keep patients head below hips to prevent aspiration. If symptoms such as loss of gag reflex, convulsions or unconsciousness occur before emesis, gastric lavage using a cuffed endotracheal tube should be considered.

Do not administer milk, cream or other substance containing vegetable or animal fats, which enhance the absorption of lipophilic substances.

If localized paresthesia develops, the site should be thoroughly washed with soap and water. Cold cream can be applied to help diminish the effect

5. FIRE FIGHTING MEASURES

FLASH POINT: Not applicable
EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, foam, or water.

NFPA RATING:

Health:	1
Flammability:	2
Reactivity:	0
Special:	None

(Least-0, Slight-1, Moderate-2, High-3, Extreme-4). These values are obtained using professional judgement. Values were not available in the guidelines or published evaluations prepared by the National Fire Protection Association, NFPA.

FIRE FIGHTING INSTRUCTIONS: As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH approved (or equivalent) and full protective gear. Keep upwind. Isolate hazard area. Avoid inhalation of smoke and fumes. Use water or foam to reduce fumes. Do not touch spilled material. If possible, move containers from area. Extinguish only if flow of water can be stopped. Use flooding amounts of water as a fog. Cool containers with flooding amounts of water from as far a distance as possible. Avoid breathing vapors.

HAZARDOUS DECOMPOSITION PRODUCTS: May form toxic materials such as: Carbon dioxide, Carbon monoxide, various hydrocarbons, etc

6. ACCIDENTAL RELEASE MEASURES

VALENT BIOSCIENCES EMERGENCY PHONE NUMBER:
WITHIN THE UNITED STATES: (877) 315-9819
OUTSIDE OF THE UNITED STATES: (651) 632-6184

UN/NA NUMBER: UN 3077 **EMERGENCY RESPONSE GUIDEBOOK NO.:** 171

If it is safe to do so:
- Evacuate non-essential personnel from the area to prevent human exposure.
- Remove all sources of ignition.
- Ventilate area, especially low areas where vapors may accumulate.
- Stop the source of the spill. Contain the spill to prevent further contamination of the soil, surface water, or ground water.
- May produce slippery conditions.

GENERAL AND DISPOSAL: Use proper protective equipment to minimize personal exposure (see Section 8). Take all necessary action to prevent and to remedy the adverse effect of the spill. For additional spill response information refer to the **North American Emergency Response Guidebook** , if applicable. Ensure that the disposal is in compliance with all Federal, State, and local regulations. Refer to Section 14 for applicable Reportable Quantity (RQ) and other regulatory requirements.

FOR SPILLS ON LAND

CONTAINMENT: Where possible, container should be oriented to prevent further leakage Prevent spread of dust Do not allow spilled material to enter any body of water

CLEANUP:
Clean up spill immediately. Vacuum or sweep up material and place in a chemical waste container. Wash area with soap and water. Pick up wash liquid with additional absorbent and place in a chemical waste container.

7. HANDLING AND STORAGE

END USER MUST READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL.

HANDLING PRECAUTIONS: Avoid contact with skin, eyes or clothing. Avoid dust generation and provide for room ventilation during handling. Avoid breathing vapors.

STORAGE: Store in a cool, well-ventilated place away from sources of heat and direct sunlight. Keep container tightly closed. Keep only in original container Do not contaminate water, food or feed by storage or disposal

WORK/HYGIENIC PRACTICES: Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove contaminated clothing and wash clothing before reuse.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

END USER MUST READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL.

EYES & FACE: Do not get this material in your eyes. Eye contact can be avoided by wearing safety glasses or goggles.

RESPIRATORY PROTECTION: Use this material only in well ventilated areas. If operating conditions result in airborne concentrations of this material, the use of a NIOSH approved air purifying respirator with organic vapor cartridge should be worn.

SKIN & HAND PROTECTION: Avoid contact with skin or clothing. Skin contact should be minimized by wearing protective clothing including gloves (such as butyl or nitrile rubber gloves).

ENGINEERING CONTROLS: Control airborne concentrations below appropriate exposure guidelines. Use local exhaust ventilation

EXPOSURE LIMITS

Chemical Name	ACGIH Exposure Limits	OSHA Exposure Limits	Manufacturer's Exposure Limits
Tetramethrin * [(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl 2,2-dimethyl-3-(2-methyl-1-propenyl) cyclopropanecarboxylate]	None	None	None
Others	None	None	None

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL FORM:	Crystalline powder
COLOR:	White
ODOR:	Faint characteristic odor
FLASH POINT:	Not applicable
MELTING POINT:	68 - 70° C
BULK DENSITY:	1.147 lb/gal @ 25° C
VAPOR PRESSURE:	0.0021 Pa @ 25° C
pH:	4.7 @ 25° C
OCTANOL/WATER PARTITION COEFFICIENT:	logPow = 4.58 @ 25° C

SOLUBILITY:

Water	1.83 ppm @ 25° C
Ethanol	8.90 g/100 mL
n-Hexane	2.74 g/100mL
Methanol	9.19 g/100 mL

10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable at normal temperatures and storage conditions.
INCOMPATIBILITY: Alkalies and strong oxidizers.
OXIDATION/REDUCTION PROPERTIES: Product does not have the potential to act as a strong oxidizing or reducing agent.
EXPLODABILITY: Not expected to be explosive
HAZARDOUS POLYMERIZATION : Will not occur
HAZARDOUS DECOMPOSITION PRODUCTS: May form toxic materials such as: Carbon dioxide, Carbon monoxide, various hydrocarbons, etc
CONDITIONS TO AVOID: Direct sunlight, source of heat, open flames, sparks and high temperature.

11. TOXICOLOGICAL INFORMATION

ACUTE TOXICITY:

The following information is for the technical material.

Oral Toxicity LD_{50} (rats)	> 5000 mg/kg	EPA Tox Category	IV
Dermal Toxicity LD_{50} (rabbits)	> 2000 mg/kg	EPA Tox Category	III
Inhalation Toxicity LC_{50} (rats)	> 2.37 mg/m^3	EPA Tox Category	IV
Eye Irritation (rabbits)	Minimally irritating	EPA Tox Category	IV
Skin Irritation (rabbits)	Non-irritating	EPA Tox Category	IV
Skin Sensitization (guinea pigs)	Non-sensitizer	EPA Tox Category	Not available

Chemical Name	IARC - Group 1 (carcinogenic to humans)	IARC - Group 2A (Probably carcinogenic)	IARC - Group 2B (Possibly carcinogenic)	NTP Carcinogen List
Tetramethrin * [(1,3,4,5,6,7-hexahydro-1,3-dioxo-2 H-isoindol-2-yl)methyl 2,2-dimethyl-3-(2-methyl-1-propenyl) cyclopropanecarboxylate]	No	No	No	Not listed

MUTAGENICITY: Negative (active ingredient)

For a summary of the potential for adverse health effects from exposure to this product, refer to Section 2. For information regarding regulations pertaining to this product, refer to Section 15.

12. ECOLOGICAL INFORMATION

AQUATIC ORGANISM TOXICITY: This product is highly toxic to fish. Tetramethrin Technical aquatic testing:

Rainbow trout 96-hour LC50 = 0.0037 mg/L;
Bluegill 96-hour LC50 = 0.016 mg/L
Daphnia magna 48-hour EC50: 0.11 mg/L

ENVIRONMENTAL FATE: Tetramethrin technical n-botanol/water: log Pow = 4.58 @ 25° C

OTHER ENVIRONMENTAL INFORMATION:
Do not discharge effluent containing this product into lakes , streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollution Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product into sewer systems without previously notifying the local sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA. Do not contaminate water when disposing of equipment wash waters.

13. DISPOSAL CONSIDERATIONS

END USERS MUST DISPOSE OF ANY UNUSED PRODUCT AS PER THE LABEL RECOMMENDATIONS.

PRODUCT DISPOSAL:
Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

CONTAINER DISPOSAL:
Non-refillable container. Do not reuse or refill this container Offer for recycling or reconditioning if available, or puncture and dispose of in a sanitary landfill, or by other approved state and local procedures

DISPOSAL METHODS:
Check government regulations and local authorities for approved disposal of this material. Dispose in accordance with applicable laws and regulations.

14. TRANSPORT INFORMATION

UN/NA NUMBER:	UN 3077
DOT (ground) SHIPPING NAME:	Environmentally hazardous substances, solid, n.o.s.
TECHNICAL NAME (hazardous material):	Tetramethrin 95%
HAZARD CLASS:	9
PACKING GROUP:	III
DOT REPORTABLE QUANTITY (RQ):	Not applicable
REMARKS:	None
EXEMPTION REQUIREMENT:	None
EMERGENCY RESPONSE GUIDEBOOK NO.:	171
MARINE POLLUTANT:	Yes, per 40 CFR172.101

15. REGULATORY INFORMATION

PESTICIDE REGULATIONS: All pesticides are governed under FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act). Therefore, the regulations presented below are pertinent only when handled outside of the normal use and applications of pesticides. This includes waste streams resulting from manufacturing/formulation facilities, spills or misuse of products, and storage of large quantities of products containing hazardous or extremely hazardous substances.

U.S. FEDERAL REGULATIONS:

Ingredients in this product are reviewed against an inclusive list of federal regulations. Therefore, the user should consult appropriate authorities. The federal regulations reviewed include: Clean Water Act, SARA, CERCLA, RCRA, DOT, TSCA and OSHA. If no components or information is listed in the space below this paragraph, then none of the regulations reviewed are applicable.

Tetramethrin * [(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl 2,2-dimethyl-3-(2-methyl-1-propenyl) cyclopropanecarboxylate]

SARA 313 Chemicals	1.0% de minimis concentration

SARA (311, 312):

Immediate Health:	Yes
Chronic Health:	No
Fire:	Yes
Sudden Pressure:	No
Reactivity:	No

STATE REGULATIONS:

Each state may promulgate standards more stringent than the federal government. This section cannot encompass an inclusive list of all state regulations. Therefore, the user should consult state or local authorities. The state regulations reviewed include: California Proposition 65, California Directors List of Hazardous Substances, Massachusetts Right to Know, Michigan Critical Materials List, New Jersey Right to Know, Pennsylvania Right to Know, Rhode Island Right to Know and the Minnesota Hazardous Substance list. For Washington State Right to Know, see Section 8 for Exposure Limit information. For Louisiana Right to Know refer to SARA information listed under U.S. Regulations above. If no components or information is listed in the space below this paragraph, then none of the regulations reviewed are applicable.

Tetramethrin * [(1,3,4,5,6,7-hexahydro-1,3-dioxo-2H-isoindol-2-yl)methyl 2,2-dimethyl-3-(2-methyl-1-propenyl) cyclopropanecarboxylate]

NJ Right To Know	Listed

For information regarding potential adverse health effects from exposure to this product, refer to Sections 2 and 11.

16. OTHER INFORMATION

REASON FOR ISSUE:	New format. Revisions throughout MSDS.
EPA REGISTRATION NUMBER:	73049-145
MSDS NO.:	ENV-0104
REVISION NUMBER:	2
REVISION DATE:	07/29/2011
SUPERCEDES DATE:	July 12, 2004
RESPONSIBLE PERSON(S):	Valent U.S.A. Corporation, Corporate EH&S, (925) 256-2803

This Material Safety Data Sheet (MSDS) serves different purposes than and DOES NOT REPLACE OR MODIFY THE EPA-APPROVED PRODUCT LABELING (attached to and accompanying the product container). This MSDS provides important health, safety, and environmental information for employers, employees, emergency responders and others handling large quantities of the product in activities generally other than product use, while the labeling provides that information specifically for product use in the ordinary course.

Use, storage and disposal of pesticide products is regulated by the EPA under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) through the product labeling. All necessary and appropriate precautionary, use, storage, and disposal information is set forth on that labeling. It is a violation of federal law to use a pesticide product in any manner not prescribed on the EPA-approved label.

The information in this MSDS is based on data available to us as of the revision date given herein, and believed to be correct. Contact Valent Biosciences to confirm if you have the most current MSDS.

Judgements as to the suitability of information herein for the individual's own use or purposes are necessarily the individual's own responsibility. Although reasonable care has been taken in the preparation of such information, Valent extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the individual's purposes or the consequences of its use.

Appendix AJ : Report & Curriculum Vitae – Charlie Hoeller

Review of Structural Hazards at Marijuana Grow Operation Sites

Provided by: Charlie Hoeller, Building Inspector Supervisor, City of Surrey

Adjunct Professor / Surrey Fire Chief Len Garis approached the Building & Construction Division in summer 2014 to perform a review of structural and building hazards in the marijuana grow operations (MGO) that had been documented by the City's Electrical and Fire Safety Inspection (EFSI) program. This review was part of a study by the University of the Fraser Valley on the hazards associated with both illegal MGOs and those that grow medical marijuana. Our instructions were to:

1. Develop a structural hazard rating system (no, minimal and high risk) that could be used to rate photos of MGO sites taken by the EFSI program.
2. Use this rating system to analyze 1,442 photos taken of MGOs by the EFSI for structural and building hazards that contravened the City's Zoning and Building Bylaws and the British Columbia Building Code.

Rating System

We were provided with 50 representative photos to create the rating system. The photos were reviewed with respect to violations to City of Surrey Zoning and Building Bylaws and the BC Building Code (BCBC).

Based on a review of the photos, the following rating system was established:

- **0 – no risk:** In these properties, the MGO had been removed, the site had been generally cleaned up and repaired. Any issues that remained would be low risk, such as staple/nail holes in walls and ceilings, or altered floor coverings.
- **1 – minimal risk** – In these properties, the MGO had been removed, but some repairs would be required to bring the site to code and the damage would required a building permit to repair – for example, holes in walls.
- **2 – high risk** – In these properties, the MGO was still in operation and there are multiple issues of non-compliance with the BCBC, City of Surrey Zoning and Building Bylaw, and property use. All require rezoning of the property and a valid building permit for a change of occupancy for the subject building.

Review of EFSI Photos

The 1,855 addresses and accompanying photos were then reviewed and ranked. A spreadsheet was created that listed each address, the building type, the structural hazard rating and details about violations and hazards, based on the photos provided. Subsequent analysis was performed by the research team that was conducting the study.

Curriculum Vitae – Charlie Hoeller

Qualifications Overview:

- Trades Qualification and Interprovincial Certification as a Carpenter.
- Diploma in Building Technology.
- Level 3 Registered Building Official (RBO) with Building Officials Association of BC (BOABC).
- 25 years employment with the City of Surrey as a Building Inspector and Supervisor of Building Inspectors.
- 14 years part-time studies instructor at the British Columbia Institute of Technology (BCIT) for two Building Code night school courses and one correspondence course.

Background:

As a Building Inspector Supervisor at the City of Surrey, my work involves:

- Reviewing building plans and onsite construction and renovation activities for all types of buildings, during all phases of construction, for compliance with the City of Surrey Zoning Bylaw and Building Bylaw, and the British Columbia Building Code and its supporting regulations.
- Conducting onsite reviews of buildings and uses for business licensing purposes.
- Staying up-to-date on changes to relevant codes, regulations, and procedures.
- Supervising and training between 10 and 15 building inspectors.

The nature of my work requires the ability to quickly assess a property and a building for potential risks and violations to the City Zoning Bylaw and Building Bylaw, and the BCBC. I have reviewed thousands of building projects through four versions of the BCBC in my 25 years with the City of Surrey, and have been a supervisor for approximately five of those years.

Certification

The BAOBC represents more than 675 members, primarily local government building inspectors and plan checkers and those involved in building design, construction, testing and research. I have achieved Level 3 certification as a Registered Building Official (RBO) through the association, based on the three-tier certification system:

- Level 1: single-family homes (Part 9 BCBC)
- Level 2: buildings up to 600 m^2 and three storeys in building height (Part 9 BCBC)
- Level 3: large buildings (Part 3 BCBC)

Teaching

I currently develop, maintain and instruct educational curriculum related to two BCBC night school courses and one correspondence course for BCIT, and have done so since the year 2000.

These courses are set up in part to provide training for candidates wishing to write the Level 1 and 2 BOABC exams as part of the three-tier certification system, and to provide Building Code training for BCIT students enrolled in Home Inspection and Estimating Programs as well as the public at large.

The courses cover:

- Level 1 content, which includes all Building Code related requirements for single-family dwelling buildings within the scope of Part 9 of the BCBC.

- Level 2 content, which includes all Building Code related requirements for buildings other than single-family dwellings within the scope of Part 9 and related Part 3 references.

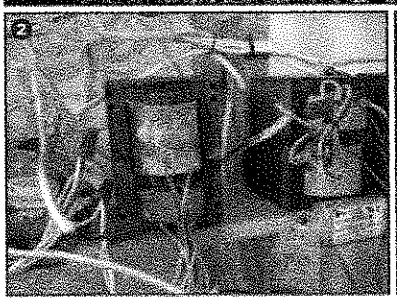
Both of the courses are offered three times per year as part of the night school continuing education service at the Burnaby BCIT campus. A version of the Level 1 course is also available as a correspondence course for those students not able to attend the night school classes.

Appendix AK: Gustin (2010) The Hazards of Grow Houses

The Hazards of Grow Houses

BY BILL GUSTIN

THE ENVIRONMENT FAVORABLE FOR GROWING marijuana indoors can be a very dangerous environment for firefighters when a fire occurs in a "grow house." The term "grow house" is misleading because it implies that marijuana growing occurs only in detached private dwellings, which is hardly the case. For example, one or two rooms in apartments are commonly converted to a grow house to produce a small crop. Conversely, some of the largest and most productive grow houses are located in rented warehouse bays (photo 1). For this article, a grow house refers to any indoor marijuana-growing operation.



(1) This grow house, located in a rented warehouse bay, is essentially a wood-frame shack built inside a Type II noncombustible building. This enclosure is oxygen deficient because of the use of carbon dioxide from cylinders to hasten the growth of the plants. (Photos by Eric Goodman.) (2) Each high-intensity lamp requires its own capacitor, which holds an electrical charge after power is shut off, and a transformer, to step up voltage. (3) Light from high-pressure sodium vapor lamps reflects off the walls and ceilings. The reflective surface acts as a mirror when viewed through a thermal imaging camera.

Growing operations are replete with electric hazards because of exposed wiring, terminals, and connections. Artificial light is created by high-voltage mercury vapor or high-pressure sodium lamps, each requiring its own igniter, capacitor, and transformer (photo 2). Firefighters risk electrocution if they make bodily contact with a metal tool or direct a stream of water on this equipment at close range. The risk for electrocution is intensified when firefighters operate in limited visibility, which may not be improved by a thermal imaging camera (TIC), because the ceilings and walls are commonly covered with reflective insulation board. The reflective surface acts as a mirror when viewed through a TIC (photo 3). All but the smallest growing operations require a substantial amount of electricity to illuminate the high-intensity lights and run the air-conditioners necessary to remove the excessive heat produced by the lights. The power is commonly obtained by illegally and dangerously tapping into the electric service before the electric meter (photo 4). This diversion of the electrical service is usually connected to separate electrical panels specifically for the grow operation (photo 5). The theft of electricity and makeshift wiring make it almost impossible for firefighters to ensure that the power has been shut off.

Grow houses are extensively insulated to increase the efficiency of air-conditioning and to reduce heat transfer to the upper floors and attic. Foil-covered insulation board commonly blocks window openings. Several inches of insulation are needed to prevent an unusually warm roof, indicative of a grow house, from being spotted by a helicopter infrared device. Extensive insulation and covered exterior openings will hasten flashover conditions. Insulation overhead can mask indications of fire in the attic or in the space between the ceiling of the growing area and the floor above. Marijuana has a distinct, pungent odor, which is readily detectable outside a

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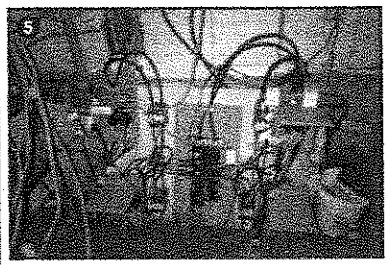
GROW HOUSE HAZARDS



(4) The wire just below the back of the weatherhead taps into the electrical service before the electric meter. [Photos courtesy of Miami-Dade (FL) Fire Rescue.] (5) Illegal diversion of electric service is usually connected to separate panels specifically for the grow operation. Theft of electricity and makeshift wiring make it almost impossible to ensure that the power is disconnected.

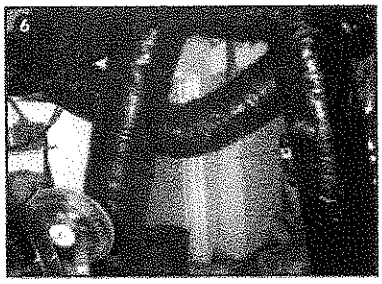
grow house. To prevent detection, grow house operators use large carbon filters to absorb odors and may seal roof soffit vents when ventilation ductwork terminates in the attic. Odor venting from turbines at or near the roof ridge is less likely to be noticed than odors venting from soffits. Similarly, it is not uncommon to route exhaust ductwork into a toilet to vent the odor of marijuana up a plumbing stack penetrating the roof. Air circulation is vital for growing marijuana and to reduce condensation that can accumulate in cold climates. As a result, growers commonly cut holes in floors to extend ductwork from the basement and between floors; this presents a falling hazard for firefighters as well as a route for vertical fire extension. Firefighters operating in a smoky grow house also risk entanglement in electric wires, water tubing suspended from the ceiling, string to support mature plants, and wire helixes inside flexible ductwork (photo 6).

Grow houses commonly have one or more pressurized gas cylinders, which can explode if exposed to fire. The cylinders are used to enrich the concentration of carbon dioxide (CO_2) to hasten growth of the plants. This is achieved by releasing CO_2 gas from a cylinder or producing it from a natural gas or a propane-fueled CO_2 generator. Increasing the level of CO_2 can cause an oxygen-deficient atmosphere. Firefighters entering an enclosed growing space must use their self-contained breathing apparatus until the space is ventilated and metered for adequate oxygen concentration. Propane vapor leaking from a cylinder connected to a carbon-monoxide generator inside a grow house in Miami-Dade County, Florida, exploded, resulting in a partial collapse of the structure and the death of one of its occupants (photo 7). Fortunately, the explosion occurred before the firefighters arrived. Booby traps intended to thwart the theft of plants cannot distinguish among a burglar, a police officer, or a firefighter. Booby traps in grow houses may be sophisticated or as simple as boards with protruding nails positioned on the floor inside of doorways.

Although it is very difficult to identify a grow house from the outside, firefighters conducting a 360° size-up should suspect any unusual hoses or wires entering a building and report their presence to the incident commander (IC). For example, police officers serving a warrant at a suspected grow house by chance happened to notice something unusual about the house next door to the suspected house: Two hoses from the swimming pool pump entered the house through a hole in an exterior wall. The officers suspected that the hoses were connected to a heat pump used to air-condition a grow operation. Their suspicions were raised when they examined the other side of the house and found large-gauge electric wires that evidently tapped into the underground electrical service before it entered the meter (photo 8).

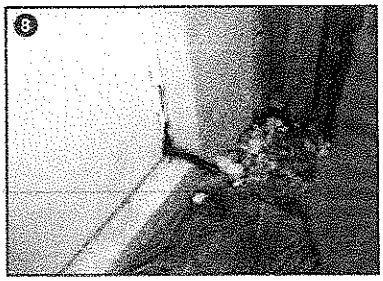
The first indication of a grow operation observed by firefighters operating in limited visibility may be a garden hose leading to a large garbage can containing water and a submersible pump, commonly used to water marijuana plants. Similarly, pumps, hoses, or plastic containers in a bath tub or shower are also suspect. Window openings covered on the inside are usually concealed by blinds and are impossible to detect; however, firefighters breaking windows from the outside for ventilation who encounter any type of covering on the inside should immediately notify the IC of a suspected grow house.

Remember that grow houses are typically secured extensively to prevent detection and break-ins. Consequently, firefighters entering a suspected grow house should rely on only one means of escape—the door through which they entered;



(6) Flexible ducts, used to exhaust telltale odor and circulate air, pose a common entanglement hazard in most grow houses. [Photos courtesy of Miami-Dade (FL) Fire Rescue.] (7) This grow house partially collapsed as the result of an explosion caused by propane leaking from a cylinder. The propane fueled a carbon dioxide generator.

GROW HOUSE HAZARDS



(8) These wires to a grow house tapped into the underground electrical service before the meter. (Photo by Eric Goodman.)

all other doors and windows may be blocked or covered. Accordingly, companies operating on the exterior of a suspected grow house should rapidly force alternate means of egress for firefighters operating inside.

There is a significant civilian life hazard at many grow houses because a portion of a residence is used for growing while the remainder is occupied by families with children. Unfortunately, innocent children are at risk because of their parents' greed; the front door may be their only means of escape from fire, because all other doorways are blocked and the windows are covered. Firefighters searching for occupants of a suspected grow house should strongly consider vent-enter-search (VES) operations. This tactic involves breaking windows from the outside, completely removing the sash and any covering on the inside, making entry, and searching the area near the window. VES allows rapid entry and search of bedrooms, which can be difficult to locate from the inside because of a grow house's makeshift partitions.

Firefighters place themselves at great risk when they enter a fire building without knowing its occupancy because they literally do not know what they're getting into. Knowing a building's occupancy or use gives firefighters a general idea of its floor plan and what hazards to expect. Firefighters are at greater risk, however, when they enter a house thinking it is a residential occupancy and are not aware that it is used for a marijuana-growing operation. Recognizing a grow house early and being aware of the associated hazards are keys to reducing the risk to firefighters operating at fires in these dangerous and illegal occupancies. ●

Thanks to Sgt. Chris McManus, Miami-Dade (FL) Police Narcotics Bureau, for his assistance with this article.

● **BILL GUSTIN**, a 37-year veteran of the fire service, is a captain with Miami-Dade (FL) Fire Rescue and lead instructor in his department's officer training program. He began his fire service career in the Chicago area and teaches fire training programs in Florida and other states. He is a marine firefighting instructor and has taught fire tactics to ship crews and firefighters in Caribbean countries. He also teaches forcible entry tactics to fire departments and SWAT teams of local and federal law enforcement agencies. Gustin is an editorial advisory board member of *Fire Engineering*.

Appendix AL: Johnson & Miller (2011) Consequences of Large-scale Production of Marijuana in Residential Buildings

Case Report

Indoor and Built Environment

Indoor Built Environ 2012;21;4:595-600 Accepted: May 1, 2011

Consequences of Large-scale Production of Marijuana in Residential Buildings

Luke I. Johnson J. David Miller

Department of Chemistry, Carleton University, Ottawa, Canada

Key Words
Health · Marijuana grow operations · Ventilation rates · Moisture

Abstract
Based on the data from the breadth of Canada (~4300km), one-third of Canadian homes have ventilation rates below the recommended standard of 0.3 air changes per hour and are at risk for moisture problems. For the purposes of this investigation, a literature review was performed on the health risks associated with exposure to living and drying marijuana plants and the fungi associated with large numbers of indoor plantings. Analysis was made of the impact on Canadian homes if used to grow marijuana. These are commonly called "marijuana grow operations" based on measured ventilation rates from homes in Windsor, Ontario and Regina, Saskatchewan (representing diverse climates) and derived moisture loadings from published data. The growing and drying of marijuana plants contributes considerable amounts of water vapour to the indoor environment. Depending on the scale of production, considerable mould damage in the building can result. There are also a number of abiotic hazards resulting from marijuana production including pesticides, carbon monoxide, and products of unvented combustion appliances. Both indirect and direct evidence are described for the health impact of living in these conditions. This has a number of implications in terms of documentation and personal protection for industrial hygienists, home inspectors, and public health officials.

Introduction

Canada is second to the USA among industrialized nations in marijuana production, although it is illegal to produce and sell this plant in both nations. This demand has caused an increase in the number of illegal "marijuana grow operations" (MGOs) in homes [1,2]. To 2003, the average number of seized plants in Ontario MGOs was *ca.* 340. The exposed population to these conditions is not well defined. As a proxy for the total, *ca.* 1000 children were found in a 3-year period in MGOs in Ontario and the estimated total number might be considerably larger, 10,000 [3]. A study from the greater Vancouver area indicated many MGOs are "guarded" by immigrant families including young children (*ca.* 20%), and that these families are accessing the health care system [4]. Across Canada, there is an increasing number of former

DOI: 10.1177/1420326X11411954
Accessible online at http://ibe.sagepub.com

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MGOs that were not detected by the police. These homes are often purchased by unsuspecting people who face both health and legal challenges, although the exact number of affected people is not known [5,6].

In 2001, the Canadian Medical Marijuana Access Regulation (MMAR) [7] came into effect. In terms of population size, there were 4900 license holders of whom 3400 grow between 2 and 292 marijuana plants for personal use in January 2010 (http://www.hc-sc.gc.ca/dhp-mps/marihuana/stat/index-eng.php). This option is not available in the USA. The percentage of licensees that grow their own plants has been stable at ~70% for some years; the remaining individuals pool their permits to a maximum of three. The average number of plants grown by individuals is 25. Approximately, 2000 physicians issue permits under these regulations. The larger, legal MGOs in Canada potentially pose many of the same risks as illegal MGOs.

There are two main sources of moisture associated with the cultivation of marijuana indoors (1) moisture from the cultivation of the plant and (2) moisture arising from the drying of the plant. These sources are additional to those associated with the normal operation of the house or apartment building. These may include occupant sources, water leaks and ventilation failure leading to condensation [8–11]. Increased moisture results in growth of the saprophytic fungi characteristic of damp building materials [12,13]. Such growth is a function of internal moisture source strength [9]. Cultivation and drying of marijuana in residential dwellings may result in extensive environmental contamination and damage to the building. A study of illegal MGOs across Canada found that 11 of 12 had serious mould and moisture damage and evidence of the use of large amounts of pesticides and fertilizers. An attempt is made to keep grow operations warm and humid, and the odour of growing marijuana is distinctive, i.e. detected by authorities and/or neighbours. For both these reasons, efforts are made to seal the buildings to avoid detection [6]. This reduces the designed ventilation rate for the homes and hence moisture removal.

The purpose of this paper is to describe the potential damage and public health consequences of the input of additional moisture to the air within residential housing from the growth and drying of different numbers of large plants indoors in the existing housing stock in representative cities in Canada. We calculated the moisture load that a typical marijuana plant adds to a house. This is interpreted in relation to how this relates to mould growth on the building fabric and the effects of saprophytic mould on population health. Except under controlled conditions, the dominant fungus on drying plants is *Aspergillus fumigatus*, an allergenic species and a facultative pathogen. Additional literature reviews were conducted in order to evaluate the health risks more specific to the conditions associated with marijuana production in residential environments.

Methods

Moisture release of potted plants varies from 7 to 15 g·h^{-1} [14]. Based on the moisture release rate of a related plant [15] and scaled for mass after Kaa [16], a full-grown marijuana plant was calculated to release 18 g·h^{-1} of water vapour (432 g·day^{-1}). This value is consistent with an estimate by Christian [17].

Typically, moulds require a water activity (a_w) of at least 0.80–0.85 to promote rapid growth [13,14]. Like all "medicinal" plants, marijuana is at a much increased risk of mould growth during the drying period after harvest unless appropriate equipment is used. During this time, water previously bound to cells becomes available to fungi as the plant begins to decay. Dead and drying plant material with moisture contents above ~12% has an a_w sufficient to promote fungal growth. Moisture content >20% in drying plant material promotes rapid fungal growth [18]. This formed the indirect evidence to exposure from moulds on the plants, which were more directly answered by looking at concentrations of moulds on the marijuana and from patient reactions to smoking it.

Measured ventilation rates in winter were obtained from CMHC and Health Canada for 59 homes in Windsor and 103 in Regina (Wheeler, Heroux, Fugler, unpublished data). This was done by the Oak Ridge National Laboratory method; also, see Ref. [19] for an explanation of the method. Conditions in Windsor, Ontario (hot and humid in summer, moderate in winter) and Regina, Saskatchewan (moderate in summer, cold and dry in winter) were calculated and measured data were obtained for Ottawa (hot, often cold in winter) [20,21]. These cities represent communities with different climates in Canada. Growth of fungi on drying plants was assessed from the literature and from objective data.

Information on health effects of dampness and housing was taken from recent cognizant authority reviews [22–27]. A literature search of published peer reviewed journal articles was conducted in early 2009 for additional hazards that might relate to marijuana production in houses. The following databases were included: Web of Science, PubMed, EMBASE, MEDLINE, the Cochrane Library,

Sci Finder, government documents and those of professional groups. The search included publications from 1978. Boolean searching was used to combine up to 20 keywords and/or MESH headings. Keywords were classified as fungal (e.g. fungi, mould, *A. fumigatus*), environmental hazard (e.g. pesticides, herbicides, defoliant), relating to marijuana grow operations (e.g. marijuana, cannabis, MGOs), health (e.g. rhinitis, dermatitis, lung function), and moisture. Studies were assessed for relevance and whether they met all the Klimisch criteria [28]. The primary screening process involved one reviewer screening *ca.* 5000 articles. Two reviewers conducted the secondary screening process applying the relevance and quality criteria independently for the 300 studies selected. Biological and chemical contaminants arising from medium to large-scale cultivation of marijuana were identified during this process.

Results

Moisture Burdens

As plants are added to an MGO, moisture release will overwhelm home ventilation capacity and/or worsen the situation, if ventilation failure already exists. In Canada, the recommended combined infiltration and mechanical ventilation is 0.3 air changes per hour ($ac{\cdot}h^{-1}$) for a household of typical occupancy [20]. Air change rates are a function of outside air infiltration and mechanical ventilation in comparison to house volume. The recommended rate is meant to handle the daily moisture load produced by a typical family, prevent mould growth and reduce other airborne contaminants. A five person family releases 15 $kg{\cdot}day^{-1}$ water vapour [29].

In general, homes built after 1980 in Ottawa are at high risk of moisture damage if used as MGOs. Air change rates much higher than those normally found in new homes would be required to tolerate the additional moisture. Many Windsor homes (41%) had air change rates below the recommended standard and would be unable to handle more than one or two house plants (Table 1). The additional moisture released by 100 plants would result in mould growth in all the Windsor homes. The average air change rate for Windsor homes tested was 0.45 $ac{\cdot}h^{-1}$ (range 0.11–1.98 $ac{\cdot}h^{-1}$), at this rate ~16 plants could be theoretically tolerable. Data collected from Regina homes showed a similar trend. Many homes (38 of 108, i.e. 37%) were inadequately ventilated. Air change rates ranged from 0.072 to 3.02 $ac{\cdot}h^{-1}$ with a median of 0.463 $ac{\cdot}h^{-1}$. Of all 103 homes tested, only eight could theoretically tolerate the moisture released by >100

Table 1. Maximum tolerable number of marijuana plants for houses in Windsor, ON

No.	Air change rate ($ac{\cdot}h^{-1}$)	House volume (m^3)	Maximum tolerable number of marijuana plants
1	0.105	680	*
2	0.106	566	*
3	0.118	1019	*
4	0.121	657	*
5	0.147	498	*
6	0.162	523	*
7	0.167	566	*
8	0.174	770	4
9	0.185	612	*
10	0.186	634	*
11	0.225	748	14
12	0.227	680	10
13	0.243	634	10
14	0.244	634	10
15	0.247	453	*
16	0.253	408	*
17	0.256	453	*
18	0.258	177	*
19	0.258	408	*
20	0.269	295	*
21	0.271	453	1
22	0.286	362	*
23	0.311	181	*
25	0.336	634	27
26	0.337	725	36
27	0.347	544	20
28	0.354	227	*
29	0.355	222	*
30	0.369	227	*
31	0.422	476	24
32	0.427	725	55
33	0.466	227	*
34	0.468	295	*
35	0.482	283	5
36	0.495	453	30
37	0.513	227	*
38	0.521	215	*
39	0.527	430	31
40	0.535	680	71
41	0.544	340	19
42	0.549	340	19
43	0.553	453	38
44	0.556	630	67
45	0.571	680	78
46	0.571	385	29
47	0.595	906	122
48	0.603	362	29
49	0.612	249	9
51	0.650	272	17
52	0.657	272	17
53	0.697	261	18
54	0.723	204	8
55	0.748	283	27
56	0.877	227	23
57	0.923	396	72
58	0.934	204	21
59	1.982	227	96
Average	0.442	451	19

Note: *Existing risk to moisture problems.

marijuana plants, assuming that the home did not have an existing mould problem. On average, houses in Regina could theoretically tolerate 31 marijuana plants; however, when homes with air change rates above 1ac-h^{-1} (7 homes) are excluded, the number of home drops to 19 (data not shown), comparable to Windsor data.

These estimates cannot include the moisture released from drying. To assess this, the presence of mould on the product was used as an indicator of the percentage that is not dried properly (which would demonstrate the use of an appropriate drier indoors). Most samples (>90%) of dried marijuana test showed evidence growth of the allergenic and opportunistic pathogens such as *Aspergillus fumigatus*, *Aspergillus flavus*, *Aspergillus niger*, *Mucor* species, and various *Penicillium* species. In most samples tested, mould contamination was high (10^4–10^7 CFU-g^{-1}) [30–33].

Discussion

Infiltration was essentially the sole source of air change within Canadian homes built before World War II (WWII). These poorly insulated, air leaky homes have (or had) air change rates well above 0.3ac-h^{-1}. Since WWII, however, there has been a need for greater energy efficiency and hence better insulation in homes. To maintain air change rates, mechanical ventilation was developed; however, many new homes have been left with inadequate ventilation [20].

Leaves of all plants bear various phylloplane fungi. The spores of these dominate outdoor air during the growing season and primarily comprise the fungus *Alternaria alternata* and a number of species of *Cladosporium*, but mainly *Cladosporium herbarum* and *Cladosporium cladosporioides*. A large percentage of the population is allergic to these fungi [34]. *A. fumigatus* grows and dominates on decaying vegetation under warm conditions or where biological heating has taken place, including piles of leaves or compost. It is cellulolytic on delignified materials including leaves as well as paper and fabrics. The prevalence of *A. fumigatus* contamination of marijuana resulting from growing, harvesting, or smoking marijuana poses a health risk. These risks include allergic reactions [13,35]. Aside from respiratory disease, those allergic individuals with chronic high exposure may also develop allergic bronchopulmonary aspergillosis or ABPA [35,36]. *A. fumigatus* infections have also been reported in marijuana-exposed populations [37–41].

Dales et al. [8] note that apart from floods, there are four major sources of mould growth in residences: leaks in building fabric (rare in Canada because it is cold to very cold in winter and for the particular reason noted previously, uncommon in MGOs), ventilation failure leading to condensation, unattended plumbing leaks and household mould (e.g. mould growth on kitchen and bathroom surfaces, hidden food spills, etc.). Some degree of mould damage is present in ~30% of Canadian homes [42,43]. Inadequate ventilation for the internal moisture sources in a house accounts for most mould growth [9,10]. As noted, field experience indicates that mould damage in MGOs is often extensive [3–6].

Reviews by cognizant authorities, Health Canada (2004) [22], INSPQ (2002) [23], the Institute of Medicine, US National Academy of Sciences [24,25], an expert panel of the United States Centers for Disease Control/National Center for Healthy Homes [26] and the World Health Organization [26] emphasize the effects on population health of mould in the context of building dampness. These include increased allergic and upper respiratory disease. Health Canada [44] and Krieger et al. [26] state that there is sufficient evidence for health benefit from remediation of mould and dampness. Fungi are associated with new onset asthma in both adults and children and with non-atopic asthma [45,46].

The field data that exist reveal a number of poorly quantified abiotic factors. The cultivation of marijuana requires the large-scale use of liquid fertilizers, insecticides and fungicides [3,4,6] not authorized for indoor use. Residues of the pesticides are detected on marijuana [33]. It is common for operators of detected MGOs in Vancouver to disconnect the furnace and re-vent the exhaust into the grow area to increase the carbon dioxide concentration (60% of detected MGOs) [4]. Virtually, all these houses had illegal wiring, and by-passes to the electrical meters [3,4]. Aside from the potential for CO poisoning, heating is also done with unvented combustion appliances thus increasing NO_2 and particulate exposures which are harmful to respiratory health [8]. There has been little systematic study of these contaminants.

From Ontario to British Columbia, the large majority of MGOs are occupied by families including children [3,4,47]. It is reasonable to anticipate that this is also the case in the USA. In response, Alberta enacted the *Drug-Endangered Children Act*. This legislation states that children exposed to an environment where manufacturing occurs, may need protection on health grounds. In the rest of Canada, Medical Officers of Health, the Provincial Health Department, and other authorities can act to

protect child health. Documenting the environmental conditions is required before taking any legal action.

Of particular concern is that at least one-third of Canadian homes could not theoretically tolerate the additional water vapour released by marijuana plants. Considering the number of plants found at illegal MGOs (and MMAR), few, if any, homes in the cities examined would be able to tolerate additional moisture. There are few data on ventilation rates in multi-unit apartment buildings. However, the available data suggest that they are likely lower than assumed and that odour transfer problems are not uncommon [48,49]. Again, this assumes that the home or apartment does not have an existing mould problem, which is an uncertain assumption. Both US and Canadian studies indicate that the attributable risk for asthma and respiratory disease from mould growth in homes is on the order of 20% [50,51]. Some risk to population health is associated with exposure to *A. fumigatus* and is related to the extent of marijuana drying that is done in a MGO. In the case of marijuana production under MMAR, houses and apartments would have to be evaluated on a case by case basis and special rooms built to permit the cultivation of the plant indoors.

It is important to note that well-maintained house plants (which are much smaller than marijuana plants) are not a particular risk. The assumption has been made that homes have fewer than three plants [29]. However, as the number increases and if the plants are not well maintained, this can increase both moisture burdens and the growth of *A. fumigatus* [52].

Conclusion

When addressing situations where families are discovered living in MGOs resulting from police action as well as public concerns of the inadvertent purchaser of undetected former MGOs, primary care physicians and municipal public health officials need to be aware of the issues discussed in this paper. These include (1) the cultivation of marijuana typically leading to moisture and mould problems, (2) risk of unusual exposures to *A. fumigatus* and, potentially, (3) chemical residues. Similarly, more information on these hazards may be needed for industrial hygienists, home inspectors, police and other first responders and public health officials in Canada and the USA.

Acknowledgments

This review was funded by Health Canada and an NSERC IRC to JDM. Helpful reviews were provided by Don Fugler PEng, Mark Lawton PEng, Morrison Hershfield, Ltd., and Richard Summerbell PhD (University of Toronto, Sporometrics, Ltd.). It is based on a larger report for Health Canada. Comments from two anonymous reviewers are appreciated.

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Appendix AM: Salares & Dyck (2007) A Discussion Paper on Indoor Air Quality Investigations on Houses Used for Marijuana Grow Operations

RESEARCH HIGHLIGHT

March 2007 Technical Series 07-101

A Discussion Paper on Indoor Air Quality Investigations of Houses Used for Marijuana Grow Operations

INTRODUCTION

This document follows from a November 2004 RCMP Marijuana Grow Operation Conference which brought together industry stakeholders and various experts in the field, including CMHC, to discuss issues and explore potential solutions to the increasing incidence of indoor residential marijuana grow operations (MGOs) in Canada. As a result, CMHC undertook a study of a small number of homes used as MGOs with the intention of gaining a better understanding of the physical damage and the environmental contamination present, and to summarize key findings that could be shared with other stakeholders.

INVESTIGATION OF A SAMPLE OF MGOs

Method

CMHC sampled 12 former MGOs across Canada. Access to 11 houses was obtained after repossession by mortgage lenders. One house was volunteered by a homeowner who had unknowingly purchased a former MGO. This was the only house occupied at the time of study; the other homes had been unoccupied for various periods of time.

CMHC invited eight individuals who had completed CMHC's Residential Indoor Air Quality (IAQ) Investigator Training Program to participate in the study. This program provides qualified individuals with the competency to investigate residences for indoor air quality problems, including moisture and mold. Although applicable, the training is not specific to MGOs.

The investigations followed the established CMHC Residential IAQ Investigation Procedure, which is based on a thorough walk-through and analysis of the premises and concludes with the preparation of a report for the owner of the house. This CMHC investigation procedure does not rely on laboratory testing of mold or chemical contaminants.

At the time of the investigations, because law enforcement officers had already removed all plants, chemicals and growing equipment, risks to first responders could not be evaluated as part of this study. Nevertheless, the IAQ investigators followed precautions by wearing personal protective equipment during their investigations.

At the conclusion of each investigation, a report addressed to the property owner was prepared. The report identified safety issues and provided a list of recommendations for rehabilitation of the house. Recommendations were prioritized according to importance and identified as low-, medium- or high-cost. Detailed procedures for cleanup or remediation were cited from CMHC publications such as CMHC's *Clean-Up Procedures for Mold in Houses*, or authoritative documents such as the New York City Department of Health's *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*, and Health Canada's *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods* (2004).

FINDINGS

House types and areas used for growing

The houses studied were detached one-, two- and three-storey houses that ranged in age from two to 95 years. The extent to which the homes were used in the grow operation varied from the garage only, to all rooms in the house. In most cases, the grow operations were conducted in the basement only.

Duration of the grow operation

With the exception of one house which was operated as an MGO for four months, in all other cases the length of time that the houses were used as MGOs could not be accurately determined. For the purpose of this study, estimates of the duration of the grow operations were based on the damage sustained by the homes.

Canada

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Ventilation, heating and electrical changes

Alterations made to accommodate ventilation equipment for the grow areas were noted in most cases. Although the ventilation equipment had been removed by police, holes cut in walls and ceilings used to vent the moisture into the attic, the garage, or up the chimney were visible. Other evidence of alterations were disconnected heating ducts, addition of wiring, electrical assemblies and electrical panels that had been tampered with.

Mold contamination

Seven houses had extensive mold contamination visible on walls, ceiling and/or wood. Two houses had moderate mold contamination and one house had no signs of moisture damage or mold. In one case, mold was found behind the painted drywall.

A musty smell was detected in nearly all of the houses, particularly in the basement or grow areas. The extensively contaminated houses had a strong musty smell throughout.

Chemical contamination

The growing equipment and most of the chemical containers had been removed by the police at the time of the CMHC investigation. Therefore, the investigations could not determine the types of chemicals used, or the extent to which they were applied. The chemical component of MCOs will be the subject of a future study.

Remediation recommendations

Recommendations were specific to each house. The investigation reports identified safety concerns and indoor air quality problems, including those that might not have been directly related to the grow operation. The reports also recommended that homeowners consult with a structural engineer when necessary, and engage the services of qualified HVAC (Heating, Ventilation and Air-Conditioning), plumbing and electrical contractors.

Extensive and costly renovation was recommended in the majority of the subject houses. Demolition was recommended only in the case of a garage that had been used as an MCO for an extended period.

In all of the subject houses, the investigators stressed the need to gut the basements and all other rooms used for growing, and to ensure that there was no mold in the insulation or wall cavity after the drywall was removed. Contractors specifically trained in mold remediation were recommended for this purpose. The investigators indicated that safety precautions and remediation procedures might need to be adjusted if the mold was found to be more extensive than originally anticipated.

They also recommended checking for the presence of mold in other areas of the house, especially when the grow operation was extensive or prolonged and/or moisture management was inadequate. Blower door tests were recommended to ensure the integrity of the building envelope.

DISCUSSION

Assessment of grow houses

With the exception of publications intended solely for mold remediation, the availability of guidance for the homeowner regarding the rehabilitation of MCOs is limited. By the conclusion of the CMHC study, several municipalities in Alberta and British Columbia had created bylaws that included specific instructions for the remediation of MCO houses. Although these guidelines may be adequate to restore a former MCO home to habitable condition, there are minor discrepancies between the requirements of individual municipalities. An harmonized approach to the remediation of MCO houses nationwide would be preferable.

In the absence of municipally legislated requirements, remediation of former MCO houses is normally performed at the discretion of the current property owner. When former MCO houses become the property of mortgage lenders, the remediation is often based on the established protocol for generic environmental contamination which may involve some form of environmental assessment.

The consensus among authoritative agencies, such as the Environmental Protection Agency (EPA), Health Canada and CMHC, is that a thorough building inspection is the first step in assessing for mold and other indoor air quality problems. In the majority of houses, laboratory testing for mold alone is not adequate for determining the nature and extent of contamination and should never be done without a prior or concurrent inspection by a qualified and experienced person (Health Canada 2004).

The extent of required remediation in CMHC's sample of 12 MCOs varied. The determining factors included the size and duration of the operation, structural modifications made, presence of protective coverings on walls, floor and ceiling in the growing area(s) and moisture conditions. A thorough investigation was necessary in each case. Because the investigation report becomes the basis of the work specifications, it is important that the investigator be appropriately trained.

Remediation of former MCOs

Municipal legislation and/or regulations that apply to the remediation of former MCOs may be imposed by the municipality upon the homeowner at the time the grow operation is discovered by the police. Municipal by-laws can provide some guidance but are not sufficiently detailed to be used as a stand-alone reference by the homeowner.

The initial investigation should be carried out by contractors with suitable qualifications and experience who have been additionally trained in the investigation of grow operations and other illegal drug production operations. While training programs specific to MGOs are not yet available in Canada, discussions among various stakeholders, including CMHC, have taken place in the wake of the National Grow-Operation Conference in late 2004.

It is critical that the property owner employs renovation contractors who are specifically trained in mold remediation. Typically, training for mold remediation contractors is for mold cleanup and does not include identification of the causes and corrective measures. The investigation is a necessary and independent step prior to the remediation.

To ensure that cleanup of mold is thorough and the underlying causes are corrected, it is recommended that a qualified professional be retained after the initial assessment to oversee the remediation process. Health Canada (2004) describes the remediation documentation requirements and general procedures for mold and contains references to more detailed material.

Broadly, the documentation must include the IAQ investigation and assessment, a description of the remediation work, the monitoring process during the renovation and the post-renovation quality assurance process. The document should also include the name of the individual who conducted the work, the findings, the recommendations and the results.

Analogous procedures are indicated for chemicals. This matter is under study by CMHC.

It is recommended that detailed records of all remediation activities be maintained as this may improve future marketability of the home.

Disclosure of former MGOs

One subject in the study was a home purchased by a family who were unaware that their home was a former MGO until they spoke with neighbours several months after they took occupancy. It was discovered that the previous owner had undertaken to hide evidence of the grow operation rather than remediate the damage. As such, the mold-covered walls and ceilings had been painted over prior to the sale. At the time of the study, no avenues of recourse for the new owners had been identified and they had to assume responsibility for the total cost of remediation.

CMHC has since been contacted by several homebuyers in similar positions. Although it is not known how often this occurs, it has been related by law enforcement officers that it is becoming more common for marijuana growers to buy and sell the MGOs within a short time. The rapid recycling of houses is intended to avoid detection by neighbours and police. The homes are superficially repaired and sold to unsuspecting buyers who may be unable to locate the previous owners. Where this occurs, new homebuyers can be unwittingly exposed to hidden contaminants from damage that was cosmetically covered over without proper remediation.

Safety of former MGOs

The cultivation of large amounts of marijuana in confined spaces gives rise to safety issues involving mold from excess moisture, as well as contamination from the use of fungicides and insecticides, various solvents and other chemicals used for various purposes. Walls, ceilings and floors can be contaminated throughout the house and especially in the grow areas. Growers may have disposed of excess chemicals in an unsafe manner such as down the drains inside or dumping outside the house.

Further research work remains to be done to identify the chemicals being used in grow operations, develop procedures for testing chemical residues and determine appropriate measures for decontamination.

SUMMARY OF RECOMMENDATIONS

The following issues of importance were highlighted during the study.

1. **Nationwide harmonization of remediation requirements**
   Some municipalities have legislated requirements for the remediation of ex-MGOs. These vary from municipality to municipality. A harmonized approach to MGO remediation would be preferable. In the absence of applicable bylaws, limited guidance is available to property owners responsible for MGO remediation.

2. **Guidelines for mortgage lenders**
   It is recommended that guidelines for the remediation of houses known, or suspected to have been used as marijuana grow operations, reflect a residential indoor air quality investigation specific to ex-MGOs, rather than a generic environmental assessment. More work is required to ensure that training for indoor air quality investigations of MGOs is appropriate and available.

3. **Qualified contractors, standard protocol**
   The investigation and remediation of former MGOs must be performed by qualified professionals. These include qualified structural, electrical and HVAC contractors as well as Residential Indoor Air Quality Investigators. It is recommended that a standard nation-wide protocol be developed.

4. Assessment

A preliminary assessment of the extent of contamination should be conducted by the IAQ investigator during the walk-through inspection. In many cases, invasive examination of finished walls will be required. The engagement of qualified professionals, and quality assurance in accordance with Health Canada (2004) and related guidelines, represents current best practice.

5. Prevention of unnecessary damage post-detection

Because they may be vacant for a period of time, former MGOs are often subject to severe water damage caused by burst pipes. This occurs after electricity, gas or oil utilities are disconnected and the house is left unoccupied during the winter. It is strongly recommended that if the utilities are to remain disconnected, the water supply be turned off by police after the investigation is concluded and the grow-op dismantled. The homeowner or property manager should ensure that the system is drained.

6. Record keeping

It is recommended that mortgage lenders and property owners retain detailed documentation of the steps taken to remediate the former MGO. This includes the initial assessment through to completion.

Disclaimer

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CMHC 2003. Clean-up Procedures for Mold in Houses. Ottawa : Canada Mortgage and Housing Corporation. ISBN: 0-660-19227-6.

Health Canada 2004. Fungal Contamination in Public Buildings: Health Effects and Investigation Methods. Ottawa: Health Canada. ISBN 0-662-37432-0. 47 p.

New York City Department of Health and Mental Hygiene 1993. Guidelines on Assessment and Remediation of Fungi in Indoor Environments. http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml

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Housing Research at CMHC

Under Part IX of the *National Housing Act*, the Government of Canada provides funds to CMHC to conduct research into the social, economic and technical aspects of housing and related fields, and to undertake the publishing and distribution of the results of this research.

This fact sheet is one of a series intended to inform you of the nature and scope of CMHC's research.

To find more *Research Highlights* plus a wide variety of information products, visit our website at

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Produced by CMHC 11-02-07

Appendix AN: Office of the Fire Commissioner – Information Bulletin No. IN 016

BRITISH COLUMBIA

INFORMATION BULLETIN

Office of the Fire Commissioner

Issue Date: March 15, 2005

Illegal Grow Operation Safety for Fire Personnel and First Responders

The purpose of this bulletin is to provide information to fire personnel regarding potential dangers that may be encountered when involved with illegal narcotic manufacturing operations, such as marihuana grow operations and clandestine drug manufacturing operations.

A significant increase in the number of illegal narcotics operations found in domestic dwellings throughout Western Canada – including British Columbia (BC), has identified a need to prepare fire fighters and other first responders for the handling of such occurences. In 2000, 44% of the marihuana cultivation incidents reported by police agencies to Statistics Canada occurred in BC2. Between 1997 and 2001, BC experienced a 200% increase in the production of marihuana. The proliferation of illegal narcotic production facilities associated with this increase can pose an extreme fire and safety risk to first response personnel. Appropriate precautions must be taken at all times to prevent serious injury or death.

Safety hazards associated with illegal narcotic production facilities include but are not limited to the following:

- modified electrical equipment;
- electrical by-passes and high energy equipment;
- illegally installed alternate power sources;
- pressurized gas cylinders;
- booby traps;
- harmful mold spores;
- reduced oxygen;
- noxious gases;
- structural alterations;
- dangerous chemicals;
- violence and intimidation.

Police have identified signs indicating the existence of illegal narcotics operations. Any one or more of these indicators could mean potential risk to first responders and the general public. If fire personnel suspect an illegal narcotic production operation, local police and BC Hydro should be contacted, and if possible, public access to the site should be restricted.

Indicators of the existence of illegal narcotics operations include but are not limited to:

- covered windows;
- unusual visitor behaviour;
- condensation on windows;
- bright lights;
- guard dogs;
- smells and odours;
- sounds of electrical humming, fans or trickling water;
- localized power surges;
- residents appear rarely to be home;
- little outside maintenance.

For additional information on illegal narcotics production operations, refer to www.cisc.gc.ca , www.ocabc.org and/or www.rcmp.ca . For information about BC Hydro's Electrical Safety Program for Fire Fighters contact BC Hydro at (604) 590-8911 or toll free at 1-888-590-8911. This program is free of charge.

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1 - Alberta Municipal Affairs, "Clandestine Drug Operations Awareness and Safety," 2004.
2 - RCMP, "Marihuana Cultivation in Canada: Evolution and Current Trends," 2002.

For further information contact: Office of the Fire Commissioner, Ministry of Public Safety and Solicitor General,
Mailing Address: PO Box 9491, Stn. Prov. Govt., Victoria B.C. V8W 9N7 / Location: Suite 200, 645 Tyee Road
Telephone (250) 356-9000, Facsimile (250) 356-9019, E-mail: ofc@gov.bc.ca, Internet: http://www.pssg.gov.bc.ca/firecom/

Appendix AO: WorkSafe BC Hazard Alert

HAZARD ALERT

Industry: Firefighting | Age: 33 | Experience: 10 years | Area: Okanagan

Firefighter injured in "grow house" fire

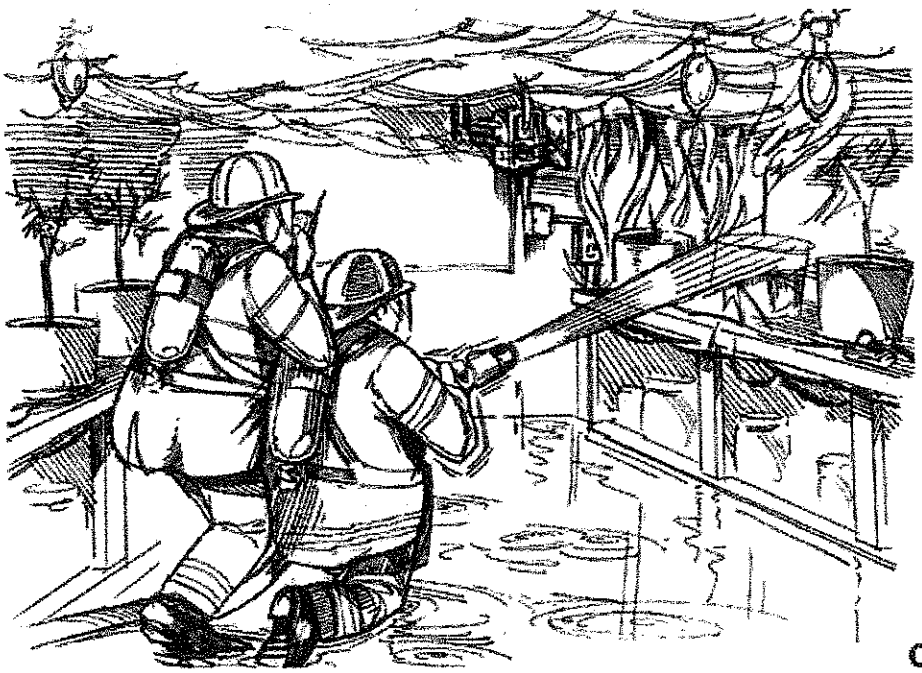
A firefighter received a prolonged electrical shock while attacking a fire in a residential structure containing a marijuana grow operation. In this incident, many factors contributed to the hazard:

- A 277-volt step-up transformer had been wired directly to the electrical panel for the grow lights. This more than doubled the voltage potential and prevented the 15-amp breaker from working properly.
- The wiring to the grow lights had open splices (not contained within junction boxes) and exposed ends of energized wiring were lying across the floor. Some wires had burned through the casing and were directly contacting the floor.
- The wiring for the transformer and the grow lights did not conform to Provincial Safety Standards.

The exposed ends of the energized wiring contacted the pools of water from the fire hoses and caused the electrical shock to the firefighter.

Safe work practices:

- Train firefighters on how to identify a "grow house" and the potential hazards that it may contain
- Attempt to extinguish a fire in an identified "grow house" without entering the building
- Stay out of the structure until the power has been turned off by by the appropriate power authority's qualified and trained worker



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