

VELSICOL[®]

TECHNICAL

ENDOSULFAN

INSECTICIDE

FOR FORMULATION OF INSECTICIDES ONLY

POISON  POISON

DANGER

DANGER

Keep out of reach of children. Poisonous if swallowed, inhaled or absorbed through the skin. Do not get in eyes, on skin or clothing. Do not breathe vapor or spray mist. Wash thoroughly with soap and water after handling and before eating and smoking; wear clean clothing after use. Wear clean synthetic rubber gloves and a mask and respirator of a type passed by the U.S. Bureau of Mines for endosulfan protection during mixing, spraying and loading operations. Do not apply or allow to drift to areas occupied by unprotected humans or beneficial animals.

This product is toxic to fish, birds and other wildlife. Keep out of lakes, streams or ponds. Do not contaminate water by cleaning of equipment, or disposal of wastes.

DO NOT USE, POUR, SPILL OR STORE NEAR HEAT OR OPEN FLAME. DO NOT STORE AT TEMPERATURES BELOW 20° F.

ANTIDOTE.

EXTERNAL—In case of contact, immediately remove contaminated clothing and flush skin or eyes with plenty of water; for eyes get medical attention.

INTERNAL—**NOTE TO PHYSICIAN:** This product contains endosulfan which is a central nervous system stimulant and may cause convulsions. There is no specific antidote. Barbituric acid derivatives may be used in treatment.

CONTAINER DISPOSAL

Do not reuse empty container. Rinse equipment and container and dispose of wastes by burying in non-crop and away from water supplies. Dispose of container by perforating and crushing and burying with wastes.

DIRECTIONS FOR USE

For information on formulations, precautions, insects controlled and labelling information on this product, refer to Velsicol Bulletin No. 548-1 "Endosulfan Formulation Guide/Label Guide."

NOTE: Formulators using this product are responsible for providing data to support their registrations.

NOTICE—Because Velsicol Chemical Corporation has no control over storage, handling, and conditions of use, which are of critical importance, Velsicol Chemical Corporation makes no representation or warranty, either express or implied, for results or residues greater than any tolerance which may be established by appropriate governmental agencies, due to misuse, improper handling or storage of this material. Nor does Velsicol Chemical Corporation assume any responsibility for injury to persons, crops, animals, soil or property arising out of misuse, improper handling or storage of this material.

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VELSICOL

TECHNICAL

INSECTICIDE

FOR FORMULATION OF INSECTICIDES ONLY



NET CONTENTS: 200 LBS.

EPA Reg. No. 876-201-AA

KEEP OUT OF REACH OF CHILDREN

SEE ANTIDOTE STATEMENT AND OTHER PRECAUTIONS BELOW



Keep out of reach of children. Poisonous if swallowed, inhaled or absorbed through the skin. Do not get in eyes, on skin or clothing. Do not breathe vapor or spray mist. Wash thoroughly with soap and water after handling and before eating and smoking; wear clean clothing after use. Wear clean synthetic rubber gloves and a mask and respirator of a type passed by the U.S. Bureau of Mines for endosulfan protection during mixing, spraying and loading operations. Do not apply or allow to drift to areas occupied by unprotected humans or beneficial animals.

This product is toxic to fish, birds and other wildlife. Keep out of lakes, streams or ponds. Do not contaminate water by cleaning of equipment or disposal of wastes.

DO NOT USE. POUR, SPILL OR STORE NEAR HEAT, FLAMES, OR OPEN FLAME. DO NOT STORE AT TEMPERATURES BELOW 32°F.

ANTIDOTE

EXTERNAL: In case of contact, immediately remove clothing. Flush with water and flush skin thoroughly with plenty of water. For eyes, get medical attention.

INTERNAL—NOTE TO PHYSICIAN: This product contains endosulfan which is a central nervous system stimulant and may cause convulsions. There is no specific antidote. Barbiturate sedation may be of aid in treatment.

CONTAINER DISPOSAL

Do not reuse empty container. Reuse equipment and label and dispose of wastes by burning or non-combustible disposal. Do not dispose of container by pouring into trash can and burning with wastes.

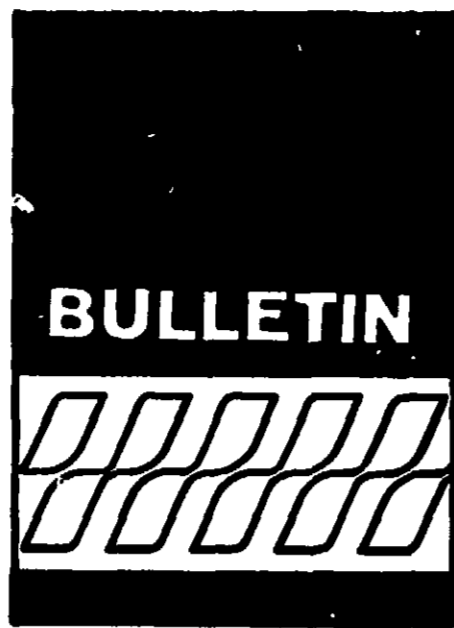
DIRECTIONS FOR USE

For information on formulation, preparation, application and disposal, contact the manufacturer, Velsicol Products, Inc., 12821 E. Highway 10, Littleton, Colorado 80120.

For information on safety, contact the manufacturer, Velsicol Products, Inc., 12821 E. Highway 10, Littleton, Colorado 80120.

NOTICE

Be aware that this product contains endosulfan, a pesticide which is listed as a restricted use pesticide by the EPA. It is not to be used on food crops, ornamentals, or in residential areas. It is also not to be used in areas where it may be inhaled or absorbed through the skin. It is also not to be used in areas where it may be inhaled or absorbed through the skin. It is also not to be used in areas where it may be inhaled or absorbed through the skin.



VELSICOL
AGRICULTURAL CHEMICALS

Bulletin 548-1
May 1975

TECHNICAL ENDOSULFAN
FORMULATION GUIDE and LABEL REGISTRATIONS

ACCEPTED
NOV 20 1975
Under the Federal Insecticide,
Fungicide, and Rodenticide Act,
as amended, for the pesticide
registered under
EPA Reg. No. 876-201.

TECHNICAL ENDOSUFAN FORMULATION GUIDE/LABEL GUIDE
Number 548-1

FOREWORD

The information given and the recommendations made herein with respect to the products discussed are based on extensive research and are believed to be accurate. However, because Velsicol Chemical Corporation has no control over formulations, storage, handling and conditions of use, which are of critical importance, Velsicol Chemical Corporation makes no representation or warranty of any kind, either express or implied, and does not warrant results nor residues greater than any tolerance which may be established by appropriate governmental agencies. Nor does Velsicol Chemical Corporation assume any responsibility for injury to persons, crops, animals, soil or property arising out of the use, misuse, handling, or storage of the materials herein discussed, whether in accordance with directions or not.

Information provided herein is not intended to be a recommendation for the infringement of any patent.

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I. TOXICOLOGY OF ENDOSULFAN

ACUTE TOXICITY:

Acute Oral and Dermal:

The following table gives the LD₅₀ values found for technical endosulfan and some of its formulations.

Material	Acute Oral LD ₅₀ * (Male albino rat)	Acute Dermal LD ₅₀ * (male albino rabbit)
Technical endosulfan	80 to 110 mg/kg	359 mg/kg
2 lbs./gal. EC	328 mg/kg	1330 mg/kg
50% Wettable Powder	218 mg/kg	600 mg/kg

* mg/kg body weight.

Acute Eye:

3 mg. in eyes of albino rabbits produced minimal irritation. No gross evidence of systemic toxicity from mucous membrane absorption was observed.

CHRONIC TOXICITY:

Chronic Feeding Studies:

2-Year feeding tests on rats and dogs at concentrations up to 30 ppm in the diet produced no gross or microscopic tissue changes or pharmacological effects.

Reproduction Study (rat):

A three-generation study showed no adverse effects from oral ingestion of endosulfan at 2 and 50 ppm in the diet.

WILDLIFE TOXICITY:

Fish:

Endosulfan is highly toxic to fish. Toxic limiting concentrations for test species ranged between about 0.001 and 0.05 ppm endosulfan in the water.

Birds:

Species	Age Group	Days to Reach LD ₅₀	LD ₅₀ (mg/kg)
Bobwhite	Young	up to 10	270
		10 to 100	380
	Adults	10 to 100	> 2600
Ring-necked pheasants	Young	up to 10	620
		10 to 100	> 1400
	Adults	10 to 100	850
Mallards	Young	up to 10	200
		up to 10	> 750
	Adults	10 to 100	310

SIGNS AND SYMPTOMS OF INTOXICATION:

The early signs of intoxication are nausea and a general feeling of being unwell followed by weakness. The next sign is generalized convulsion.

FIRST AID:

In case of ingestion, give a tablespoon of salt in a glass of warm water and repeat until vomit fluid is clear. In case of skin contact, remove contaminated clothing and wash skin thoroughly with soap and water. For eyes, flush with plenty of water and get medical attention. Artificial respiration and/or oxygen may be necessary. Do not give stimulants.

NOTICE TO PHYSICIANS:

Endosulfan is a central nervous system stimulant. There is no specific antidote. If patient is convulsing, give pentobarbital (0.25 to 0.50 gram) intravenously. Otherwise phenobarbital (0.06 to 0.10 gram) may be given orally. Do not use oily laxatives as they increase absorption. Patient should be under medical observation for at least 24 hours in any case of suspected intoxication. Electroencephalogram may show abnormal alpha wave activity.

II. CLEAN-UP PROCEDURES FOR ENDOSULFAN SPILLS

Endosulfan is a toxic substance. Fatal poisoning may result from skin contact, from ingestion or from inhalation of either technical or formulated material. Skin contact should be avoided. When working in a contaminated area, protective clothing should be worn including rubber boots, rubber gloves and

safety goggles. All protective clothing should be destroyed or decontaminated after use. Respiratory protective equipment should be worn whenever dust or vapors are encountered. All personnel should shower thoroughly with soap and water immediately after exposure.

Spillages of dry materials should be swept up and placed in sturdy, leak-free containers. Traces of dust remaining after a thorough sweep-up should be scrubbed up with soap and water. The soap and water, brushes, mops and rags used should be combined with the sweepings. The containers should be sealed, appropriately labeled and transferred to an approved burial site.

In the case of liquid spillage, care must be taken to avoid fire since the solvents used in endosulfan formulations are flammable. If the spillage is from a leaking container, the remaining liquid should be transferred to a properly labeled, leak-free container. The damaged container should be crushed and disposed of in an approved burial ground. The spilled liquid should be soaked up with any available absorbent such as sawdust, clay, vermiculite, sweeping compound or "Kitty Litter." The absorbent should be transferred to a sturdy, leak-free container. The contaminated area should be scrubbed with soap and water. The liquid washings should be soaked up with absorbent materials and combined with the original absorbent. Any brushes, rags, or mops used in the clean-up should be added to the absorbent. The collection container should be labeled, sealed and transferred to an approved burial site.

III. DISPOSAL OF EMPTY CONTAINERS

Metal cans and drums which contained endosulfan technical or formulated material can be hazardous if improperly handled. Therefore, under no circumstances should empty containers be abandoned or allowed to accumulate in an area accessible to unauthorized persons. Pesticide residue remaining in these containers may be a hazard to children, pets, livestock and wildlife as well as to adults who may convert the containers to other uses.

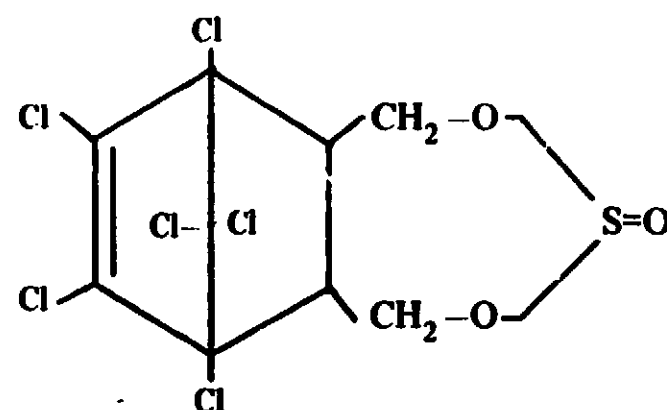
The following procedure is recommended for disposing of endosulfan drums and cans. It is essential that all personnel engaged in the handling and decontamination of empty containers be aware of the potential hazards. These hazards may be due to contact with the residues in the container and/or contact with the rinse solution. Personnel engaged in the decontamination process should wear protective clothing including protective gloves and footwear, freshly laundered cap and coveralls, and a face shield or goggles.

1. To minimize the toxic hazard, completely empty the containers. For cans containing a liquid, the drain and rinse procedure is recommended. Allow the container to drain for 30 seconds into the spray or mix tank while held in a near-vertical position. The container should be rinsed three times, refilling 1/5 to 1/4 full with solvent, gently swirling the solvent in the can and pouring the rinse solvent into the spray or mix tank. The drain and rinse procedure is both safer and more economical since it assures maximum use of the chemical.
2. After emptying, cardboard and paper containers should be compacted and transferred to an approved burial ground. Cans and drums should be securely closed and transferred to a professional drum reconditioner or punctured to prevent reuse and transferred to an approved burial site.

IV. CHEMICAL AND PHYSICAL PROPERTIES - ENDOSULFAN

A. CHEMICAL NAME AND FORMULA

6,7,8,9,10,10-hexachloro-1,5,
5a,6,9,9a-hexahydro-6,9-methano-
2,4,3-benzodioxathiepin-3-oxide
 $C_9H_6Cl_6O_3S$ (Mol. Wt. 407)



B. TYPICAL PROPERTIES

Appearance: Tan to dark-brown solid

Melting Point: Pure Technical 70-100°C
Alpha isomer 108° - 110°C
Beta isomer 208° - 210°C

Specific Gravity: 1.75

Solubility: Insoluble water
Soluble most organic solvents.

Odor: Mild odor. SO₂ odor may be present

Assay of technical: 95% minimum

Flammability: Non-flammable

Explosive Hazard: None

Toxicity: See page 1.

Stability: Stable to sunlight but in the presence of moisture, acid or base slowly hydrolyzes with evolution of SO₂.

V. LIQUID FORMULATIONS

A. SOLUBILITY OF TECHNICAL ENDOSULFAN

Endosulfan is highly soluble in aromatic solvents such as xylene or heavy aromatic naphtha and less soluble in aliphatic solvents such as kerosene. In aromatic solvents, cold stable formulations with a toxicant concentration as high as 3 lbs./U.S. gallon can be made. The cold stability depends upon the concentration of endosulfan and the solvent and has to be determined for each formulation.

B. CALCULATIONS FOR EMULSIFIABLE CONCENTRATE FORMULATIONS

Liquid formulations of endosulfan are usually labeled and sold on a weight-per-volume basis

(Example: 2 lb. endosulfan per gallon); however, precision formulating is best accomplished on a percent-by-weight basis. It thus becomes necessary to give percent-by-weight dimensions to weight-per-gallon formulations. This may be accomplished as shown in the following steps:

1. Determine the batch size in gallons. This will depend on the size of the formulating kettles. (Use approximately 75% of the total kettle volume to provide room for expansion and vigorous agitation).
2. Calculate the weight of actual endosulfan in the batch by multiplying the total gallons per batch by pounds of endosulfan in each gallon of formulation. (Make the same calculation for other toxicants, if present.) Example: 100 gallon batch of 2 lb/gallon E.C. requires 100 X 2 lb. or 200 lbs. endosulfan.
3. Calculate the weight of technical endosulfan (and other toxicants, if present) by dividing the weight of actual endosulfan by the percent assay of the technical endosulfan. Example (assume use of 96% technical endosulfan): 200 lb. actual endosulfan ÷ 0.96 = 208.3 lb. technical endosulfan.
4. Convert weight of the technical endosulfan to gallons of technical endosulfan per batch by dividing total weight of technical endosulfan by 14.59. (Technical endosulfan weighs 14.59 pounds per gallon in solution.) If other toxicants are present, make the same conversion from pounds per batch to gallons per batch.
5. Estimate the weight per gallon of the finished formulation and multiply by the number of gallons in the batch and the percent of emulsifier per batch. Divide by the weight per gallon of the emulsifier to be used (if no figure is available, use 8.4 lb/gal). This figure is the gallons of emulsifier per batch.
6. Calculate gallons of solvent by adding the gallons of endosulfan (and other toxicants, if present) and emulsifier. Subtract from the number of gallons to be made per batch, thus giving the gallons of solvent required. Multiply by weight per gallon of the solvent to calculate pounds of solvent per batch.
7. Add the weights of endosulfan (and other toxicants, if present), emulsifier, and solvent, to determine total weight per batch of finished formulation. To calculate the percent by weight of each ingredient, divide the weight of each ingredient by the total weight of the combined ingredients.
8. If the percent emulsifier as computed in the preceding step is appreciably different from that desired, determine the proper weight of emulsifier by multiplying the total weight per batch by the desired percent level of emulsifier. Then repeat steps 5, 6 and 7.
9. Based on the percent-by-weight figures computed above (step 7), prepare a small laboratory-size batch. Check its specific gravity with a hydrometer (at 68°F. ± 2°F). Multiply the specific gravity by 8.34 to calculate the weight of the formulation in pounds per gallon. Check this figure against the calculated weight per gallon (total weight per batch divided by number of gallons in a batch).

Note: Changes in solvents or in percentage of assay of technical endosulfan (or other

toxicant, if present) requires recalculation of the formulation to establish new percent-by-weight values for each formulation ingredient.

C. EMULSIFIERS FOR ENDOSULFAN

Many emulsifiers are blends of anionic and nonionic surface-active agents. Calcium salt anionics are frequently blended with ether-type nonionics. Formulations made with ether-type nonionics generally have better storage characteristics than those made using ester-type nonionics.

The optimum anionic-nonionic emulsifier blend is influenced by many factors, including choice of solvent, use dilution, water hardness and temperature and active ingredient level. Many companies offer pairs of emulsifiers which may be blended in varying ratios to meet a range of emulsification requirements. Within the United States, surfactants should be selected from among those exempt from requirement of tolerance by EPA. Leading emulsifier suppliers are prepared to make specific recommendations, if given the formulation to be emulsified, use dilution, range of water hardness and temperature and degree of emulsion stability required.

D. STABILITY OF ENDOSULFAN IN LIQUID FORMULATIONS

In order to improve the stability of endosulfan in liquid formulations, it is recommended that Kronox S* be added to liquid formulations at a level of 1% by weight.

E. TYPICAL FORMULATIONS

Listed below are typical liquid endosulfan formulations:

2 lb. endosulfan/U.S. gallon E.C.

	Wt/Wt	lbs/100 gal.
Endosulfan Tech 96%	24.9	208.3
Kronox S*	1.0	8.4
Xylene	69.1	578.0
Emulsifier	5.0	41.8
	<u>100.0</u>	<u>836.5</u>

Specific Gravity 1.003 @ 20°C
lbs/gallon 8.365 @ 20°C

35% Endosulfan E.C.

Endosulfan Tech 96%	36.5	328.2
Kronox S*	1.0	9.0
Xylene	57.5	517.0
Emulsifier	5.0	44.9
	<u>100.0</u>	<u>899.1</u>

Specific Gravity 1.078 @ 20°C
lbs./gallon 8.991 @ 20°C

* Kronox S is a product of the FMC Corporation.

1 lb. Endosulfan - 1 lb. Methyl Parathion/U.S. gallon

	Wt/Wt	lbs/100 gal.
Endosulfan Tech 96%	12.7	104.9
Methyl Parathion 80%	15.2	125.5
Kronox S*	1.0	8.3
Emulsifier	5.0	41.2
Xylene	66.1	545.8
	<u>100.0</u>	<u>825.7</u>

Specific Gravity 0.990 @ 20°C
lbs/gallon 8.257 @ 20°C

*Kronox S is a product of the FMC Corporation.

F. MANUFACTURING PROCEDURE EMULSIFIABLE CONCENTRATE

1. Weight solvent into mix kettle.
2. Weight in correct amount of technical endosulfan (and other toxicants, if present). Agitate until dissolved.

Note: It is not necessary to use heat to dissolve endosulfan at normal temperatures (60°F to 90°F or 16°C to 32°C). If heat is necessary to dissolve other toxicants, it is recommended that the other toxicants be dissolved first and the solution temperature be lowered to 90°F (32°C) or less before the addition of endosulfan.

3. Weigh in emulsifier and agitate until uniform.
4. Check the specific gravity and emulsification to make sure they are within specification.
5. Filter and package.

G. CONTAINERS FOR ENDOSULFAN LIQUID FORMULATIONS

The containers used should have a pigmented phenolic lining such as Bradley and Vrooman A30148 and conform to DOT specifications as follows:

5 gallon pails - closed head, DOT 17E, 24 gauge with Reike spouts.

30 gallon drums - closed head, DOT 17C, 18 gauge.

VI. ENDOSULFAN DRY FORMULATIONS

A. WETTABLE POWDERS

1. Carriers

Endosulfan can be formulated as a wettable powder at concentrations up to 50% active. However, endosulfan undergoes catalytic decomposition on certain carriers and care must be

taken to either use inert carriers that do not promote decomposition or to chemically deactivate carriers that would normally promote decomposition. Inert carriers include Bentonite, Calcium Diluent and Pyrax ABB. Moderately active carriers which can be deactivated include Florex, A-taclay and Celite 209. For deactivation, diethylene glycol at a concentration of 3% to 5% of the weight of the carrier can be sprayed onto the carrier prior to the addition of endosulfan.

2. Wetting and Dispersing Agents

The selection of proper surfactants is essential to the preparation of fast dispersing, stable wettable powder suspensions. Wetting agents lower the surface tension of water to permit rapid suspending of the powder in water. Dispersing agents prevent the formation of agglomerates which settle rapidly and destroy the uniformity of the suspension. A wide selection of wetting and dispersing agents is satisfactory for use in endosulfan formulations. Within the United States, selection should be made from among those exempt from requirement of tolerance by EPA.

3. Equipment

a. Blender

To spray impregnate the deactivator onto the carrier, a sturdy ribbon blender or a tumbler such as a concrete mixer should be used. The blender should be totally enclosed but provided with clean-out and sampling ports. Provision must also be made for a spray manifold inside the blender. After adding deactivator, the same blender can be used to mix endosulfan and surfactants with the carrier.

b. Spray Manifold

Deactivator is sprayed onto the surface of the moving carrier through one or more spray nozzles positioned inside the blender. The number and size of the nozzles should be chosen to provide good coverage of the surface of the moving carrier and to provide a long enough spray time to assure all the carrier is evenly covered. A spray time of 4 to 10 minutes is generally adequate. It should be remembered that in tumbler type blenders, the surface of the moving carrier is not horizontal, but at an angle to the horizontal and the nozzles must also be positioned to spray at the same angle to the horizontal.

c. Milling Equipment

A roller mill or air mill can be used to reduce the particle size of the wettable powder until better than 99% passes through a 200 mesh screen. Care should be taken to make sure that the mill does not overheat during the grinding operation. Because of its low operating temperature and ability to produce a very small particle size, an air mill is ideal for endosulfan formulation.

d. After Blender

A ribbon blender after the mill is recommended to reblend the formulation after grinding and to hold the material in a proper state for bagging.

4. Formulation Procedure

The blender is charged with the full quantity of carrier and the deactivator is sprayed onto the surface of the agitated carrier. The spray time should be long enough to assure complete coverage; generally 4 to 10 minutes is sufficient. The deactivator can be sprayed without dilution, provided it is kept warm enough to assure good flow characteristics. If necessary, it can be diluted with a little water. The water will be held by the carrier and can be considered part of the inert portion of the formulation.

After the spray impregnation is complete, the mixture should be after blended for a few minutes to assure complete absorption of the deactivator. At this point, the wetting and suspending agents and technical endosulfan are added to the deactivated carrier. The mixture is blended a few additional minutes until it is homogeneous and then passes through the mill. The particle size should be fine enough so that a minimum of 99% will pass through a 200 mesh sieve (wet sieve analysis Velsicol Analytical Method AM 0396).

From the grinding mill, the material can be passed to the after blender where it is reblended and then either packaged or put into bulk storage.

B. DUSTS

Dusts are generally made by first preparing a dust concentrate of 25% to 50% and then letting this concentrate down with an inert diluent such as talc. The dust concentrate is made in the same way a wettable powder is made, only the wetting and suspending agents are left out. Endosulfan wettable powder can also be used as a dust concentrate. It is essential that the dust concentrate be well-blended with the diluent to assure a homogeneous mixture. There are numerous materials that may be used as diluents for the dust base, however, long term storage studies are recommended to make sure the diluent does not promote the chemical degradation of endosulfan.

C. GRANULES

1. Carriers

Sorptive carriers such as attapulgites have been used for endosulfan formulations. Because of the catalytic degradation that they promote, it is necessary that they be deactivated before impregnation. Even with deactivation, attapulgite-based granules have limited shelf life and should be used the same season they are formulated. Organic materials such as corn cobs or walnut shells generally have better storage stability. Any material used as a carrier should be checked for long term storage stability.

A 24/48 mesh granule is compatible with most application equipment and is suitable for most uses; however, larger or smaller granules may be better for specific uses. High quality granules with a minimum of fines (material below 60 mesh) should be used since the finer particles tend to be blown away during application.

2. Equipment

An enclosed tumbler blender with a built-in spray manifold is recommended. Ribbon blenders can be used, but the attrition of the blades produces excess fines.

3. **Formulation Procedure**

Endosulfan technical can be dissolved in an aromatic solvent and spray impregnated directly onto the granules. Adequate safety precautions should be employed when using flammable solvents. The spray lines, the blender and the granules should also be warm enough to prevent formation of crystals. Do not heat endosulfan solution above 110°F (43°C). The spray time should be long enough to assure complete coverage of the granules and the granules should be after-blended for a few minutes to assure that a homogenous mixture is obtained. Excessive blending should be avoided as this tends to produce fines. In a typical tumbler blender, a combined spray and blend time of 6 to 12 minutes is adequate.

The granules may be packaged immediately after impregnation.

D. **TYPICAL DRY FORMULATIONS**

1. **Endosulfan 50% Wettable Powder**

	Wt/Wt %
Endosulfan Tech 96%	52.1
Attaclay	21.4
Bardens Clay	10.0
Talc X-5	10.0
Diethylene glycol	3.0
Wetting and Suspending Agents	3.5
	100.0

2. **Endosulfan 50% Dust Base**

Endosulfan Tech 96%	52.1
Attaclay	21.4
Bardens Clay	12.0
Talc X-5	11.5
Diethylene glycol	3.0
	100.0

3. **Endosulfan 5% Dust**

Endosulfan 50% Dust Base	10.0
Talc X-5	90.0
	100.0

4. **Endosulfan 3% Granular**

Endosulfan Tech 96%	3.13
HAN	6.87
Diethylene glycol	6.00
Florex 24/48	84.00
	100.00

VII. ANALYTICAL METHODS FOR ENDOSULFAN

A. **TECHNICAL ENDOSULFAN**

Technical endosulfan can be analyzed using a gas chromatographic method utilizing a flame ionization detector.

1. **Precision:** ± 0.5%

2. **Reagents and Apparatus**

Vial, 5 dram
Pipet, 10 ml
Syringe, 10 μl

Gas Chromatograph with flame ionization detector

Column: 7 ft. x ¼ in., SS of 10% OV-210 on Gas Chrom Q 80/100 mesh
Column Temp: 230°C
Injection Temp: 250°C (on-column injection)
Detection Temp: 250°C
Carrier Flow Rate: 83 cc/min nitrogen
Chart Spread: 1/3 in/min

Benzene, reagent grade
Isopropanol, reagent grade
Endosulfan I, reference grade
Endosulfan II, reference grade
Tetracosane, reference grade

3. **Procedure:**

1. Weigh 0.30-0.34g of the technical sample into a 5 dram vial.
2. Add to the same vial 0.74 – 0.78g n-tetracosane.
3. Pipet 10 ml Benzene to the vial.
4. Cap the vial and shake for several minutes. An unusually large amount of insoluble material indicates a high endosulfan alcohol content. Add a few drops of isopropanol to dissolve the endosulfan alcohol. (Note)
5. Inject 1 μl of the mixture into the gas chromatograph.
6. The following blend of standards is prepared and chromatographed duplicating the component areas in the sample as closely as possible.

Response Factor Solution:
76mg N-Tetracosane
200 mg Endosulfan I
100 mg Endosulfan II

10 ml Benzene
1 μl injection

Component	Relative Retention Time	Response Factor	
		FID	TC
Endosulfan Ether	—	—	—
Tetracosane	1.00	—	—
Endosulfan I	1.82	0.3	0.51
Endosulfan II	2.96	0.3	0.50

Total analysis time is in the order of 26 min. under the conditions above.

NOTE: Endosulfan alcohol is usually not present. It has a retention time between isomer I and II and a low response is encountered with this compound.

4. Calculations:

$$\frac{A(C)}{A(IS)} \times \frac{W(IS)}{W(C)} = \text{Response Factor (R.F.)}$$

$$\frac{A(C)}{A(IS)} \times \frac{W(IS)}{R.F.} \times \frac{100}{W(S)} = \% \text{ Component}$$

where: A(C) = area of component
A(IS) = area of internal standard
W(IS) = weight of internal standard
W(C) = weight of component
R.F. = response factor
W(S) = weight of sample

To determine the component in Lbs/Gal:

$$\text{Lbs/Gal} = \frac{\% \text{ Component}}{100} \times \text{Specific Gravity} \times 8.345$$

Dilutions:

When the sample is subjected to dilutions before analysis, the sample weight must be corrected by the appropriate dilution factor in the equations above.

B. FORMULATIONS:

Liquid formulations may be analyzed directly using this method. The sample size should be selected so as to contain 0.3-0.34g of endosulfan.

Solid formulations should be subjected to soxhlet extraction with benzene and the extracts analyzed as described above. Sample size should be selected so as to contain 0.3 - 0.34g endosulfan.

VIII. ENDOSULFAN LABEL INFORMATION

The following precautionary statements should appear on liquid formulations of endosulfan.

WARNING

Keep out of reach of children. Hazardous if swallowed, inhaled or absorbed through the skin. Do not get in eyes, skin or clothing. Do not breathe vapor or spray mist. Wash thoroughly with soap and water after handling and before eating and smoking; wear clean clothing after use. Wear clean synthetic rubber gloves and a mask and respirator of a type passed by the U.S. Bureau of Mines for endosulfan protection during mixing, spraying and loading operations. Do not apply or allow to drift to areas occupied by unprotected humans or beneficial animals. Workers entering treated fields within 24 hours of application should wear protective clothing.

This product is toxic to fish, shrimp, crabs, birds and other wildlife. Birds feeding on treated areas may be killed. Keep out of lakes, streams, ponds, tidal marshes and estuaries. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment, or disposal of wastes. Apply this product only as specified on this label.*

This product is toxic to bees. Do not apply when bees are actively visiting the treatment area.

Based on the flash point of the product, the following statements should appear on the label.

- 20° F or lower – DANGER – EXTREMELY FLAMMABLE. KEEP AWAY FROM FIRE, SPARKS AND HEATED SURFACES.
- Between 20° and 80° F – WARNING -- FLAMMABLE! KEEP AWAY FROM HEAT OR OPEN FLAME.
- Between 80° and 150° F – DO NOT USE, POUR, SPILL OR STORE NEAR HEAT OR OPEN FLAME.
- Over 150° F – No statement required.

ANTIDOTE

EXTERNAL – In case of contact, immediately remove contaminated clothing and flush skin or eyes with plenty of water; for eyes get medical attention.

INTERNAL – If swallowed: Give a tablespoon of salt in a glass of warm water and repeat until vomit fluid is clear. Have victim lie down and keep quiet. Call a physician immediately.

*This exemplary Environmental Precautionary Paragraph may require certain modifications depending on the actual formulation and use of end products.

NOTE TO PHYSICIAN: This product contains endosulfan which is a central nervous system stimulant and may cause convulsions. There is no specific antidote. Barbituric acid derivatives may be used in treatment.

CONTAINER DISPOSAL

Do not reuse empty container. Rinse equipment and container and dispose of wastes by burying in noncropland away from water supplies. Dispose of container by perforating and crushing and burying with wastes.

The following should be used for solid formulations.

WARNING

Keep out of reach of children. Hazardous if swallowed, inhaled or absorbed through the skin. Do not get in eyes, on skin or clothing. Do not breathe dust or spray mist. Wash thoroughly with soap and water after handling and before eating and smoking; wear clean clothing after use. Wear clean synthetic rubber gloves and a mask and respirator of a type passed by the U.S. Bureau of Mines for endosulfan protection during mixing, spraying and loading operations. Do not apply or allow to drift to areas occupied by unprotected humans or beneficial animals. Workers entering treated fields within 24 hours of application should wear protective clothing.

This product is toxic to fish, shrimp, crabs, birds and other wildlife. Birds feeding on treated areas may be killed. Keep out of lakes, streams, ponds, tidal marshes and estuaries. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment, or disposal of wastes. Apply this product only as specified on this label.*

This product is toxic to bees. Do not apply when bees are actively visiting the treatment area.

Based on the flash point of the product, the following statements should appear on the label.

20° F or lower – **DANGER – EXTREMELY FLAMMABLE. KEEP AWAY FROM FIRE, SPARKS AND HEATED SURFACES.**

Between 20° and 80° F – **WARNING – FLAMMABLE! KEEP AWAY FROM HEAT OR OPEN FLAME.**

Between 80° and 150° F – **DO NOT USE, POUR, SPILL OR STORE NEAR HEAT OR OPEN FLAME.**

Over 150° F – **No statement required.**

*This exemplary Environmental Precautionary Paragraph may require certain modifications depending on the actual formulation and uses of end products.

ANTIDOTE

EXTERNAL In case of contact, immediately remove contaminated clothing and flush skin or eyes with plenty of water; for eyes get medical attention.

INTERNAL If swallowed: Give a tablespoon of salt in a glass of warm water and repeat until vomit fluid is clear. Have victim lie down and keep quiet. Call a physician immediately.

NOTE TO PHYSICIAN: This product contains endosulfan which is a central nervous system stimulant and may cause convulsions. There is no specific antidote. Barbituric acid derivatives may be used in treatment.

CONTAINER DISPOSAL

Do not reuse empty container. Destroy it by burying with waste.

A Disclaimer Statement such as:

NOTICE: Because Velsicol Chemical Corporation has no control over storage, handling, and conditions of use, which are of critical importance, Velsicol Chemical Corporation makes no representation or warranty, either express or implied, for results or residues greater than any tolerance which may be established by appropriate governmental agencies, due to misuse, improper handling or storage of this material. Nor does Velsicol Chemical Corporation assume any responsibility for injury to persons, crops, animals, soil or property arising out of misuse, improper handling or storage of this material. –

should appear on all labels.

In addition the EPA Registration Number, net contents, manufacturer's name and address and the statement:

**WARNING
KEEP OUT OF REACH OF CHILDREN**

See Left Panel for Additional Precautionary Statements
must appear on the front (center) panel of the label.

USE DIRECTIONS

Refer to Section IX which lists the registered uses of endosulfan, the crops, insects, formulations, use directions and limitations.

SAMPLE INGREDIENT STATEMENTS

Endosulfan 2 lb/gal emulsifiable concentrate

ACTIVE INGREDIENTS:	
Endosulfan*	24.4%
Xylene (Petroleum distillate)	70.0%
INERT INGREDIENTS	5.6%
	TOTAL 100.0%

*Hexachlorohexahydromethano-2,4,3-benzodioxathiepi: oxide

Endosulfan 50% Wettable Powder

ACTIVE INGREDIENT:	
Endosulfan *	50%
INERT INGREDIENTS	50%
TOTAL	100%

*Hexachlorocyclohexane-2,4,3-benzodioxathiopin oxide

Endosulfan 2% Dust

ACTIVE INGREDIENT:	
Endosulfan *	2%
INERT INGREDIENTS	98%
TOTAL	100%

*Hexachlorocyclohexane-2,4,3-benzodioxathiopin oxide

IX. REGISTERED USES OF ENDOSULFAN

The following pages contain information on the registered uses of endosulfan and includes crops, insects, tolerances, formulations, dosages and use directions and limitations.

NOTE: Formulators using this product are responsible for providing data to support their registrations.

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Alfalfa (Forage crop)	0.3 (Green) 1.0 (Hay)	Meadow spittle bug	EC	¼ lb. / acre in a minimum of 10 gal. water for ground application or 2 gal. water for aerial application.	Apply 1 week after eggs begin to hatch or when first small masses of froth are produced in crowns of plants. Do not make more than one application per cutting. Do not graze or cut forage within 21 days of treatment.
Alfalfa (Seed crop)	--	Aphids	EC, WP	½ lb./acre	Use crop for seed production only. Do not feed treated forage to livestock.
		Lygus bugs	EC, WP	1½ to 2 lbs. per acre.	
		Meadow spittle bug	EC	¼ lb./acre.	
WP	½ to 2 lb./acre.				
Almonds	1.0 (Hulls) 0.2 (almonds)	Peach twig borer	EC, WP	½ lb. / 100 gal. water	Make application at pink-bud or petal-fall and again in May using 400 to 500 gallons of spray mix per acre. Do not make more than one application per season.
Apples	2.0	Apple aphid Rosy apple aphid	EC, WP	½ lb. / 100 gal. water or 2.0 to 2½ lbs. per acre	Do not feed pomace from treated apples to livestock. When applying up to 4 lbs. (a.i./acre) per season--do not make application within 30 days of harvest. Do not apply more than twice during the fruiting period.

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	Rate	Remarks
Apples (Cont'd.)	2.0	Woolly apple aphid Russet apple aphid reductum	WP	1.0 lb./acre	
		Apple aphid Apple rust mite Woolly apple aphid (Eastern areas)	EC	1.3 to 1.5 lb./100 gal. water or 1.5 to 2.0 lbs./acre (Rust mite only)	Do not make applications within 30 days of harvest.
			WP	1/2 lb. / 100 gal. water or 4.0 lb./acre	Do not make applications within 30 days of harvest.
		Apple aphid Apple rust mite Woolly apple aphid (Western areas)	WP	3/8 lb./100 gal. water or 3 lbs./acre.	
Apricots	—	<i>See Peaches</i>	—	—	—
Artichokes	2.0	Artichoke aphid Green peach aphid	EC	1/4 lb./acre	Do not make application within 7 days of harvest.
			D	1.0 lb./acre	
		Artichoke plume moth	EC, D	1.0 lb./acre	
Barley	—	<i>See Small Grains</i>	—	—	—
Beans (succulent and dry)	2.0	Black bean aphid Bean leaf skeletonizer Cucumber beetle Green stink bug Mexican bean beetle	WP, EC, D	1/2 to 1.0 lb./acre.	<i>For cowpea curculio</i> —Make 3 applications at 5 day intervals starting when pods are 1/2 inch long. Do not use the EC formulation on lima beans. Do not make more than 3 applications per season. (See additional limitations on next page)

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Beans (Cont'd.)	2.0	Cowpea curculio	EC	½ to 1.0 lb. per acre.	<i>(See limitations on previous page)</i> Do not make applications within 3 days of harvest. Do not feed treated threshings to livestock. Do not allow livestock to graze on treated fields. Do not use on lima beans that are to be removed from the field for processing.
		Western bean cut worm	EC	1.0 lb./acre	
Blackeyed Peas	-	<i>See Southern Field Peas</i>	-	-	-
Blueberries	0.1	Blueberry budmite	EC	1½ lb./300 gal. water/acre.	Apply immediately after harvest and repeat 6 to 8 weeks later. Do not apply after buds are well formed.
Boxelders	-	<i>See Trees and Shrubs</i>	-	-	-
Broccoli	-	<i>See Cole Crops</i>	-	-	-
Brussels Sprouts	-	<i>See Cole Crops</i>	-	-	-
Cabbage	-	<i>See Cole Crops</i>	-	-	-
Cantaloupe	-	<i>See Melons</i>	-	-	-
Carrots	0.2	Green peach aphid	EC, WP, D	½ to 1.0 lb. per acre	Do not make more than 2 applications per season. Do not make application within 7 days of harvest. Do not use tops for food or feed.
Cauliflower	-	<i>See Cole Crops</i>	-	-	-
Celery	2.0	Green peach aphid	EC, WP, D	½ lb./acre	Do not make application within 7 days of harvest.
		Cabbage looper	EC, WP, D	½ to 1.0 lb. per acre.	Do not make more than 3 applications per season.
		Green peach aphid			Do not make application within 4 days of harvest.

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Cherries	2.0	Black Cherry aphid Plum nursery mite	EC, WP	½ lb. / 100 gal. water or 2 to 2½ lbs. per acre. (plum nursery mites only)	Do not make more than 2 applications after shuck-split. Do not make application within 21 days of harvest.
		Lesser peach tree borer	WP	¾ lb. / 100 gal. water or 2 to 2½ lbs. / acre	Spray all bark areas from ground area to scaffold limbs. Time applications with moth flight.
		Peach tree borer	WP	<i>Eastern area</i> ½ to ¾ lb. per 100 gal. water. <i>Western area</i> ¾ lb. / 100 gal. water.	Do not make more than 2 applications after shuck-split. Do not make applications within 21 days of harvest.
		Miner/la moth (Michigan only)	EC, WP	1 lb./acre	Make application during delayed dormant period. Do not make more than 2 applications after shuck-split. Do not apply within 21 days of harvest.
		Eye-spotted bud moth Fruittree leaf-roller (Pacific Northwest only)	EC, WP	½ lb./acre	<i>For bud moth:</i> Make application during popcorn stage of growth. <i>For leafroller:</i> Make application during pre-pink stage of growth. Do not make more than 2 applications after shuck-split. Do not make application within 21 days of harvest.
Cherry Nursery Stock	-	See Nursery Stock	-	-	

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Citrus (Nursery and Non-bearing only)	—	Citrus aphid	EC, WP	$\frac{1}{4}$ lb./100 gal. water or $2\frac{1}{2}$ lbs./acre.	Repeat applications as necessary. Do not apply to bearing trees or trees that will bear fruit within 12 months. Shrimp and crab may be killed at recommended application rates. Do not apply where these are important resources.
Cole crops (broccoli, brussels sprouts, cabbage, cauliflower)	2.0	Cabbage aphid Cabbage looper Cross-striped cabbage worm Diamond-back moth larvae Flea beetle Harlequin bug Imported cabbage worm Stink bug	EC, WP, D	$\frac{3}{4}$ to 1 lb. per acre.	<i>For cabbage and broccoli</i> —Do not make application within 7 days of harvest. <i>For Brussels sprouts and cauliflower</i> —Do not make application within 14 days of harvest.
Collards	2.0	Cabbage looper Diamond back moth larvae Harlequin bug Imported cabbage worm	EC, WP, D	$\frac{3}{4}$ lb./acre	Do not make more than 1 application per season. Do not make application within 21 days of harvest.
Corn, sweet (Fresh market only).	0.2 (kernel + cob with husk removed)	Corn leaf aphid	EC, D	1 lb./acre	For fresh vegetable use only. Do not apply to sweet corn to be processed. Applications may be made up to the day of harvest. <i>For aphids</i> —Make application when pests first appear and repeat as necessary. (See additional limitations on next page)
		Corn earworm	EC, D	$1\frac{1}{2}$ lb./acre	

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Corn, sweet (Cont'd.)	0.2 (kernel + cob with husk removed)				<p><i>(See other limitations on previous page)</i></p> <p><i>For earworms</i>—Make applications at 2 to 3 day intervals beginning when silks first appear and continuing until they begin to dry.</p> <p>Do not make more than 5 applications per season.</p> <p>Do not feed forage or ensilage to livestock or allow livestock to be grazed in treated fields.</p>
Corn, field and sweet (seed crop only)	—	Corn earworm	EC, WP	1-1½ lbs./acre	<p><i>For earworms</i>—Direct spray to area of cornsilks. Application should be made at 2 to 5 day intervals depending on the temperature and degree of infestation.</p> <p><i>For aphids</i>—Make application when aphids first appear. Repeat as necessary.</p> <p>Do not use seed for food, feed or oil purposes.</p> <p>Do not feed forage or ensilage to livestock or allow livestock to graze in treated fields.</p>
		Corn leaf aphid	EC, WP	1 lb./acre	
Cotton	1.0 (cotton-seed)	Boll weevil	EC, D	½ to 1¼ lbs./acre	<p>Do not graze meat or dairy animals in treated fields.</p> <p>When applying <i>up to</i> ¼ lb. (a.i.)/acre do not apply after 25% of bolls are open.</p> <p>When applying <i>more than</i> ¼ lb. (a.i.)/acre, do not apply after bolls open.</p> <p>Workers entering treated areas within 24 hours of treatment should wear protective clothing.</p>
		Bollworm Cabbage looper Cotton stink bug Lygus bug	EC, D	1 lb./acre	
		Cotton leaf perforator	EC, WP, D	1 lb./acre	
		Thrips	EC, D	1½ lbs./acre	
Cowpeas	—	<i>See Southern Field Peas</i>	—	—	—

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Crowder peas	—	<i>See Southern Field Peas</i>	—	—	—
Cucumbers Pumpkins Summer squash Winter squash	2.0	Aphids Cucumber beetles Squash vine borer Striped cabbage flea beetle	EC, WP (Not registered for flea beetle on pumpkins)	½ to 1 lb./acre	May be applied up to the day of harvest. <i>For vine borer</i> —Make applications to flower buds, stems and vines on a weekly basis beginning when moths first appear.
			D	¾ to 1 lb. per acre	
		Melonworm Pickleworm Squash beetle Squash bug (Cucumbers and squash only)	EC, WP	½ to 1 lb/acre	May be applied up to the day of harvest. Make applications when insects first appear. Repeat applications as necessary.
Dogwood	—	<i>See Trees and Shrubs</i>	—	—	—
Douglas Fir	—	<i>See Trees and Shrubs</i>	—	—	—
Eggplant	—	<i>See Tomatoes</i>	—	—	—
Elm trees	—	<i>See Trees and Shrubs</i>	—	—	—
Fern (leather-leaf)	—	Leather leaf fern borer	EC, WP	½ lb. / 100 gal. water	Begin treatment when first larval feeding is observed in the midvein area at the base of the leaflets. Repeat applications as needed to maintain control at 2 to 3 week intervals.
Filberts	0.2	Filbert aphid	WP	½ lb. / 100 gal. water or 1½ to 2 lbs. / acre	Make application when insects first appear and repeat as needed. Application may be made up to last day of harvest.
		Filbert Leafroller	WP	1½ to 2 lbs./acre	Do not graze livestock in treated groves.

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Grapes	2.0	Grape leafhopper Rose chafer	EC, WP	½ lb./100 gal. water or 1 to 1½ lbs./acre	Do not make application within 7 days of harvest. Do not use on Concord variety as injury is likely to occur.
			D	1 to 1½ lbs. per acre. (leafhopper only)	
Kale	2.0	Cabbage flea beetle Harlequin bug Imported cabbage worm	EC, WP, D	¾ lbs./acre	Do not make more than one application per season. Do not make application within 21 days of harvest.
Lettuce	2.0	Cabbage looper Diamond back moth larvae Green peach aphid Imported cabbage worm	EC, WP, D	¾-1 lb./acre	<i>For head lettuce</i> —Do not make more than 3 applications after thinning. Do not make application within 14 days of harvest. Remove wrapper leaves at harvest. Do not feed crop wastes to livestock. <i>For leaf lettuce</i> —Do not make more than 2 applications per season. Do not make application within 14 days of harvest.
Lilacs	—	<i>See Trees and Shrubs</i>	—	—	—
Logs, felled	—	Bark beetles (Scolytid Spp.)	EC	4 lbs./100 gal. water	Make application to felled logs in late spring. Spray logs thoroughly to spray run-off.
		Wood borers (Buprestids, cerambycids, curculionids)	EC	8 lbs./100 gal. water	

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Macadamia nuts	0.2	Southern green stink bug	EC, WP	1.0 lbs. / 100 gal. water	Make applications up to the date of harvest when insects first appear and repeat as necessary. Do not apply more than 15 lb. (a.i.)/acre. Do not graze livestock on treated groves.
Melons (Canteloupe, muskmelons, watermelon)	2.0	Aphids Cucumber beetles Striped cabbage flea beetle	EC, WP	½ to 1 lb./acre	Applications may be made up to day of harvest. <i>For squash vine borers</i> —Make weekly application to flower buds, stems and vines beginning when moths first appear.
			D	¾ to 1 lb. per acre.	
		Cabbage looper Omniverous leaf-roller	EC, WP	1 lb./acre	
			D	1 to 1½ lbs. per acre.	
		Melonworm Pickleworm Squash beetle Squash bug Squash vine borer	EC, WP	½ to 1 lb./acre.	
Rindworm (watermelon only)	EC, WP	½ to 1 lb./acre.	Application may be made up to date of harvest.		
Muskmelons	—	<i>See Melons</i>	—	—	—
Mustard Greens Turnip Greens	2.0	Aphids Cabbage looper Imported Cabbage worm	EC, WP, D	¾ lb./acre	Do not make more than 1 application per season. Do not make application within 21 days harvest.
Nectarines	—	<i>See Peaches</i>	—	—	—

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Nursery stock Cherry Peach Plum	—	Peach tree borer	EC, WP	2 lbs. to 40 gal. water	Preplanting dip treatment. Immerse bundles of trees so that roots and crown are covered well above the grafting bud scar. If trees are not planted immediately, allow to dry before returning to the storage cellar. Wear rubber gloves during the dipping operation.
Oats	—	See Small Grains	—	—	—
Ornamental Plants	—	See Trees and Shrubs	—	—	—
Peaches Apricots Nectarines	2.0	Cat-facing insects (stink bug type) Green peach aphid Peach twig borer	West Coast WP	4 lbs./acre	Make foliar application. Do not make more than 2 applications during the fruiting season. Do not make application within 30 days of harvest.
			Rest of Country EC, WP	½ lb./100 gal. water or 2-2½ lbs./acre	Spray all bark from ground to scaffold branches. Do not make application within 21 days of harvest or Thoroughly wet trunk and main branches. Do not make more than 2 applications during the fruiting season. Do not make application within 30 days of harvest.
			D (aphids only)	1½ lbs./acre	
		Lesser peach tree borer	EC, WP	¾ lb./100 gal. water	Thoroughly wet trunk and main branches. Do not make more than 2 applications during the fruiting season. Do not make application within 30 days harvest.

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Peaches, etc. (Cont'd.)	2.0	Peach silver note	EC, WP	½ lb. / 100 gal. water or 2-2½ lbs. / acre	Do not make more than 2 applications during the fruiting season. Do not make application within 30 days of harvest.
		Peach tree borer	EC, WP	Western area ½ lb. / 100 gal. water. Other areas ¾ lb. / 100 gal. water.	Spray all bark areas from ground level to scaffold limbs as required. Do not make application within 21 days of harvest.
Peaches	2.0	Black cherry aphid Black peach aphid Rusty plum aphid	EC, WP	½ lbs. / 100 gal. water or 2 to 2½ lb. / acre	Do not make more than 2 applications during the fruiting season. Do not make application within 30 days of harvest.
Peach Nursery Stock	-	See Nursery Stock	-	-	-
Pears	2.0	Green apple aphid	D	EAST. 1.5 lb./acre WEST 1.5 to 1.8 lb./acre	Do not make more than 2 applications during the fruiting period. Do not make application within 7 days of harvest.
		Conspere stink bug Pear rust mite	EC, WP	½ lb./100 gal. water or 2 to 2½ lb./acre	For stink bug—a prebloom application to the orchard floor may be made using a maximum of 2 lbs. (a.i.)/acre using 200 to 400 gallons of dilute spray per acre. When making such a treatment, do not graze livestock in treated orchards. Do not make orchard floor treatment after petal fall.

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Pears (Cont'd.)	2.0	Pear psylla	EC, WP	2.5 lbs./acre in 10 gallons of water per acre for aerial application or 40 gallons of water per acre for semi-concentrate or 300 gallons of water per acre for dilute application.	Make application when adults are first noticed or nymphs are small. Repeat application to maintain control. Do not make more than 5 applications during the fruiting season or make application within 21 days of harvest. or Do not make more than 2 applications during the fruiting season or make application within 7 days of harvest.
		Pear leaf blister mite	EC, WP	¼ to ½ lb./100 gal.	Make a post harvest or dormant application.
Peas (succulent)	2.0	Pea aphid Pea weevil	EC, WP	1 lb./acre	Use only on peas to be harvested by combining. Do not make more than 2 applications per season. Do not make application within 5 days of harvest. Do not feed treated vines to livestock or allow livestock to graze in treated fields.
Peas (seed crop)	—	Pea aphid Pea weevils	EC, WP	½ to ¾ lb. per acre.	Do not feed treated vines or threshings to dairy or meat animals.
			D	1 to 1.2 lb. per acre.	
Pecans	0.2	Pecan nut case-bearer	WP	½ to ¾ lb. per 100 gal. water	<i>For casebearers</i> —Make application when eggs of first generation appear on the tips of young nuts. A second application may be required after second generation eggs are deposited. <i>(See additional limitations on next page)</i>
		Black pecan aphid	EC, WP	¾ lb./100 gal. water.	

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Pecans (Cont'd.)	2.0	Spittlebug	WP	$\frac{1}{2}$ lb. / 100 gal. water	<i>(See limitations on previous page)</i> <i>For spittlebugs</i> —Make application when leaves are half-grown and make repeat applications as required to maintain control. Do not make application after chuck-split. Do not graze dairy or meat animals in treated groves.
Peppers	2.0	Flea beetle Green peach aphid Hornworm	EC, WP	$\frac{1}{2}$ to 1 lb./acre	Do not make application within 1 day of harvest when applying $\frac{1}{2}$ lb. (a.i.)/acre. When applying rates above $\frac{1}{2}$ lb. (a.i.)/acre do not make application within 4 days of harvest.
			D	1–1 $\frac{1}{2}$ lbs./acre	Do not make application within 1 day of harvest.
		Pepper maggot	EC, WP	$\frac{1}{2}$ to 1 lb./acre.	Do not make application within 1 day of harvest when applying $\frac{1}{2}$ lb. (a.i.)/acre. When applying rates above 1 lb. (a.i.)/acre, do not make application within 4 days of harvest.
			D	$\frac{1}{2}$ to $\frac{3}{4}$ lb. per acre.	Do not make application within 1 day of harvest.
Pineapples (Fresh Market only)	2.0	Pineapple fruit mite	EC	2 lb./acre	Make applications at 7 to 10 day intervals (if necessary)—particularly during the 40 day bloom period. Do not make more than 4 applications. Do not make application within 7 days of harvest. Do not feed treated forage or pineapple by-products to livestock.
Pine trees	—	<i>See Trees and Shrubs</i>	—	—	—

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Plums Prunes (fresh)	2.0	peach tree borer	EC	½ to ¾ lb. per 100 gal. water (West only).	Spray all bark areas from ground level scaffold limbs as required. Do not make application within 7 days of harvest.
			WP	¾ lb. / 100 gal. water (East only).	
		Lesser peach tree borer	EC, WP	¾ lb. / 100 gal. water or 2 to 2½ lbs./acre.	Make application of spray so as to thoroughly wet trunk and main branches. Do not make application within 7 days of harvest.
		Peach twig borer	EC, WP	2 to 2½ lbs. per acre.	Apply as needed. Do not make application within 7 days of harvest.
		Hop aphid Leaf curl plum aphid Plum nursery mite Thistle aphid	EC, WP	¾ lb. / 100 gal. water or 2 to 2½ lbs./acre.	<i>For mites</i> —make application when mites first appear and repeat as necessary. <i>For aphids</i> —make application when eggs hatch. Summer applications should be made before leaves curl. Do not make application within 7 days of harvest.
Prunes	2.0	Fruittree leaf-roller (Pacific Northwest only)	EC, WP	½ lb./acre	Make application during pre-pink stage of growth.
Plum Nursery Stock	—	See Nursery Stock	—	—	—

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Potatoes	0.2	Aphids	EC, WP	½ to 1 lb./acre.	Application may be made as needed up to harvest. Do not plant root crops other than carrots, potatoes or sweet potatoes as follow-up crops.
		Colorado potato beetle	D	9/10 to 1-2/10 lb./acre	
		Flea beetle			
		Green stinkbug			
		Leaf-footed and other plant bugs			
		Leaf hopper			
		Potato tuberworm			
		Southern armyworm			
		White fly			
		False chinch bug	EC, WP, D	1 lb./acre	
		Potato psyllid	EC, WP	½ to 1 lb./acre	
	D		1 lb./acre		
		European cornborer	EC, WP	½ to 1 lb. per acre.	
			D	1 lb./acre	
		Three lined potato beetle	EC, WP, D	½ lb./acre	
Prunes	-	<i>See Plums</i>	-	-	-
Pumpkins	-	<i>See Cucumbers</i>	-	-	-
Rye	-	<i>See Small Grains</i>	-	-	-
Safflower	0.2 (seed)	Green peach aphid	EC, WP, D	½ lb./acre	Do not make application after flower heads open.
Shade trees and shrubs	-	<i>See Trees and Shrubs</i>	-	-	-

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Small grains (barley, oats, rye, wheat)	0.1 (grain) 0.2 (straw)	Army cutworm	EC	½ lb./acre	For aerial application use ½ lb. (a.i.)/2 gallons of diesel fuel oil per acre. Make application when larvae first appear and repeat as needed. Do not make application after heads begin to form. Do not feed treated forage to dairy animals or animals being finished for slaughter.
Southern Field Peas (blackeyed peas, cowpeas, crowder peas, southern peas)	2.0	Cowpea curculio	EC, WP	½ to 1 lb./acre	Make 3 applications at 5 day intervals beginning when the first pods are ½ inch long. Do not make application within 3 days of harvest. Do not feed treated threshings to livestock or allow livestock to graze in treated fields.
Southern peas	—	See Southern Field Peas	—	—	—
Spinach	2.0	Spinach crown mite Green peach aphid	EC, WP, D	½ lb./acre	Do not make more than one application/season. Do not make application within 21 days of harvest.
Spruce	—	See Trees and Shrubs	—	—	—
Squash	—	See Cucumbers	—	—	—

CROP	TOLERANCE (ppm)	INSECT	FORMULATION	DOSAGE (lbs. a.i.)	DIRECTIONS OR LIMITATIONS
Strawberry	2.0	Cyclamen mite	EC, WP	½ lb. / 100 gal. water	Apply spray dosages in 800 gallons of water in western areas and 400 gallons of water in eastern areas. Do not make applications at intervals of less than 15 days or more than twice during any 35 day period when fruit is present. Do not make application within 4 days of picking.
		Meadow spittlebug Strawberry aphid	EC, WP, D	1 lb./acre	Do not make application within 4 days of picking. Do not make application at intervals of less than 15 days or more than twice during any 35 day period when fruit is present.
		Tarnished plant bug	EC, WP	½ lb./100 gal. water or 1 lb./acre	Do not make application at intervals of less than 15 days or more than twice within a 35 day period when fruit is present.
		Garden symphylan (northwest only)	EC	1 lb. (plant dip)/100 gal. water.	Mix thoroughly then dip entire plant. When dipping bundles of plants, force out trapped air to assure thorough wetting of the entire plant. Drain and allow plants to dry before setting them out in the field. Wear rubber gloves during dipping.
Sugarbeets	0.1 (roots)	Green peach aphid	EC, WP	½ to 1 lb./acre	Do not feed treated tops to livestock. Do not make application within 30 days of harvest.
			D	1 lb./acre	
		Meadow spittlebug	EC, WP	½ lb./acre	Do not plant root crops other than carrots, potatoes, sugarbeets and sweet potatoes as follow-up crops
			D	1 lb./acre	