

READ THE ENTIRE LABEL BEFORE USING THIS PRODUCT.

USE ONLY IN ACCORDANCE WITH INSTRUCTIONS.

KEEP OUT OF REACH OF CHILDREN

## TERRAIN

### INGREDIENTS

Permethrin.....38.4%  
Other ingredients ..... 61.6%

TERRAIN is an effective termiticide and contains as its active ingredient, Permethrin.

Permethrin is a broad spectrum synthetic pyrethroid insecticide, used against a variety of pests, on nut, fruit, vegetable, cotton, ornamental, mushroom, potato, and cereal crops. It is used in greenhouses, home gardens, and for termite control. It also controls animal ectoparasites, biting flies, and cockroaches. It may cause a mite buildup by reducing mite predator populations. Permethrin is available in dusts, emulsifiable concentrates, smokes, ULV (ultra-low volume), and wettable powder formulations.

Trade Names Of Other Firms: Trade names for products containing permethrin include Ambush, BW-21-Z, Cellutec, Dragnet, Ectiban, Eksmin, Exmin, FMC 33297, Indoثرin, Kafil, Kestrel, NRDC 143, Pounce, PP 557, Pramex, Qamlin, and Torpedo.

### What is Permethrin and how does it work?

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### **Key Benefits of TERRAIN:**

1. Highly effective against termites
2. Broad spectrum insecticide
3. Low potential to leach to groundwater

### PRECAUTIONS

#### **Hazards to Humans (and Domestic Animals) CAUTION**

Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Avoid contact with eyes, skin or clothing. Wash thoroughly after handling.

#### **Personal Protective Equipment:**

Some materials that are chemical-resistant to this product are listed below. If you want more options, follow the instructions for category G on an EPA chemical resistance category selection chart. 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/maintaining PPE. If no such 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.

#### **Environmental Hazards**

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 treated areas. Drift and runoff from treated areas may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters.

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 it to drift to blooming crops if bees are visiting the treatment area.

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 Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

### Physical/Chemical Hazards

Do not use or store near heat or open flame.

#### FIRST AID

**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 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.

### PRECAUTIONARY STATEMENTS

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### Physical/Chemical Hazards

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#### DIRECTIONS OF USE

**Resistance.** Some insects are known to develop resistance to products used repeatedly for control. Because the development of resistance cannot be predicted, the use of this product should conform to resistance management strategies established for the use area. Consult your local or state agricultural authorities for details. If resistance to this product develops in your area, this product, or other products with a similar mode of action, may not provide adequate control. If poor performance cannot be attributed to improper application or extreme weather conditions, a resistant strain of insect may be present. If you experience difficulty with control and resistance is a reasonable cause, immediately consult your local company representative or agricultural advisor for the best alternative method of control for your area.

#### SUBTERRANEAN TERMITE CONTROL

The use of this product prevents and controls termite infestations in and around structures and constructions.

The dilute insecticidal emulsion must be adequately dispersed in the soil to establish a barrier between the wood and the termites in the soil. As a good practice: 1) all non-essential wood and cellulose containing materials should be

removed from around foundation walls, crawl spaces and porches; 2) eliminate termite access to moisture by repairing faulty plumbing and/or construction grade.

Soil around untreated structural wood in contact with soil should be treated as described below. To establish an effective insecticidal barrier with this product the service technician must be familiar with current termite control practices such as: trenching, rodding, sub-slab injection, coarse fan spraying of soil surfaces, crack and crevice (void) injection, excavated soil treatment, and brush or spray applications to infested or susceptible wood. These techniques must be correctly employed to prevent or control infestations by subterranean termites such as: *Coptotermes*, *Heterotermes*, *Reticulitermes* and *Zootermopsis*. The biology and behavior of the species involved should be considered by the service technician in determining which control practices to use to eliminate or prevent the termite infestation.

**Important:** Contamination of public and private water supplies must be avoided by following these precautions: Use anti-backflow equipment or procedures to prevent siphonage of insecticide into water supplies. Do not contaminate cisterns or wells. Do not treat soil that is water saturated or frozen or in any conditions where runoff or movement from the treatment area (site) is likely to occur.

Permethrin the active ingredient in TERRAIN termiticide/insecticide, is extremely toxic to fish and aquatic invertebrates. Care should be used when making applications near bodies of water. As part of FMC's stewardship program, refer to available support literature on well water, ponds and stream concerns. Locate sources of water discharge from structures, such as french drains and sump systems. Turn off discharge pumps until after application is complete. Observe for any change in color or odor of effluent discharge. Consult state and local specifications for recommended distances of wells from treated areas, or if such regulations do not exist, refer to Federal Housing Administration Specifications (H.U.D.) for guidance.

**Note:** Crawlspace are to be considered inside of the structure.

**Critical Areas:** Critical areas include areas where the foundation is penetrated by utility services, cracks and expansion joints, bath traps and areas where cement constructions have been poured adjacent to the foundation such as stairs, patios, and slab additions.

#### **Structures with Wells/Cisterns Inside Foundations**

Structures that contain wells or cisterns within the foundation of a structure can only be treated

using the following techniques:

1. Do not treat soil while it is beneath or within the foundation or along the exterior perimeter of a structure that contains a well or cistern. The treated backfill method must be used if soil is removed and treated outside/away from the foundation. The treated backfill technique is described as follows:
  - a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material or into a wheelbarrow.
  - b. Treat the soil at the rate of 4 gallons of dilute emulsion per 10 linear feet per foot of depth of the trench, or 1 gallon per 1.0 cubic feet of soil. See "Mixing Directions" section of the label. Mix thoroughly into the soil taking care to contain the liquid and prevent runoff or spillage.
  - c. After the treated soil has absorbed the diluted emulsion, replace the soil into the trench.
2. Treat infested and/or damaged wood in place using an injection technique such as described in the "Control of Wood Infesting Insects" section of this label.

#### **Structures with Adjacent Wells/Cisterns and/or Other Water Bodies**

Applicators must inspect all structures with nearby water sources such as wells, cisterns, surface ponds, streams, and other bodies of water and evaluate, at a minimum, the treatment recommendations listed below prior to making an application

1. Prior to treatment, if feasible, expose the water pipe(s) coming from the well to the structure, if the pipe(s) enter the structure within 3 feet of grade.
2. Prior to treatment, applicators are advised to take precautions to limit the risk of applying the termiticide into subsurface drains that could empty into any bodies of water. These precautions include evaluating whether application of the termiticide to the top of the footer may result in contamination of the subsurface drain. Factors such as depth to the drain system and soil type and degree of compaction should be taken into account in determining the depth of treatment.
3. When appropriate (i.e., on the water side of the structure), the treated backfill technique (described above) can also be used to minimize offsite movement of termiticide.

Prior to using this technique near wells or cisterns, consult state, local or federal agencies for information regarding approved treatment practices in your area.

**Application Rate:** Use a 0.5% emulsion for subterranean termites. For other pests on the label use specific listed rates.

**Mixing Directions:** Mix the termiticide use dilution in the following manner: Fill tank 1/4 to 1/3 full. Start pump to begin by pass agitation and place end of treating tool in tank to allow circulation through hose. Add appropriate amount of TERRAIN. Add remaining amount of water. Let pump run and allow recirculation through the hose for 2 to 3 minutes.

TERRAIN may also be mixed into full tanks of water, but requires substantial agitation to insure uniformity of the emulsion. To prepare a 0.5% water emulsion, ready to use, dilute 1.25 gallons of TERRAIN with 94.75 gallons of water.

**Mixing:** For the desired application rate, use the chart below to determine the amount of TERRAIN for a given volume of finished emulsion:

**Amount of TERRAIN termiticide/insecticide**  
(Gallons except where noted)

Emulsion Concentration	Amount of TERRAIN	Amount of Water	Desired Gallons of Finished Emulsion
<b>0.5%</b>	1.6 fl. oz.	7.9 pints	1
	6.6 fl. oz.	31.6 pints	4
	8.3 fl. oz.	39.5 pints	5
	16.6 fl. oz.	9.9	10
	0.25	18.75	19
	0.5	37.5	38
	0.75	57.25	58
	1.25	94.75	96
	2.5	189.5	192
<b>1.0%*</b>	1.6 fl. oz.	62.3 fl. oz.	0.5
	3.3 fl. oz.	7.8 pints	1
	6.6 fl. oz.	15.6 pints	2
	16.6 fl. oz.	4.9	5
	33.3 fl. oz.	9.7	10
	0.5	18.5	19
	1	37	38
	1.5	56.5	58
	2.5	91	96
5	187	192	
<b>2.0*</b>	1.6 fl. oz.	30.3 fl. oz.	25
	6.6 fl. oz.	7.6 pints	1
	33.3 fl. oz.	4.74	5
	66.6 fl. oz.	9.5	10
	1	18	19
	2	36	38
	3	55	58
	5	91	96
	10	182	192

Common units of measure:

1 pint = 16 fluid ounces (oz.)

1 gallon = 4 quarts = 8 pints = 128 fluid ounces (oz.)

\*For termite applications, only use these rates in conjunction with the application volume adjustments as listed in the section below or in the foam or underground service application sections.

**Pre-Construction Subterranean Termite Treatment**

**Pre-Construction Treatment: Do not apply at a lower dosage and/or concentration than specified on this label for applications prior to the installation of the finished grade.**

When treating foundations deeper than 4 feet, apply the termiticide as the backfill is being replaced, or if the construction contractor fails to notify the applicator to permit this, treat the foundation to a minimum depth of 4 feet after the backfill has been installed. The applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to a minimum depth of 4 feet. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

Effective pre-construction subterranean termite control is achieved by the establishment of vertical and/or horizontal insecticidal barriers using 0.5% emulsion of TERRAIN. To meet termite proofing requirements, follow the procedures in the latest edition of the Housing and Urban Development Minimum Property Standards.

**Horizontal Barriers:** Create a horizontal barrier wherever treated soil will be covered, such as footing trenches, slab floors, carports, and the soil beneath stairs and crawlspaces.

For a 0.5% rate, apply 1 gallon of dilution per 10 square feet, or use 1.6 fluid ounces of TERRAIN per 10 square feet in sufficient water (no less than 1/2 gallon or more than 2 gallons) to provide thorough and continuous coverage of the area being treated.

If the fill is washed gravel or other coarse material, it is important that a sufficient amount of dilution be used to reach the soil substrate beneath the coarse fill.

Applications shall be made by a low pressure spray (less than 50 p.s.i.) using a coarse spray nozzle. If slab will not be poured the same day as treatment, cover treated soil with a water-proof barrier such as polyethylene sheeting. This is not necessary if foundation walls have been installed around the treated soil.

**Vertical Barriers:** Vertical barriers must be

established in areas such as around the base of foundations, plumbing, utility entrances, back-filled soil against foundation walls and other critical areas.

For a 0.5% rate, apply 4 gallons of dilution per 10 linear feet per foot of depth or 6.4 fluid ounces of TERRAIN per 10 linear feet per foot of depth from grade to top of footing in sufficient water (not less than 2 gallons or more than 8 gallons) to ensure complete coverage.

- a. When trenching and rodding into the trench, or trenching, it is important that emulsion reaches the top of the footing. Rod holes must be spaced so as to achieve a continuous termiticidal barrier, but in no case more than 12 inches apart.
- b. Care should be taken to avoid soil wash-out around the footing.
- c. Trenches need not be wider than 6 inches. Emulsion should be mixed with the soil as it is being replaced in the trench.
- d. For a monolithic slab, an inside vertical barrier may not be required.

Hollow block voids may be treated at a rate of 2 gallons of emulsion per 10 linear feet so that the emulsion will reach the top of the footing. Prior to each application, applicators must notify the general contractor, construction superintendent, or similar responsible party, of the intended termiticide application and intended sites of application and instruct the responsible person to notify construction workers and other individuals to leave the area to be treated during application and until the termiticide is absorbed into the soil.

**Post-Construction Subterranean Termite Treatment Application Volume:**

To provide maximum control and protection against termite infestation apply the specified volume of the finished water emulsion and active ingredient as set forth in the directions for use section of this label. If soil will not accept the labeled application volume, the volume may be reduced provided there is a corresponding increase in concentration so that the amount of active ingredient applied to the soil remains the same.

**Note:** Large reductions of application volume reduce the ability to obtain a continuous barrier. Variance is allowed when volume and concentration are consistent with label directed rates and a continuous barrier can still be achieved.

Where desirable for post construction treatments, the volume of the 1.0% emulsion may be reduced by 1/2 the labeled volume or a 2.0% emulsion may be applied at 1/4 the labeled volume (see Volume Adjustment Chart). Volume adjustments

at 2.0% are not recommended for subslab injection. See Volume Adjustment Chart below.

**Note:** When volume is reduced, the hole spacing for subslab injection and soil rodding may require similar adjustment to account for lower volume dispersal of the termiticide in the soil.

**Volume Adjustment Chart**

Rate (% emulsion)	0.5%	1.0%	2.0%
Volume allowed Horizontal (gallons emulsion/10 sq. ft.)	1.0 gallons	0.5 gallons	0.25 gallons*
Vertical (gallons emulsion/10 lin. ft.)	4.0 gallons	2.0 gallons	1.0 gallons*

\*Not recommended for subslab injection.

**After Treatment:** All holes in commonly occupied areas into which TERRAIN has been applied must be plugged. Plugs must be of a non-cellulose material or covered by an impervious, non-cellulose material. Use a 0.5% emulsion for post-construction treatment. Post-construction soil applications shall be made by injection, rodding, and/or trenching or coarse fan spray with pressures not exceeding 25 p.s.i. at the nozzle. Care should be taken to avoid soil wash-out around the footing. Do not apply emulsion until location of wells, radiant heat pipes, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these elements.

**Foundations:** For applications made after the final grade is installed, the applicator must trench and rod into the trench or trench along the foundation walls and around pillars and other foundation elements, at the rate prescribed from grade to the top of the footing. When the footing is more than four (4) feet below grade, the applicator must trench and rod into the trench or trench along the foundation walls at the rate prescribed to a minimum depth of four feet. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. However, in no case should a structure be treated below the footing.

**Slabs:** Vertical barriers may be established by sub-slab injection within the structure and rodding and/or trenching outside at the rate of 4 gallons

of emulsion per 10 linear feet per foot of depth. Special care must be taken to distribute the treatment evenly. Treatment should not extend below the bottom of the footing. Treat along the outside of the foundation and where necessary beneath the slab on the inside of foundation walls. Treatment may also be required beneath the slab along both sides of interior footing-supported walls, one side of interior partitions and along all cracks and expansion joints. Horizontal barriers may be established where necessary by long-rodging or by grid pattern injection vertically through the slab.

- a. Drill holes in the slab and/or foundation to allow for the application of a continuous insecticidal barrier.
- b. For shallow foundations (1 foot or less) dig a narrow trench approximately 6 inches wide along the outside of the foundation walls. Do not dig below the bottom of the footing. The emulsion should be applied to the trench and soil at 4 gallons of emulsion per 10 linear feet per foot of depth as the soil is replaced in the trench.
- c. For foundations deeper than 1 foot follow rate for basement.
- d. Exposed soil and wood in bath traps may be treated with a 0.5% emulsion.

**Basements:** Where the footing is greater than 1 foot in depth from grade to the bottom of the foundation, application must be made by trenching and rodding into the trench, or trenching at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth. When the footing is more than four feet below grade, the applicator may trench and rod into the trench, or trench along foundation walls at the rate prescribed for four feet of depth. Rod holes must be spaced so as to achieve a continuous termiticide barrier, but in no case more than 12 inches apart. The actual depth of treatment will vary depending on soil type, degree of compaction, and location of termite activity. However, in no case should a structure be treated below the footing. Sub-slab injection may be necessary along the inside of foundation walls, along cracks and partition walls, around pipes, conduits, piers, and along both sides of interior footing-supported walls.

**Accessible Crawl Spaces:** For crawl spaces, apply vertical termiticide barriers at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of the footing, or if the footing is more than 4 feet below grade, to a minimum depth of 4 feet. Apply by trenching and rodding into the trench, or trenching. Treat both sides of foundation and around all piers and pipes. Where physical obstructions such as concrete walkways adjacent to foundation elements prevent trenching, treatment may be

made by rodding alone. When soil type and/or conditions make trenching prohibitive, rodding may be used. When the top of the footing is exposed, the applicator must treat the soil adjacent to the footing to a depth not to exceed the bottom of the footing. Read and follow the mixing and use direction section of the label if situations are encountered where the soil will not accept the full application volume

- a. Rod holes and trenches must not extend below the bottom of the footing. Rod holes must be spaced so as to achieve a continuous termiticide barrier but in no case more than 12 inches apart.
- b. Trenches must be a minimum of 6 inches deep or to the bottom of the footing, whichever is less, and need not be wider than 6 inches. When trenching in sloping (tiered) soil, the trench must be stepped to ensure adequate distribution and to prevent termiticide from running off. The emulsion must be mixed with the soil as it is replaced in the trench.
- c. When treating plenums or crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

**Inaccessible Crawl Spaces:** For inaccessible interior areas, such as areas where there is insufficient clearance between floor joists and ground surfaces to allow operator access, excavate if possible, and treat according to the instructions for accessible crawl spaces. Otherwise, apply one or a combination of the following two methods.

1. To establish a horizontal barrier, apply to the soil surface, 1 gallon of emulsion per 10 square feet overall using a nozzle pressure of less than 25 p.s.i. and a coarse application nozzle (e.g., Delavan Type RD Raindrop, RD-7 or larger, or Spraying Systems Co. 8010LP TeeJet or comparable nozzle). For an area that cannot be reached with the application wand, use one or more extension rods to make the application to the soil. Do not broadcast or powerspray with higher pressures.
2. To establish a horizontal barrier, drill through the foundation wall or through the floor above and treat the soil perimeter at a rate of 1 gallon of emulsion per 10 square feet. Drill spacing must be at intervals not to exceed 16 inches. Many States have smaller intervals, so check State regulations which may apply.

When treating plenums and crawl spaces, turn off the air circulation system of the structure until application has been completed and all termiticide has been absorbed by the soil.

**Masonry Voids:** Drill and treat voids in multiple masonry elements of the structure extending from the structure to the soil in order to create a continuous treatment barrier in the area to be treated. Apply at the rate of 2 gallons of emulsion per 10 linear feet of footing, using a nozzle pressure of less than 25 p.s.i. When using this treatment, access holes must be drilled below the sill plate and should be as close as possible to the footing as is practical. Treatment of voids in block or rubble foundation walls must be closely examined: Applicators must inspect areas of possible runoff as a precaution against application leakage in the treated areas. Some areas may not be treatable or may require mechanical alteration prior to treatment. All leaks resulting in the deposition of termiticide in locations other than those prescribed on this label must be cleaned up prior to leaving the application site.

Do not allow people or pets to contact contaminated areas or to reoccupy the contaminated areas of the structure until the clean-up is completed.

**Note:** When treating behind veneer care should be taken not to drill beyond the veneer. If concrete blocks are behind the veneer, both the blocks and the veneer may be drilled and treated at the same time.

**Excavation Technique:** If treatment must be made in difficult situations, along fieldstone or rubble walls, along faulty foundation walls, and around pipes and utility lines which lead downward from the structure to a well or pond, application may be made in the following manner:

- a. Trench and remove soil to be treated onto heavy plastic sheeting or similar material.
- b. Treat the soil at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth of the trench. Mix the emulsion thoroughly into the soil taking care to prevent liquid from running off the liner.
- c. After the treated soil has absorbed the liquid emulsion, replace the soil in the trench.

#### **Foam Applications**

TERRAIN termiticide/insecticide emulsion, from 0.5 to 2.0%, may be converted to a foam with expansion characteristics from 2 to 40 times.

**Localized Application Foam Applications:** The emulsion may be converted to a foam and the foam used to control or prevent termite infestations. Depending on the circumstances, foam applications may be used alone or in combination with liquid emulsion applications. Applications may be made behind veneers, piers,

chimney bases, into rubble foundations, into block voids or structural voids, under slabs, stoops, porches, or to the soil in crawlspaces, and other similar voids.

Foam and liquid application must be consistent with volume and active ingredient instructions in order to insure proper application has been made. The volume and amount of active ingredient are essential to an effective treatment. At least 75% of the labeled liquid emulsion volume of product must be applied, with the remaining percent delivered to appropriate areas using foam application. Refer to label and use recommendations of the foam manufacturer and the foaming equipment manufacturer. Foam applications are generally a good supplement to liquid treatments in difficult areas, but may be used alone in difficult spots. Note location of electrical sources prior to foaming voids to avoid possible shock hazard.

#### **Application Under Slabs or to Soil in Crawlspaces to Prevent or Control Termites**

Application may be made using TERRAIN foam alone or in combination with liquid emulsion. The equivalent of at least 4 gallons (6.4 ounces of TERRAIN concentrate) of 0.5% emulsion per 10 linear feet (vertical barrier), or at least 1 gallon (1.6 ounces of TERRAIN concentrate) of 0.5% emulsion per 10 square feet (horizontal barrier) must be applied either as emulsion, foam, or a combination of both. For a foam only application, apply TERRAIN concentrate in sufficient foam concentration and foam volume to deposit 6.4 ounces of concentrate per 10 linear feet or 1.6 ounces of concentrate per 10 square feet. For example, 1 gallon of 2% emulsion generated as foam to cover 10 linear feet is equal to the application of 4 gallons of 0.5% emulsion per 10 linear feet.

#### **Sand Barrier Installation and Treatment**

Termites can build mud tubes over treated surfaces as long as they have access to untreated soil and do not have to move TERRAIN treated soil. Fill in cracks and spaces with builder's or playbox sand and treat the sand with TERRAIN. The sand should be treated as soil following the termiticide rate listed on the TERRAIN label.

Retreatment for subterranean termites can only be performed if there is clear evidence of reinfestation or disruption of the barrier due to construction, excavation, or landscaping and/or evidence of the breakdown of the termiticide barrier in the soil. These vulnerable or reinfested areas may be retreated in accordance with application techniques described in this product's labeling. The timing and type of these retreatments will vary depending on factors such as termite pressure, soil types, soil conditions and other factors which may reduce the

effectiveness of the barrier.

**Annual retreatment of the structure is prohibited unless there is clear evidence that reinfestation or barrier disruption has occurred.**

**APPLICATION IN CONJUNCTION WITH THE USE OF FIRSTLINE® TERMITE BAITS**

As part of the integrated pest management (IPM) program for termite control, TERRAIN termiticide/insecticide may be applied to critical areas of the structure including plumbing and utility entry sites, bath traps, expansion joints, foundation cracks and areas with known or suspected infestations at a rate of 0.5% as a spot treatment or complete barrier treatment. Applications may be made as described in the Postconstruction treatment section of this label.

**SPECIFIC PEST CONTROL APPLICATIONS**  
**Underground services**

Such as: wires, cables, utility lines, pipes, conduits, etc. Services may be within structures or located outside structures, in right-of-ways or to protect long range (miles) of, installations of services.

Soil treatment may be made using 0.5% to 1.0% TERRAIN emulsion to prevent attack by termites and ants. Apply 2 to 4 gallons of emulsion per 10 linear feet to the bottom of the trench and allow to soak into the soil. Lay services on the treated soil and cover with approximately 2 inches of fill soil. Apply another 2 to 4 gallons per 10 linear feet over the soil surface to complete the treatment barrier. In wide trenches, only treat the soil in the area near the services. It is important to establish a continuous barrier of treated soil surrounding the services.

Where soil will not accept the above labeled volume, 1 to 2 gallons of 1.0% TERRAIN may be used per 10 linear feet of trench both to the bottom of the trench and over the soil on top of the services. Finish filling the trench with treated fill soil. The soil where each service protrudes from the ground may be treated by trenching/rodding of no more than 1 to 2 gallons of emulsion into the soil.

**Precautions:**

Do not treat electrically active underground services.

**Posts, Poles, and Other Constructions**

Create an insecticidal barrier in the soil around wooden constructions such as signs, fences and landscape ornamentation by applying a 0.5% emulsion.

Previously installed poles and posts may be treated by sub-surface injection or treated by gravity flow through holes made from the bottom of a trench around the pole or post. Treat on all sides to create a continuous insecticidal barrier

around the pole. Use 1 gallon of emulsion per foot of depth for poles and posts less than six inches in diameter. For larger poles, use 1.5 gallons of emulsion per foot of depth. Apply to a depth of 6 inches below the bottom of the wood. For larger constructions, use 4 gallons per 10 linear feet per foot of depth.

**Treatment of Wood-in-Place for Control of Wood-Infesting Insects**

(Localized Areas in Structure)

For the control of insects such as termites, ants, carpenter ants, and wood-infesting beetles such as Old House Borer and Powder Post in localized areas of infested wood in and around structures, apply a 0.5% emulsion to voids and galleries in damaged wood and in spaces between wooden members of a structure and between wood and foundations where wood is vulnerable. Paint on or fan spray applications may also be used. Plastic sheeting must be placed immediately below overhead areas that are spot treated except for soil surfaces in crawlspaces. Application may be made to inaccessible areas by drilling, and then injecting emulsion with a crack and crevice injector into the damaged wood or void spaces. This type of application is not intended to be a substitute for soil treatment, mechanical alteration or fumigation to control extensive infestation of wood-infesting insects.

**Control of Bees and Wasps Indoors:** To control bees, wasps, hornets, and yellow jackets apply a 0.5% emulsion. Application should be made in the late evening when insects are at rest. Spray liberally into hiding and breeding places, especially under attic rafters, contacting as many insects as possible. Repeat as necessary. Termite carton nests in trees or building voids may be injected with 0.5% to 1.0% emulsion. Multiple injection points to varying depths may be necessary. It is desirable to physically remove carton nest material from building voids when such nests are found.

**Important:** Do not apply emulsion until location of heat pipes, ducts, water and sewer lines and electrical conduits are known and identified. Caution must be taken to avoid puncturing and injection into these structural elements. Do not apply into electrical fixtures, switches, or sockets.

**Treatment of Preconstruction Lumber and Logs**

**General Information**

TERRAIN insecticide should be diluted with water. To prepare the spray, dilute TERRAIN as shown in the following spray dilution chart:

**Spray Dilution Chart**

Gallons of Spray Mixture Desired	Gallons of TERRAIN Insecticide To Use		
	0.5% Solution	0.75% Solution	1.0% Solution
40	1/2	3/4	1
80	1	1.5	2
200	2.5	3 3/4	5
400	5	7.5	10
800	10	15	20

### Directions for Application

To protect unseasoned lumber and logs from wood destroying insects, such as Termites, Carpenter Ants and Beetles (Ambrosia, Powderpost, Old house borers and others), totally treat wood with a 0.5% to 1.0% solution of TERRAIN. This solution can be applied by various methods including spraying, brushing, dipping, and pressure treatment. Frequent monitoring of dip and pressure systems are necessary to insure that the desired level of TERRAIN is maintained. Wood can be handled after treatment when dry.

1. For dip treatments, the wood should be totally submersed in the solution until thoroughly wet and then allowed to dry in a suitable location. Dipping solutions to which TERRAIN has been added should be agitated before use if left unused for long periods of time. Sediment, debris and other deposits should be periodically cleaned from the tank.
2. For pressure treatments the wood should be placed in the treatment chamber, the TERRAIN solution added and the system pressurized up to 250 psi for up to one hour depending on the density and type of wood treated. After the pressure is released and the system drained, the wood should be placed in a suitable location for drying.
3. For spray treatments, the wood should be sprayed thoroughly including back and ends.
4. For brush treatments, all parts of wood surfaces should be thoroughly treated.

### Rate Conversion Chart

Pounds Active per Acre	Formulation Ounces per Acre
0.05	2.0
0.10	4.0
0.15	6.0
0.20	8.0
0.25	10.0
0.30	12.0
0.40	16.0

### AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The requirements in this box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.

PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is: Coveralls, Chemical-resistant gloves, such as Barrier Laminate or Viton, and Shoes plus socks.

### Chemigation Use Directions

Apply this product only through sprinkler including center pivot, lateral move end tow, side (wheel) roll, traveler, big gun, solid set, or handmove irrigation systems.

Do not apply this product through any other type of irrigation system. Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system. Crop injury, lack of effectiveness, or illegal residues in the crop can result from nonuniform distribution of treated water. If you have questions about calibration, you should contact State Extension Service specialists, equipment manufacturers, or other experts. A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.

The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.

The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the

supply tank when the irrigation system is either automatically or manually shut down.

The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.

The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.

Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.

Do not apply when wind speed favors drift beyond the area intended for treatment.

TERRAIN insecticide should be applied continuously for the duration of the water application. TERRAIN should be diluted in sufficient volume to ensure accurate application over the area to be treated. When using chemigation, a minimum of 0.1 inch per acre of irrigation water is recommended. Agitation generally is not required when a suitable diluent is used. A diluent test should be conducted to ensure that phase separation will not occur during dilution and application.

Failure to achieve a uniform dilution throughout the time of application may result in undesirable residues or less than desirable control.

#### COMMERCIAL IMPREGNATION AND APPLICATION OF TERRAIN ON DRY BULK FERTILIZERS

TERRAIN insecticide may be impregnated on dry bulk fertilizers. When applied as directed, TERRAIN/dry bulk fertilizer mixtures provide insect control equal to that provided by the same rates of TERRAIN applied in water.

The TERRAIN/fertilizer mixtures may be surface applied or shallow incorporated.

The higher rate should be used if incorporation is used.

**Impregnation:** Apply using a minimum of 200 pounds of dry bulk fertilizer per acre and up to a maximum of 450 pounds per acre with the recommended amount of TERRAIN insecticide per acre. Use a closed rotary-drum mixer or a similar type of closed blender equipped with suitable spray equipment. The spray nozzle(s) should be positioned to provide a uniform, fine spray pattern over the tumbling fertilizer for thorough coverage. The physical properties of fertilizers vary, particularly in liquid absorptive capacity. When absorptivity is sufficient, simple spray impregnation of the fertilizer with TERRAIN provides a satisfactory, dry mixture. If the absorptive capacity is inadequate, the use of a

highly absorptive powder is required to provide a dry, flowable mixture. Microcel E (Johns-Manville Products Corporation) is a recommended absorbent powder.

Generally less than 2% by weight of Microcel E is required. **DO NOT** impregnate TERRAIN onto straight coated ammonium nitrate or straight limestone because these materials will not absorb the insecticide. Dry fertilizer blends containing mixtures of ammonium nitrate or limestone may be impregnated with TERRAIN. The amount of TERRAIN actually required in the preparation of individual fertilizer mixtures should be determined carefully for each production operation. This is necessary to ensure that the amount of pesticide actually contained in the mixture applied to the soil represents the correct rate of use. Bulk fertilizer impregnated with TERRAIN insecticide should be applied immediately, not stored. All individual state regulations relating to bulk dry fertilizer blending, registration, labeling, and application of the mixtures are the responsibility of the individual and/or company selling the fertilizer and TERRAIN mixture.

#### GENERAL INSTRUCTIONS

Unless otherwise directed by registered supplemental labeling, follow the Directions for Use in each crop group section.

TERRAIN is a 3.2 pounds per gallon formulation of the insecticide permethrin.

Apply TERRAIN when insects appear or feeding is noticed. The higher rate should be used as pest populations increase. Repeat the application as necessary to maintain control. TERRAIN may be applied by both ground and aerial equipment. Use sufficient water to obtain full coverage. With the exception of crops listed below, rotational crops should not be planted within 60 days of last application. This label must be in the possession of the user at the time of application.

#### Alfalfa; Alfalfa grown for seed (0 day phi)\*

(Includes lucerne, sainfoin, holy clover, esparcet, birdsfoot trefoil and varieties and/or hybrids of these)

Insects Controlled	Rate of Application	Method of Application
Armyworms Blue Alfalfa Aphid Cutworms Green Cloverworm Green Peach Aphid Loopers Pea Aphid Spotted Alfalfa Aphid	2 to 8 ounces (0.05 to 0.2 pound active) per acre	Use higher recommended dosage for increased pest pressure or for increased residual pest control. Apply with ground equipment in a minimum of 10 gallons of finished

Velvetbean Caterpillar Webworms		
Alfalfa Weevil Cucumber Beetle Egyptian Alfalfa Weevil Meadow Spittlebug Plant Bugs (including <i>Lygus</i> spp.) Potato Leafhopper Stink Bugs	4 to 8 ounces (0.1 to 0.2 pound active) per acre	
Do not apply more than 0.2 pound active ingredient per cutting. *When rates greater than 0.1 pound active per acre are used, do not apply within 14 days of harvest. Do not apply to mixed stands with intentionally-grown forage grasses and/or legumes.		

#### Almonds (7 day phi)

Insects Controlled	Rate of Application	Application Method of Application
Navel Orangeworm Peach Twig Borer	8 to 16 ounces (0.2 to 0.4 pound active) per acre	Apply when insects appear. Apply in a minimum of 15 gallons of finished spray per acre by aircraft or 25-400 gallons of finished spray per acre with ground equipment.
Ants	16 ounces (0.4 pound active) per acre	Apply by ground equipment in a minimum of 15 gallons of finished spray per acre. Application should follow mowing of weed growth to insure maximum coverage of the soil

Do not apply more than 0.8 pound active per acre during hull Do not apply more than 2.0 pounds active per acre per season. Do not graze livestock in treated areas. Do not feed cover crops from treated areas to livestock.		

#### Apples

Insects Controlled	Rate of Application	Method of Application
Green Fruitworm Oblique Banded Leafroller Plum Curculio Redbanded Leafroller Rosy Apple Aphid Spotted Tentiform Leafminer Tarnished Plant Bug White Apple Leafhopper	4 to 16 ounces (0.1 to 0.4 pound active) per acre	Use with ground equipment only. Apply in 25-400 gallons of finished spray per acre when insects appear and repeat as required to maintain control.
Do not apply more than 0.6 pound active per acre per season. Do not apply after petal fall. Do not graze livestock in treated areas. Do not feed cover crops from treated areas to livestock.		

#### Artichoke (0 day phi)

Insects Controlled	Rate of Application	Method of Application
Artichoke Plume Moth Leafminers	4 to 12 ounces (0.1 to 0.3 pound active) per acre.	Apply with ground equipment in a minimum of 10 gallons of finished spray per acre or in a minimum of 2 gallons per acre by aircraft. Apply as needed. Buds may be harvested on the day of

	application.
Do not apply more than 5 applications (1.5 pounds active ingredient) per acre per season.	

**Asparagus (1 day phi)**

Insects Controlled	Rate of Application	Method of Application
Asparagus Beetle Cutworms	2 to 4 ounces (0.05 to 0.1 pound active) per acre	Apply with ground equipment in a minimum of 10 gallons of finished spray per acre. Apply as needed.
Asparagus Beetle Japanese Beetle (Adult stage)* Lygus Bugs Tarnished Plant Bug	4 ounces (0.1 pound active) per acre	For post harvest application, apply to the fern stage of the asparagus plant after spear harvest when larval and adult stage are present. *Not for control of this insect in California.
Do not apply more than 0.4 pound active ingredient per acre per season.		

**Avocado (7 day phi)**

Insects Controlled	Rate of Application	Method of Application
Avocado Caterpillar Avocado Lace Bug Avocado Leafhopper Avocado Leafroller Avocado Looper Avocado Tree Girdler Avocado Whitefly Brown Soft Scale Mirids Omnivorous Looper Orange Tortrix Scale Crawlers	8 ounces (0.2 pound active) per acre	Apply with ground equipment in 25-400 gallons of finished spray per acre. Apply when insects first appear and repeat at 7 to 10 day intervals as needed to provide control.

Do not apply more than 1.2 pounds active ingredient per acre per season. Do not graze livestock in treated areas. Do not feed cover crops from treated areas to livestock.		

**Broccoli; Chinese Broccoli** (gai lon, white flowering broccoli); **Brussels Sprouts; Cauliflower; Cavalo broccolo; Kohlrabi (1 day phi)**

Insects Controlled	Rate of Application	Method of Application
Armyworm spp. Cabbage Looper DiamondbackMoth Imported Cabbageworm Plant Bugs Thrips	2 to 4 ounces (0.05 to 0.1 pound active) per acre	Apply with ground equipment in a minimum of 10 gallons of finished spray per acre or in a minimum of 2 gallons per acre by aircraft. Apply as needed.
Do not apply more than 0.8 pound active ingredient per acre per season.		

**Cabbage; Cabbage, Chinese** (napa) (tight-heading varieties only) **(1 day phi)**

Insects Controlled	Rate of Application	Method of Application
Cabbage Looper DiamondbackMoth Imported Cabbageworm Southern White Butterfly	2 to 8 ounces (0.05 to 0.2 pound active) per acre	Apply with ground equipment in a minimum of 10 gallons per acre or in a minimum of 2 gallons per acre by aircraft. Apply as needed.
Armyworm spp. Cutworms Flea Beetles	4 to 8 ounces (0.1 to 0.2 pound active) per acre	
Do not apply more than 1.0 pound active ingredient per acre per season.		

**Cantaloupes:** For general use directions refer to the **Cucurbit Vegetables** crop grouping.

**Celery, Florence fennel** (sweet anise, sweet fennel, finocchio) (fresh leaves and leaf petioles only): For general use directions refer to the

**Leafy Vegetable** crop grouping.

**Cherries** (Includes Sweet Cherries and Tart Cherries) **(3 day phi)**

Insects Controlled	Rate of Application	Method of Application
Green Fruitworm Lesser Peach Tree Borer Plum Curculio Redbanded Leafroller Rose Chafer Tarnished Plant Bug	4 to 8 ounces (0.1 to 0.2 pound active) per acre	Use TERRAIN insecticide as a dilute spray. Apply when insects appear. Apply with ground equipment in 25- 400 gallons of finished spray per acre.
<p>Do not graze livestock in treated areas. Do not feed cover crops from treated areas to livestock. <i>East of the Rockies</i>, do not exceed 6 applications per season, with no more than 4 applications after petal fall. <i>West of the Rockies</i>, do not apply more than 4 applications per season, with no more than 3 applications after petal fall.</p>		

**Chrysanthemums**

Insects Controlled	Rate of Application	Method of Application
Liriomyza Leafminer Flies	20 fluid ounces (0.5 pound active) per 100 gallons (1 teaspoon per gallon)	Avoid spraying the blooms. TERRAIN may be applied on a weekly schedule. Caution: TERRAIN has demonstrated excellent plant safety, however, not all cultivars have been tested. Before treating large numbers of plants of a particular cultivar, treat a few plants and observe prior to full scale applications.

**Collards and Turnips (1 day phi)**

Insects Controlled	Rate of Application	Method of Application
Beet Armyworm	2 to 4	Apply with

Cabbage Looper Corn Earworm Cutworms Diamondback Moth European Corn Borer Fall Armyworm Green Cloverworm Imported Cabbageworm Leafhoppers Leafminer Southern Armyworm Southern White Butterfly Tobacco Budworm Vegetable Leafminer Aphids*	ounces (0.05 to 0.1 pound active) per acre	ground equipment only. Apply with ground equipment in a minimum spray volume of 10 gallons of finished spray per acre. Apply as needed.
<p>For use on Collards in AR, AZ, GA, IL, NC, OK, SC, and TX and on Turnips in FL, GA, IL, IN, OK, SC, TX, and WA. Do not apply more than 0.8 pound active ingredient per acre per season on Collards and Turnips (AR, TX &amp; IN). Do not apply more than 0.4 pound active ingredient per acre per season on Turnips (SC, GA, FL &amp; WA). * Suppression only.</p>		

**Conifers (Container and Field Grown)**

Insects Controlled	Rate of Application	Method of Application
Nantucket Pine Tip Moth	4 to 8 fluid ounces (0.1 to 0.2 pound active) per acre	TERRAIN may be diluted in a non-volatile vegetable oil or water in a minimum of 1 gallon of finished spray per acre using equipment calibrated to give adequate coverage. Begin application when the adults appear and repeat at 5 to 7 day intervals or as needed throughout the season.

**DISPOSAL METHODS**

**Pesticide Disposal**

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 of the nearest EPA Regional Office for guidance.

#### Container Disposal

**Metal Containers:** Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill or by other approved State and Local procedures. Do not cut or weld metal containers.

**Plastic Containers:** Triple rinse (or equivalent). Then offer for recycling or reconditioning or dispose of in a sanitary landfill, or incineration, or, if allowed by State and Local authorities, by burning. If burned, stay out of smoke.

**Returnable/Refillable Sealed Container:** Do not rinse container. Do not empty remaining formulated product. Do not break seals. Return intact to point of purchase.

#### STORAGE CONDITION

Do not store below 10°F, (-12°C).

Do not use or store near heat, open flame or hot surfaces.

Keep out of reach of children and animals. Store in original containers only.

Store in a cool dry place and avoid excess heat. Carefully open containers. After partial use replace lids and close tightly. Do not put concentrate or dilute material into food or drink containers. Do not contaminate other pesticides, fertilizers, water, food, or feed by storage or disposal.

In case of spill, avoid contact, isolate area and keep out animals and unprotected persons.

Confine spills. Call FMC: (800) 331-3148.

To confine spill: If liquid, dike surrounding area or absorb with sand, cat litter or commercial clay. If dry material, cover to prevent dispersal. Place damaged package in a holding container. Identify contents.

For More Details including effects on environment email [contact@ivorychem.com](mailto:contact@ivorychem.com) with Subject "TERRAIN DETAILS"

More Details:

#### TOXICOLOGICAL EFFECTS

- **Acute toxicity:** Permethrin is moderately to practically non-toxic via the oral route, with a reported LD50 for technical permethrin in rats of 430 to 4000 mg/kg [12]. Via the dermal route, it

is slightly toxic, with a reported dermal LD50 in rats of over 4000 mg/kg, and in rabbits of greater than 2000 mg/kg [12,2]. Permethrin caused mild irritation of both the intact and abraded skin of rabbits. It also caused conjunctivitis when it was applied to the eyes [9]. The 4-hour inhalation LC50 for rats was greater than 23.5 mg/L, indicating practically no inhalation toxicity. The toxicity of permethrin is dependent on the ratio of the isomers present; the cis-isomer being more toxic [12].

- **Chronic toxicity:** No adverse effects were observed in dogs fed permethrin at doses of 5 mg/kg/day for 90 days [15]. Rats fed 150 mg/kg/day for 6 months showed a slight increase in liver weights [9]. Very low levels of permethrin in the diet of chickens (0.1 ppm for 3 to 6 weeks after hatching) have been reported to suppress immune system activity [9].
- **Reproductive effects:** The fertility of female rats was affected when they received very high oral doses of 250 mg/kg/day of permethrin during the 6th to 15th day of pregnancy [25]. It is not likely that reproductive effects will be seen in humans under normal circumstances.
- **Teratogenic effects:** Permethrin is reported to show no teratogenic activity [9].
- **Mutagenic effects:** Permethrin is reported to show no mutagenic activity [9].
- **Carcinogenic effects:** The evidence regarding the carcinogenicity of permethrin is inconclusive.
- **Organ toxicity:** Permethrin is suspected of causing liver enlargement of the liver and nerve damage [9]. Effects on the immune system have been noted in animal studies.
- **Fate in humans and animals:** Permethrin is efficiently metabolized by mammalian livers [40]. Breakdown products, or "metabolites," of permethrin are quickly excreted and do not persist significantly in body tissues [41]. When permethrin is administered orally to rats, it is rapidly metabolized and almost completely eliminated from the body in a few days. Only 3 to 6% of the original dose was excreted unchanged in the feces of experimental animals [41]. Permethrin may persist in fatty tissues, with half-lives of 4 to 5 days in brain and body fat [9]. Permethrin does not block, or inhibit, cholinesterase enzymes [40].

## ECOLOGICAL EFFECTS

- **Effects on birds:** Permethrin is practically non-toxic to birds [12]. The oral LD50 for the permethrin formulation, Pramex, is greater than 9900 mg/kg in mallard ducks, greater than 13,500 mg/kg in pheasants, and greater than 15,500 mg/kg in Japanese quail [41].
- **Effects on aquatic organisms:** Aquatic ecosystems are particularly vulnerable to the impact of permethrin. A fragile balance exists between the quality and quantity of insects and other invertebrates that serve as fish food [41]. The 48-hour LC50 for rainbow trout is 0.0125 mg/L for 24 hours, and 0.0054 mg/L for 48 hours [12]. The 48-hour LC50 in bluegill sunfish and salmon is 0.0018 mg/L [12]. As a group, synthetic pyrethroids were toxic to all estuarine species tested. They had a 96-hour LC50 of less than or equal to 0.0078 mg/L for these species [42]. The bioconcentration factor for permethrin in bluefish is 715 times the concentrations in water and is 703 in catfish. This indicates that the compound has a low to moderate potential to accumulate in these organisms.
- **Effects on other organisms:** Permethrin is extremely toxic to bees. Severe losses may be expected if bees are present at treatment time, or within a day thereafter [2,43]. Permethrin is also toxic to wildlife [9]. It should not be applied, or allowed to drift, to crops or weeds in which active foraging takes place [12].

## ENVIRONMENTAL FATE

- **Breakdown in soil and groundwater:** Permethrin is of low to moderate persistence in the soil environment, with reported half-lives of 30 to 38 days [12,25]. Permethrin is readily broken down, or degraded, in most soils except organic types. Soil microorganisms play a large role in the degradation of permethrin in the soil. The addition of nutrients to soil may increase the degradation of permethrin. It has been observed that the availability of sodium and phosphorous decreases when permethrin is added to the soil [44]. Permethrin is tightly bound by soils, especially by organic matter. Very little leaching of permethrin has been reported [45]. It is not very mobile in a wide range of soil types [41]. Because

permethrin binds very strongly to soil particles and is nearly insoluble in water, it is not expected to leach or to contaminate groundwater.

- **Breakdown in water:** The results of one study near estuarine areas showed that permethrin had a half-life of less than 2.5 days. When exposed to sunlight, the half-life was 4.6 days [44]. Permethrin degrades rapidly in water, although it can persist in sediments [15,45]. There was a gradual loss of toxicity after permethrin aged for 48 hours in sunlight at 0.05 mg/L in water [45].
- **Breakdown in vegetation:** Permethrin is not phytotoxic, or poisonous, to most plants when it is used as directed. Some injury has occurred on certain ornamental plants. No incompatibility has been observed with permethrin on cultivated plants. Treated apples, grapes, and cereal grains contain less than one mg/kg of permethrin at harvest time [12].

## PHYSICAL PROPERTIES AND GUIDELINES

### Physical Properties:

- **Appearance:** Permethrin is an odorless, colorless crystalline solid or a viscous liquid that is pale brown [12].
- **Chemical Name:** 3-phenoxybenzyl(1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate [12]
- **CAS Number:** 52645-53-1
- **Molecular Weight:** 391.30
- **Water Solubility:** ca. 0.2 mg/L @ 20 C [12], insoluble in water
- **Solubility in Other Solvents:** s. in most organic solvents except ethylene glycol [12]
- **Melting Point:** 34-35 C [12]
- **Vapor Pressure:** 0.045 mPa @ 25 C [12]
- **Partition Coefficient:** 6.1004[12]
- **Adsorption Coefficient:** 100,000 [26]



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