

Subterranean Termite Control for Public Educational Facilities (rev. 5/00)

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This document is based on proposed changes to the Florida Building Code as of 2001. This document was written by the Florida School IPM Advisory Board and is intended to provide suggestions to school officials when considering subterranean termite treatments to school buildings. The implementation of Integrated Pest Management (IPM) into Florida schools has reduced the risk of pesticide exposure to children and reduced the risk of exposure to pests. This document is consistent with implementation of IPM. This document has two main sections, “Building Practices and Standards” and “Treatment Methods and Practices”.

Subterranean termites (referred to as simply “termites” throughout this document) are insects that can invade and damage structures in Florida. They occur everywhere in the state. They constantly forage for sources of cellulose and can enter a structure through a gap as small as 1/64th of an inch. Sources of cellulose can be structural wood, finish wood, paper covering of drywall, books, records, stored products, furniture, and many other wood or paper based products. Termite feeding on these materials can cause tens of thousands of dollars of damage.

Public educational facilities are vulnerable to termite damage, even if constructed with non-wood structural elements. The time to institute control measures for termites is during planning and construction. This document will provide information on building practices and standards that will assist in termite control and on control techniques that are implemented during and after construction. The use of an integrated pest management (IPM) approach to termite control will offer the highest probability of preventing termite infestation and damage.

Building Practices and Standards

The following building practices should be observed to construct a facility that is not conducive to termite infestation. While it is not possible to build a structure that is “termite proof”, it is possible to avoid creating conditions that favor termite infestation or make it difficult or impossible to control termites.

- A. Posting of Treatment Notices
- B. Exterior Siding (Wall Covering)
- C. Roof Assemblies and Rooftop Structures
- D. Foundation Treatment
- E. Foundation Masonry
- F. Foundation Preparation
- G. Termite Protection for Wood Framing

A. POSTING OF TREATMENT NOTICES

Certificate of Soil Treatment for prevention of termites. A weather resistant jobsite posting board should be provided to receive duplicate Treatment Certificates as each required chemical soil treatment is completed, providing a copy for the person the permit is issued to and building permit files. The Treatment Certificate shall provide the identity of the applicator, time and date of the treatment, site location, area treated, chemical used, percent concentration and number of gallons used, to establish a verifiable record of protective treatment. Final exterior treatment shall be completed prior to final building approval.

B. EXTERIOR SIDING (WALL COVERING)

Veneered Walls

In order to provide for inspection for termite infestation, and to prohibit exterior siding contact to soil, clearance between exterior wall coverings (i.e., stucco, siding) and soil on the exterior of a building should not be less than 6 inches (152 mm).

- EXCEPTION: (1) Paint or decorative cementitious finish less than five-eighths of an inch thick applied directly to the masonry foundation sidewall;
- (2) Access or vehicle ramps which rise to the interior finish floor elevation for the width of such ramps only.
 - (3) A four (4) inch inspection space above entry areas, exterior slabs adjacent to school buildings.
 - (4) Masonry veneers

C. ROOF ASSEMBLIES and ROOFTOP STRUCTURES

Weather Protection

Protection against decay and termites. All condensate lines, and roof down spouts should discharge at least one foot away from the structure sidewall, whether by underground piping, tail extensions, or splash blocks. Gutters with down spouts are required on all buildings with eaves of less than six inches horizontal projection except for gable end rakes or on a roof above another roof. Irrigation/sprinkler systems and risers for spray heads should have sprinkler heads or be located two (2) feet from building so as to prevent water contacting walls and prevent soil disturbance and leaching of termiticides. Inclusion of drought tolerant plants (being consistent with Educational Codes on Landscapes) into landscape plans can aid in achieving this goal.

The purpose of these suggestions is to limit all possible soil disturbance near the foundations of buildings. Liquid soil termiticide applied to these areas during construction can be easily disturbed by subsequent landscape operations and water input rendering a failed termiticide barrier.

D. FOUNDATION TREATMENT

Termite Protection (see also, Treatment Methods and Practices)

Soil treatment. Termite protection should be provided by chemical soil treatment with termiticides or other approved methods of termite protection.

Initial chemical soil treatment inside foundation perimeter should be completed after all excavation, backfilling, and compaction is complete.

Soil area disturbed after initial chemical soil treatment should be retreated with a chemical soil treatment, including spaces boxed or formed.

Spaces in concrete floors boxed out or formed for the subsequent installation of plumbing traps, drains, or for any other purpose should be created by using plastic or metal permanently placed forms of sufficient depth to eliminate any planned soil disturbance after initial chemical soil treatment.

Chemically treated soil should be protected with a minimum 6 mil vapor retarder to protect against rainfall dilution. If rainfall occurs before vapor retarder placement re-treatment is required. Any work, including placement of reinforcing steel, done after chemical treatment until the concrete floor is poured, should be done in such manner as to avoid penetrating or disturbing treated soil.

Concrete overpour or mortar accumulated along the exterior foundation perimeter should be removed prior to exterior chemical soil treatment, to enhance vertical penetration of the chemicals.

Chemical soil treatments should also be applied under all exterior concrete on grade within one (1) foot of the primary structure sidewalls. Also, a vertical chemical barrier should be applied promptly after construction is completed, following initial landscaping and irrigation/sprinkler installation. The vertical barrier is a termiticide applied to the perimeter of the structure at the label rate of 4 gallons per 10 linear feet per foot of depth. The vertical barrier is part of the entire pre-treatment requirement and should be completed after final grade. Any soil within 1 foot of structure disturbed after the chemical vertical barrier is applied shall be promptly retreated.

Penetrations. Protective sleeves around metallic piping penetrating concrete slab-on-grade floors should not be of cellulose containing materials and should receive application of a termiticide.

E. FOUNDATION MASONRY

Termite Inspection

Cells and cavities in masonry units and air gaps between brick, stone, or masonry veneers and the structure should be cleaned of all non-preservative treated or non-naturally durable wood, or other cellulose containing material prior to concrete placement

EXCEPTION: Inorganic material manufactured for closing cells in masonry construction or clean earth fill.

Brick, stone, or other veneer should be supported by a concrete bearing ledge of such thickness as required in Chapter 14 (Florida Building Code), which is poured integrally with the concrete foundation. No hidden cold joint should exist in the foundation unless there is an approved physical barrier. An approved physical barrier should also be installed from below the wall sill plate or first block course horizontally to embed in a mortar joint.

EXCEPTION: Veneer supported by a structural member secured to the foundation sidewall, provided at least a six inch clear inspection space of the foundation sidewall exterior exist between the veneer and the top of any soil, sod, mulch or other organic landscaping component, deck, apron, porch, walk, or any other work immediately adjacent to or adjoining the structure.

F. FOUNDATION PREPARATION

The foundation and the area encompassed within one foot therein should have all vegetation, stumps, large dead roots, cardboard, trash, and foreign material removed and the fill material should be free of vegetation and foreign material. The fill should be compacted to assure adequate support of the foundation. Foreign cellulose material such as stumps, cardboard, form boards and the like can become food sources for termites which then are able to gain access to the structure.

After all work is completed, loose wood and debris shall be completely removed from under the building and within six inches thereof. All wood forms and supports should be completely removed. This includes, but is not limited to: wooden grade stakes, forms, contraction spacers, tub trap boxes, plumbing supports, bracing, shoring, forms, or other cellulose containing material placed in any location where such materials are not clearly visible and readily removable prior to completion of the work. Wood should not be stored in contact with ground under any building.

EXCEPTION: Materials which are of naturally durable wood or are pressure treated for ground contact, and which are installed with at least six inches clear space from the structure to allow for inspection and treatment for termites.

In order to reduce chances of termite infestation, no wood, vegetation, stumps, dead roots, cardboard, trash, or other cellulose containing material should be buried on the building lot within fifteen (15) feet of any building or the position of any building proposed to be built.

G. TERMITE PROTECTION FOR WOOD FRAMING

Protection against decay and termites

In areas where hazard of termite damage is very heavy, the building official should require floor framing of naturally durable wood, preservative treated wood, soil treatment, or other approved methods of termite protection.

Decks, fences, patios, planters, or other wooden building components that directly abut the sidewall of the foundation or structure shall be constructed so as to provide:

1. - eighteen (18) inch clearance beneath or,
2. - or provide for six inch clearance between the top of the component and the exterior wall covering or,
3. - have components that are easily removable by screws or hinges to allow access for inspection of the foundation sidewall and treatment for termites.

Treatment Methods and Practices

The following treatment methods are available for control of subterranean termites.

- A. Soil Treatment with Residual Termiticides
- B. Installation of termite colony monitoring and baiting systems
- C. Installation of physical barriers to termite infestation
- D. Treatment of structural wood with borate-containing compounds

A. Soil Treatment with Residual Termiticides

Insecticides registered for use as soil applied termiticides are listed in Table 1. In order to be registered, these products had to demonstrate (under slab) 100% protection of wood from termite attack for five years under Florida conditions. These products, then, will work if they are applied properly and the protection is not defeated through construction or maintenance practices.

Proper application of soil applied termiticides requires that the material be applied to create a continuous barrier between the structure and termite colonies in the soil. Creation of this barrier requires at least two separate applications during construction, and, may require additional applications depending on the construction. These applications are:

under the slab (**horizontal barrier**)

to the perimeter of the foundation (**vertical barrier**)

band application (minimum 1 foot) under any adjacent slabs such as driveways, patios, walkways, etc.

The rate of application of termiticide solution is the same for all the registered products. Termiticide solution will contain a specific concentration of active ingredient and water. The application rates given below are for the solution. The concentration of active ingredient typically used in these solutions is given in Table 1.

Table 1. Florida Registered Soil Termiticides - (Alphabetical by Active Ingredient)

Product ¹	Active Ingredient ²	Active ingredient concentration in solution applied to soil ³	Relative Toxicity (mg per kg of body weight) ⁴	Repellent/Non-Repellent ⁵
Biflex Talstar	bifenthrin	0.06-0.12%	Oral Rat LD ₅₀ = 375 Dermal Rat LD ₅₀ >2000	Repellent
Dursban Equity Cyren	chlorpyrifos	0.75 - 1.0 %	Oral Rat LD ₅₀ = 96-270 Dermal Rabbit LD ₅₀ = 2000	Non-Repellent
Prevail Demon TC	cypermethrin	0.25% - 0.50%	Oral Rat LD ₅₀ = 250-4123 Dermal Rabbit LD ₅₀ >2000	Repellent
Tribute	fenvalerate	0.5 - 1.0%	Oral Rat LD ₅₀ = 451 Dermal Rat LD ₅₀ >5000	Repellent
Termidor	fipronil	0.06 - 0.125%	Oral Rat LD ₅₀ = 296 Dermal Rabbit LD ₅₀ = 374	Non-Repellent
Premise	imidacloprid	0.05 - 0.10%	Oral Rat LD ₅₀ = 1858-2591 Dermal Rat LD ₅₀ >2000	Non-Repellent
Prelude Dragnet	permethrin	0.50%	Oral Rat LD ₅₀ = 430-4000 Dermal Rat LD ₅₀ >2500	Repellent

Description of Table Columns:

¹ **Product Names:** These are the “Trade” names assigned to products by the manufacturer and are trademarked. Termiticides are usually best known by pest management professionals by these names.

² **Active Ingredient:** This is the name of the chemical insecticide formulated in the product. This is the compound which kills the insect pest.

³ **Active Ingredient Concentration:** Soil termiticides are formulated by the manufacturer at various concentrations based on research and experimentation which shows the best results under certain conditions. Soil termiticides are usually diluted on site as they are usually packaged as concentrates.

⁴ **Relative Toxicity:** This is a toxicological standard used by the EPA when evaluating toxicity of insecticides. LD₅₀ refers to the amount of insecticide necessary to cause mortality in 50% of test animals. LD₅₀'s are recorded as milligrams (mg) of active ingredient per kilogram (kg) of test animal. For instance, if the Rat LD₅₀ of a compound is 500, this means that it required 500 mg of an active ingredient to kill 50% of a population of rats which each weigh 1 kg. The higher the LD50 number the less toxic the compound. The US EPA has four toxicity classifications for pesticides based on oral

toxicity: LD₅₀ = 0 - 50 is category I, LD₅₀ = 50 - 500 is Category II, LD₅₀ = 500 - 5000 is Category III, and LD₅₀ > 5000 is Category IV. Two additional routes of exposure for which LD₅₀ values are determined are “Dermal” and “Inhalation”.

⁵ **Repellent/Non-Repellent:** A termiticide barrier composed of a repellent termiticide repels termites. A properly applied repellent termiticide will provide protection for the structure unless the barrier is disturbed. A termiticide barrier composed of a non-repellent termiticide kills termites. A properly applied non-repellent termiticide can provide protection for the structure even if the barrier is disturbed.

Note: Concentration of active ingredient in the tank mix varies with product. For all products, rates of finished mix applied are the same:

For monolithic slabs :

- 1 gallon per ten square feet for the horizontal barrier
- 4 gallons per ten linear feet for vertical barrier around perimeter

For supported or floating slabs :

- 1 gallon per ten square feet for the horizontal barrier
- 4 gallons per ten linear feet for inside perimeter of stem wall (concrete block walls), plus 2 gallons per ten linear feet for block voids, plus 4 gallons per ten linear feet for the exterior vertical barrier.

For monolithic slabs - no interior vertical treatment is needed

On labels where timing of establishment of vertical barriers is not specified by label language, the appropriate barrier (interior, exterior, or block void) should be established at the point in construction where it is most appropriate. This means prior to pouring of slab for the interior and block void barriers in supported and floating slab construction. The exterior vertical barrier should be established after establishment of the final grade.

Products and Manufacturers (World Wide Web information)

Dursban, Equity; DowAgroSciences - <http://www.dowagro.com/>

Cyren; CheminovaAgro - <http://www.cheminova.com>

Prevail; FMC - <http://www.fmc-apgspec.com/>

Demon TC; Zeneca - <http://www.zenecaprofprod.com>

Premise; Bayer Corp. - <http://www.nobugs.com>

Prelude; Zeneca - <http://www.zenecaprofprod.com>

Dragnet; FMC - <http://www.fmc-apgspec.com>

Biflex, Talstar; FMC - <http://www.fmc-apgspec.com>

Tribute, Termidor; Aventis Environmental Science - <http://www.aventis.com>

B. Installation of termite colony monitoring and baiting systems

Termite baits use small amounts of insecticide to knock out populations of termites foraging in and around the structure. Some baits may even eradicate entire termite colonies. Termite baits consist of paper, cardboard, or other termite food, combined with a slow-acting substance lethal to termites. Regardless of which bait is used, the customer must be prepared and willing to accept the possibility of a lengthy baiting process.

Some bait products are inserted below ground out in the yard, whereas others are installed above ground level on the inside of the structure. Baits are applied below ground by enticing termites to feed on wooden stakes, cardboard, or some other cellulose-based material. The toxicant-laced bait can either be installed initially, or substituted after termites have been detected in an untreated monitoring device. Only after a monitoring station has been identified as having active termite foraging is a toxicant-treated bait material placed into the monitoring station. The more below ground stations installed, the better the chances of intercepting termites. Planning, patience, and persistence are requisites for successfully using below-ground termite baits as it may take several months to a year to eliminate termites from a structure.

Termite baits may also be installed above ground in known areas of termite activity. Typically, the stations are installed directly in the path of active termite tunnels after the mud tubes have been broken. Effects tend to be more rapid with above-ground baiting because the procedure does not depend upon "chance" termite encounters with the stations.

1. The Sentricon™ System (<http://www.dowagro.com/>) This method of termite baiting has been the most extensively tested of those currently on the market. The Sentricon Colony Elimination System™ was developed by DowAgrosciences and is sold only through authorized pest control firms. The Recruit™ bait contains hexaflumuron (0.5%), a slow-acting ingredient which disrupts the normal growth process in termites (i.e., termites die while attempting to molt). Termite control with the Sentricon System™ involves a 3-step process:

(1) initial monitoring to "pinpoint" termite activity, (2) delivery of the bait, and (3) subsequent monitoring to provide on-going protection. Recruit AG™ is a termite bait for use as an above ground delivery system for elimination of subterranean termite colonies. Recruit AG™ can only be used in conjunction with the Sentricon Colony Elimination System™ and is not available as a separate program.

2. Firstline™. (<http://www.fmc-apgspec.com/>) The FirstLine™ Termite Bait Station is intended for above-ground baiting of active termite tubes. The station consists of a semi-transparent plastic housing (4x4x1-inches) with open slots at the base. Contained within is corrugated cardboard treated with a slow-acting ingredient (sulfluramid) lethal to termites.

Another formulation of Firstline™ was introduced for below ground use, FirstLine GT™ ("GT" stands for ground treatment). Label directions emphasize placement of baits in areas where termite activity is known or suspected, i.e., installation may not involve insertion of baits at fixed intervals around the

entire perimeter of the building as is required with the Sentricon system. Firstline GT™ may be installed in the soil initially, in effect, by-passing the unbaited monitoring step utilized with Sentricon™.

3. Exterra™ Termite Interception and Baiting System™ (<http://www.ensystex.com/>) Use of Exterra™ is a multi-step process. The first step is the placement of stations in the ground around the perimeter of the structure. The next step is inspection of the stations and baiting of active stations with Labyrinth™ (bait that contains the active ingredient). The next step is reinspection of stations and replenishment of consumed bait. When termite activity in the station is eliminated, the station is refurbished and the cycle of inspection and baiting begins again. The toxic bait in Labyrinth™ is diflubenzuron (0.25%), a chitin synthesis inhibitor that causes termites to die while attempting to molt. The biggest advantage of Exterra™ is that stations can be monitored or refilled with bait without disturbing termites in the station.

<u>Product</u>	<u>Active Ingredient</u>	<u>Rat Dermal LD₅₀</u>	<u>Rat Oral LD₅₀</u>
Sentricon	hexaflumuron	>2000 mg/kg	>5000 mg/kg
FirstLine	sulfluramid	>2000 mg/kg	>5000 mg/kg
Exterra	diflubenzuron	>10,000 mg/kg	>4600 mg/kg

C. Installation of physical barriers to termite infestation

Termi-mesh™ Termite Barrier (<http://www.termi-mesh.com>) Termi-mesh is a flexible, corrosion-resistant, high-grade, stainless steel mesh that termites cannot penetrate. The holes of the mesh are too small for termites to crawl through and it is too strong for termites to chew through. Termi-mesh is designed to prevent subterranean termites from entering a structure through any entrances through the foundation. It is applied over the soil surface beneath the foundation in potential termite entry areas, ie. around plumbing pipes. For this reason, Termi-mesh can only be installed during new construction. Termi-mesh must be installed by specially trained technicians approved by Termi-mesh Inc. Termi-mesh is very new to the continental United States however it has been available in Hawaii and Australia for several years.

D. Treatment of structural wood with borate-containing (DOT) compounds

Disodium octaborate tetrahydrate (DOT), which is similar to boric acid, acts as a stomach poison. Termites will generally avoid wood that has been treated with borate compounds. Borate products are usually directly applied to wood as a liquid or dust formulation. The treatment is applied to all wood within 24" of the ground. This would include sill plates, studs, and exterior sheathing.

1. Bora-Care® (40% DOT) (<http://www.nisuscop.com>) active ingredient concentration in solution applied to wood = 23% (1:1) or 16% (2:1)

2. TimBor® (98% DOT) (<http://www.borax.com>) active ingredient concentration in solution applied to wood = 10% or 15%

<u>Product</u>	<u>Active Ingredient</u>	<u>Rat Oral LD₅₀</u>	<u>Rat Dermal LD₅₀</u>
Bora-Care	borates	>2000 mg/kg	>5000 mg/kg
TimBor	borates	2550 mg/kg	>2000 mg/kg

Other Resources

University of Florida/IFAS - <http://www.ifas.ufl.edu>

Florida Dept. of Education - <http://www.firn.edu/doe/doehome.htm>

University of Florida Ft. Lauderdale Research and Education Center -
<http://www.ftld.ufl.edu/entomolo.htm>

Florida Dept. of Agriculture and Consumer Services/Bureau of Entomology and Pest Control
<http://doacs.state.fl.us/~aes-ent/>

Florida Termite Help - <http://www.floridatermitehelp.org>