**Material & Methods**

- PVC tube (15 cm diam., 60 cm length)
- Dry builders sand 5 cm
- CPVC pipe treatments n=5
  - Composition
    - length
  - Concrete 12 cm
  - Soil treatment (10% moisture) n=2
    - Bifenthrin 12% a.i.
    - Control (water)
  - Moistened (10%) builders sand
  - Cardboard food source (1 cm²)
- Lidded bottom
- Flip tube
- Remove dry builders sand
- Cardboard food source above concrete
- Lidded top
- Flip tube
- Termites to bottom 10 g (~2,500)
- Stored 4 wks
Liquid Termiticide Treatment of CPVC Pipe Causes Failure

- CPVC Failures from termiticides
  - During past 5-7 years
  - Confirmed by pipe manufacturers
  - ~12 failures per 120,000 houses
  - Usually within the 6 months of installation
- 77% of reported failures in Florida
- Litigation
  - Thousands of dollars in damage each claim

Initial Setup
12 registered termiticides

- Water
- Terminet SC
- Taekstar One
- Premise 2
- Dragnet
- Permethrin Pro
- Prelude
- Termidor SC
- Cyper TC
- Dursban TC
- Permethrin Pro
- Termidor SC

Measured Distance

Some Pipes Failed within 1 day

Conclusions of the studies

- Some termiticide concentrates / spray solutions + stress caused failure of CPVC pipe
- Treated soils + stress did not cause failure of CPVC pipe
- Volatile Organic Chemicals found in termiticides caused CPVC failure within 4 days
- Termiticide + Stress + CPVC Glue caused faster failure of CPVC
  - CPVC glue softens the CPVC
  - Termiticides penetrate and increase cracking
Termiticides for New Construction in Fla

• Not all rates of termiticides worked for 5 years
• Florida rule required re-registration of all termite products
  – 8 products in 2002
• 75 termiticides registered in Florida (8/03/2010)
  – 67 (42 repellent, 25 non-repellent) soil treatment products
    • 27 bifenthrin
    • 22 imidacloprid
    • 6 permethrin
    • 8 cypermethrin
    • 2 fipronil
    • 1 lambda-cyhalothrin
    • 1 chlorfenapyr
    • 1 chlorantraniliprole
  – 5 termite baits
    • 3 Noviflumuron
    • 1 Hexaflumuron
    • 1 Diflubenzuron
  – 3 disodium octaborate tetrathionate for wood treatment

Non-Chemical Methods of Termite Protection for New Construction

Example
  – Termi-Mesh System
  • Local building officials may approve these essentially non-chemical methods

Termite protective devices can be installed on pipes passing through concrete or cinder block walls and floors.

Goal of a Soil Termiticide

• Protect the structure and its contents by killing or repelling termites
• In all common soil types
• At label rate
  – Rate is 4 gal per 10 linear feet of 6 inch wide trench per foot of depth
  – Or 1 gal per 10 sq ft
  – These translate into ? ppm or ? inches thickness of treatment for various soils
• For at least 5 years
  – Is there enough ppm left after 5 years of leaching, weathering, and disturbance?

How are termiticides tested?
(How do we know what we know)

• Laboratory
  – Topical application
  – Termite confinement on treated soil
  – Tube tests
  – Arena tests
Laboratory Techniques
Topical Application

- Place a known amount of insecticide on termite
- Hold termite for 1-3 days
- Count dead


Amount Needed to Kill 50% of treated EST workers

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>ug per g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlordane</td>
<td>20.10</td>
</tr>
<tr>
<td>Chlorpyrifos</td>
<td>1.74</td>
</tr>
<tr>
<td>Permethrin</td>
<td>0.62</td>
</tr>
<tr>
<td>Cypermethrin</td>
<td>0.13</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Laboratory Techniques
Tube Test

- Treat soil
- Place in tube (hold with agar plug)
- Hold for 7 days
- Measure penetration
- Count dead

Gahlhoff & Koehler 2001. Penetration of the eastern subterranean termite into soil treated at various thicknesses and concentrations of Dursban TC and Premise 75. J. Econ. Entomol 92: 1133-1137.

Laboratory Techniques
Termite Confinement on Treated Soil

- Treat soils of different types with various concentrations of termiticides
- Place in cup with termites
- Hold for appropriate time
- Count dead


Full Label Rate

- Repellent: Dragnet, Talstar
  - No penetration
  - 8-34% mortality
- Non-Repellent: Premise, Termidor, Phantom, Altriset
  - Penetration
  - 100% mortality for Dursban, Premise, and Termidor
LC-50 of Termiticides in Confined on Treated Soil

Laboratory Techniques

Arena Test

- Treat soil
- Place 5 cm treated band in arena
- Gaps
- Hold for 28 days
- Record days to find gap or 100% mortality

Tunneling of R. flavipes in arena treated with repellent termiticide
Pyrethroid - Talstar, FMC - Label Rate

Termite found gap in 3 days and survived indefinitely

Tunneling of R. flavipes in arena treated with repellent termiticide
Pyrethroid - Talstar, FMC - Label Rate

Premise 75 WP Low Label Rate (50 ppm)
Day 7 (100% mortality at 7 days)

Tunneling of R. flavipes in arena treated with non-repellent termiticide
Fipronil – Termidor 80 WG - Label Rate

1 day after release
4 days after release
100 % mortality
FDACS Requirements for Registration of Soil Applied Residual Treatments

- Requires
  - Field plot tests
- Methods
  - Gulfport tests
  - Tamashiro soil plug bioassay
  - Experimental house treatment

Soil Termiticide Mode of Action

1. Kills or repels termites
2. Protects wood from damage

Soil Applied Residual Treatments Performance Standards

Field plot tests

- Wood damage ratings by subterranean termites
  - 9 or higher (NO MORE THAN SURFACE SCARRING) on ASTM D1758-96 standard, or
  - = 1 on USDA Forest Service scale
  - in 90% of test samples
  - For a minimum of 5 years
- Wood protection in field plots meets the requirement that the product protects the structure and its contents

Gulfport Termiticide Testing Concrete Slab Procedure

- Wood damage rating = at least 9 ASTM rating for 5 years
- 5 feet
- 21 inches

Gulfport Tests

- ≥9 for ASTM wood damage
- In 90% of plots
- 5 years

Gulfport Tests with FL Standard Bifenthrin (Est. 1986)

- 0.062% concrete slab test
  - 16 years = Arizona
  - 21 years = Florida
  - 7 years = Mississippi
  - 16 years = South Carolina
- 0.125% concrete slab test
  - 15 years = Arizona
  - 21 years = Florida
  - 7 years = Mississippi
  - 21 years = South Carolina
- Control plots
  - 69% hits in Florida

2006 USDA report
Gulfport Tests with FL Standard Fipronil (Termidor 80) (Est. 1994)

- 0.06% concrete slab test
  - 13 years = Arizona
  - 13 years = Florida
  - 13 years = Mississippi
  - 13 years = South Carolina
- 0.125% concrete slab test
  - 13 years = Arizona
  - 13 years = Florida
  - 13 years = Mississippi
  - 13 years = South Carolina
- Control plots
  - 6-20% hits in Florida: KILLED TERMITES IN CONTROL PLOTS

Gulfport Tests with FL Standard Fipronil (Termidor SC) (Est. 1999)

- 0.06% concrete slab test
  - 8 years = Arizona
  - 7.5 years = Florida
  - 8 years = Mississippi
  - 8 years = South Carolina
- 0.125% concrete slab test
  - 8 years = Arizona
  - 8 years = Florida
  - 8 years = Mississippi
  - 8 years = South Carolina
- Control plots
  - 58% hits in Florida

Tamashiro Soil Plug Bioassay

- Test plots are cleared and a 26 inch square in the center is treated with termicide
- Plots are covered with a vapor barrier and the concrete slab is poured
- At set times after treatment, slab is drilled or lifted.
- Soil plugs are removed and a PVC spacer is put into ground
- In lab, plugs are placed in tube test bioassay


Leveling the site

Leveling form boards

Adding correct soil type
Treating the soil

Pouring concrete

Removing concrete form

Finished slab lifted for soil sampling

Taking core sample and evaluating termites control

Tube Bioassay of Soil Plugs

Concrete slab: 26 by 26 inches

Lift slab

Soil plugs removed
Penetration of Formosan termites into soil plugs weathered 24-33 yr

% Penetration

- 0.075% Dieldrin
- 0.5% Aldrin
- 1.0% Chlordane
- 1% Heptachlor
- 2% DDT
- Water

% Mortality of Formosan termites exposed to soil plugs from 1958 treatment

- Coral
- Clay
- Sandy loam

Distance EST penetrated into soil plugs in tube tests after 1 yr of aging

Distance (cm)

- 1% Dursban
- 0.031% Biflex
- 0.3% Prevail
- 0.5% Demon
- 0.5% Dragnet

% Mortality of EST in Soil Plug Tests after 1 yr of Aging

- Control
- 1% Dursban
- 0.031% Biflex
- 0.3% Prevail
- 0.5% Demon
- 0.5% Dragnet


Experimental House Treatment

- Infested houses
- Pest control company
- Inspection at various intervals after treatment

House Treated with Experimental Termiticide
Subterranean termite infestation

Treat the House

Corner infestation (3 months after treatment)

Corner infestation (6 months after treatment)

Summary of Soil Termiticide Evaluation Techniques

• Laboratory
  – Topical application
  – Termite confinement on treated soil
  – Tube tests
  – Arena tests
• Field
  – Gulfport tests ** 2 star rating
  – Tamashiro soil plug bioassay ***** 5 star rating
  – Experimental house treatment **** 4 star rating

Stand-Alone Bait Systems

• Requires both
  – Field plot tests
  – Building tests
**Bait System Mode of Action**

1. **Kills termites**
2. **Reduces termite numbers and consumption in monitor**
3. **Protects wood from damage**

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**Stand-Alone Bait Systems Performance Standards**

**Field plot tests**
- Baited termite population reduced by
  - at least 50% in wood consumption or termite numbers
  - in 75% of baited populations
  - within 12 months of initiation of feeding on bait active ingredient
- Reductions maintained for at least 6 months

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**Field plot bait test**

50% reduction in termites or food consumption in independent monitors within 12 months and maintained for 6 months

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**Stand-Alone Bait Systems Performance Standards**

**Building tests with existing infestations**
- **Independent monitors**
  - At least 90% reduction in termite activity
  - Within 12 months of initiation of feeding on bait active ingredient, and
- **Building monitoring**
  - Cessation of live termite activity
  - In at least 90% of test buildings
  - Within 12 months after initiation of feeding on the formulated bait
- **Reinfestation of Buildings**
  - Visual inspection – No reinfestation within 2 years
  - Research and visual inspection – no reinfestation within 1 year

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**Results of a Sentricon test**

*Formosan subterranean termite colony containing 3.9 million foragers eliminated in 3 months*

Standard: 90% reduction of termite activity in independent monitors within 12 months
- Cessation of termite activity in structure within 12 months
- Control maintained for 1-2 years

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**Pesticides Applied to Wood**

- Requires both
  - Field plot tests
  - Building tests
Wood Treatment Mode of Action

- 1. Kills or repels termites
- 2. Protects wood from damage

Untreated Wood
Treated Wood

Pesticides Applied to Wood
Performance Standards

- **Field plot tests**
  - Subterranean termite damage to wood
    - 9 or higher (no more than surface scarring) on ASTM D1758-96 standard, or
    - = 1 on USDA Forest Service scale
    - for 90% of test samples
    - For a minimum of 5 years

- **Building tests**
  - No infestation in at least 90% of buildings within 5 years of the treatment

House as Poisonous Bait?

Can we do better?
The objective is to prevent termites from eating the house;
NOT necessarily, kill the termites.
But that can be good!

Southeast Pest Management Conference

Reserve the dates
SEPMC 2012
May 6-9, 2012