PREVENTOL® TM Preservative Insecticide for EPS Foam

LANXESS Corporation

Cyndi Fink
Marketing & Sales Representative
Material Protection Products

Pittsburgh, PA 15275

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History of EPS Foam and Termites

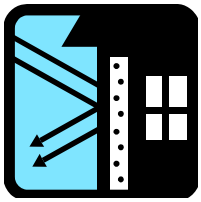
1970s

– EPS emerges as an efficient and cost-effective insulation material

1980s – Present

– Use of EPS insulation grows rapidly

– Green building trend, energy conservation



Early 1990s

– Contractors and Pest Control Operators notice termite damage to EPS installed in below-ground applications

– Loss of insulation integrity

– Inability to inspect structures for termites

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History Continued

1993

- National Pest Control Association
- Guidelines that member companies do not accept or warrantee pest control jobs on structures containing foam insulation

1996

- Southern Building Code Congress International
- Imposes restrictions on use of foam insulation
- Recommends changes to Standard Building Code (Southern states)

1998 - 2000

- Changes to building code implemented for foam plastic protection against termites
- 1998 International One- and Two-Family Dwelling Code (I1&2)
  2000 International Building Code (IBC)
  2000 International Residential Code (IRC)

2003

- Four “legacy” building code evaluation services merge to form ICC-ES

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Termites in Foam Insulation

Why do termites tunnel through foam?

- Foam contains no nutritional value
- Insects build tunnels through foam to access food sources and for shelter
- Foam protects insects and allows them to access food undetected

How do tunnels affect foam?

- Tunnels reduce insulating value
- Termite excretions affect strength of foam
- Damage to foam positively correlated to damage to wooden parts of the structure

Detection and treatment

- Most infestations occur at or below grade
- Difficult to detect infestation until significant damage to structure has occurred
- Treating structures containing foam difficult

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Current Restrictions on Foam Insulation in Building Codes

No restrictions for foam used for:

- Above ground applications
- Regions of “heavy” to “slight” termite infestations
- Non-structrual applications (geofoam)

Foam can not be used in areas of “very heavy” termite infestation at or below grade

Exceptions in “very heavy” areas

- Buildings where structural members are made from non-combustible material or pressure treated wood
- Foam plastic is installed in the interior side of walls
- A method of protecting the foam is provided

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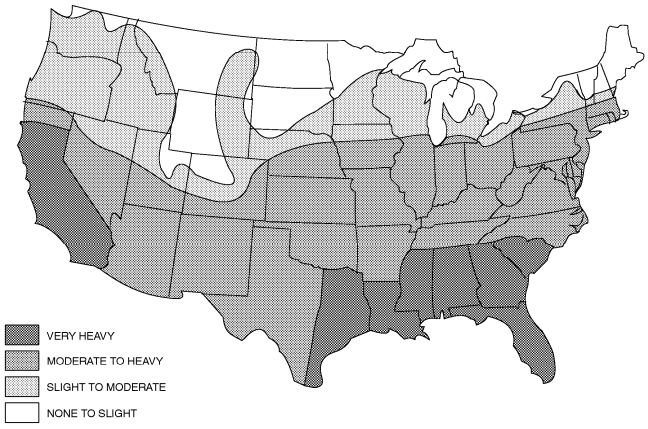
ICC Termite Infestation Map



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ICC-ES Criteria for Foam Testing

ICC-ES AC 239: Acceptance Criteria for Termite-Resistant Plastics

- Compliance necessary for use of foam below-ground in “very heavy” termite areas
- Requires one laboratory test plus one 3-year field test in a “very heavy” infestation area to determine efficacy of treatment method OR two 3-year field tests in “very heavy” termite infestation areas
- Testing based on modified American Wood Protection Association methods

Above-grade and below-grade in “heavy” to “slight” regions

- AC 239 compliance not required
- Still susceptible to termite invasion
- Termite control responsibility of contractor and/or property owner
- Treated foam often specified
- Expansion of native and exotic termite species

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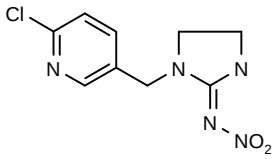
PREVENTOL® TM Preservative Insecticide (imidacloprid)*



Organic molecule with proven track record

- 98% active ingredient, powder
- EPA registered by LANXESS Corporation
- Neonicotinyl class of pesticides
- Successfully used for long term protection of wood against damage by termites and other wood boring insects
- This molecule is also used in the pest control industry, for crop protection, and as a topical flea and tick control treatment for pets under various tradenames (not affiliated with LANXESS Corporation)

Mode of Action

- Systemic insecticide which acts on the insect’s nervous system
- Kills the insect instead of merely repelling it

* *As with any product, use of PREVENTOL® TM Preservative Insecticide in a given application must be tested (including field testing, etc.) by the user in advance to determine suitability*

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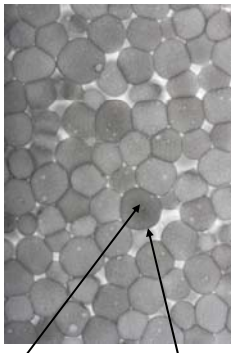
PREVENTOL® TM Preservative Insecticide for EPS

PREVENTOL® TM Preservative Insecticide is blended with pre-expanded polystyrene beads

- Easy to incorporate or meter into any system
- Application rate between 100 – 500 ppm (w/v)
- Added prior to or during expansion process

PREVENTOL® TM Preservative Insecticide coats the individual EPS beads

- Does not interfere with the bonding process between beads
- Surrounds each bead with a barrier of protection
- Insecticide is not wasted by incorporating it throughout the EPS bead



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Safety and Handling Guidelines for PREVENTOL® TM Preservative Insecticide

Safety & Handling

- PREVENTOL® TM Preservative Insecticide used at low concentrations
- Imidacloprid rated in EPA's 1986 Carcinogen Risk Assessment Guidelines as group "E"
  - Evidence of non-carcinogenicity for humans: Shows no evidence for carcinogenicity in at least two adequate animal tests in different species or in both adequate epidemiologic and animal studies
- Treated foam safe to handle by manufacturers and installers
- Treated foam requires no special labeling
- Foam is considered a treated article, no additional claims are made

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PREVENTOL® TM Preservative Insecticide Properties*

- pH neutral, stable up to pH 9
- Non-corrosive, non-abrasive
- Low water solubility, low leach rate, low volatility
- Used at low concentrations (100 – 500 ppm)
- Will not damage expansion vessels, clog mold plates, or harm cutting wires
- Organic molecule, retained in organic polystyrene matrix
- Evenly distributed throughout the polystyrene matrix
- Systemic insecticide
- Easy to incorporate into EPS manufacturing process
- Can be incorporated into other building products for systems approach to building protection

* *These items are provided as general information only. They are approximate values and are not considered part of the product specification.*

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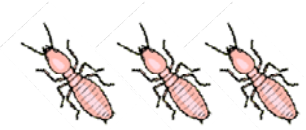
Efficacy Testing
Single-choice laboratory test blocks



AWPA E1 *Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites*

No-choice test

Rated on AWPA E1 scale (0 = failure, 10 = sound)

Focus termite species:

- *Reticultermes flavipes* (native subterranean termite)
- *Coptotermes formosanus* (Formosan termite)

Treatments included:

- EPS with PREVENTOL® TM Preservative Insecticide at 3 concentrations
- Untreated EPS control
- Copper azole treated wood control (standard above ground concentration)
- Untreated wood control

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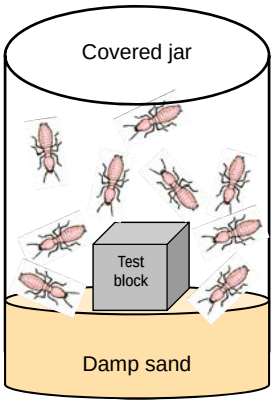
AWPA E1
Single-choice test



Single-choice test

- 400 termites added to each jar
- Test continues for four weeks
- Useful for determining the toxicity of material to termites
- Determine if material is sufficiently effective to prevent termite feeding, even when no other choices are available

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Laboratory Test Block Results
R. flavipes

Matrix	Treatment	Concentration	Termite damage rating (average of 10 repliates)
EPS	None	0 ppm	7.4 Moderate attack, penetration
EPS	PREVENTOL® TM Preservative Insecticide	60 ppm	9 Light attack
EPS	PREVENTOL® TM Preservative Insecticide	300 ppm	9.1 Light attack
EPS	PREVENTOL® TM Preservative Insecticide	600 ppm	9.2 Light attack
Wood (SYP)	None	0 ppm	2.8 Heavy attack/failure
Wood (SYP)	Copper azole	0.108 pcf	9 Light attack

AWPA Termite Rating System
10 = sound
9 = Slight attack, up to 3% of cross sectional area affected
7 = Moderate to severe attack, penetration, 10 – 30% of cross sectional area affected
4 = Very severe attack, 50 – 75% of cross sectional area affected
0 = Failure

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Laboratory Test Block Results
C. formosanus

Matrix	Treatment	Concentration	Termite damage rating (average of 10 replicates)
EPS	None	0 ppm	4 Heavy attack
EPS	PREVENTOL® TM Preservative Insecticide	60 ppm	8.4 Light to moderate attack
EPS	PREVENTOL® TM Preservative Insecticide	300 ppm	10 Sound
EPS	PREVENTOL® TM Preservative Insecticide	600 ppm	10 Sound
Wood (SYP)	None	0 ppm	0.4 Failure
Wood (SYP)	Copper azole	0.108 pcf	9 Light attack

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Conclusions
AWPA E1 Single-choice test

PREVENTOL® TM Preservative Insecticide provides an effective method for protection of EPS foam

Concentrations between 300 – 600 ppm are effective against both native *R. flavipes* and the more voracious *C. formosanus*

– *C. formosanus* now considered a severe threat to the southern U.S.

Untreated foam was penetrated by both termite species, resulting in moderate to severe attack

Untreated wood controls show heavy attack to failure

Insect mortality complete in most test units due to effects of insecticide and/or lack of food over four week test period

Fulfills requirements in ICC-ES AC239, *Acceptance Criteria for Foam Resistant Plastics*

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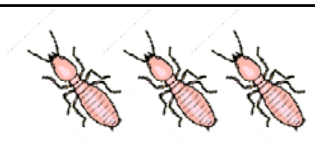
Efficacy Testing
Two-choice laboratory test blocks



AWPA E1 *Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites*

Two-choice test using EPS foam and wood controls

Rated on AWPA E1 scale (0 = failure, 10 = sound)

Focus termite species:

- *Reticultermes flavipes* (native subterranean termite)

Treatments included:

- Untreated EPS
- EPS with PREVENTOL® TM Preservative Insecticide
- Wood treated with CCA
- Untreated wood

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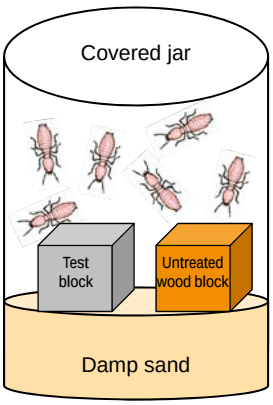
AWPA E1
Two-choice test



Two-choice test

- 400 termites added to each jar
- Test continues for four weeks
- Useful to determine if toxic material is effective when other choices are available
- Determine if toxicity is sufficient to deter termites when food source is not limited to a single toxic material
- Good test to mimic field situations where other material is available

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Results
Two-choice laboratory test blocks

Matrix	Treatment	Concentration (% w/v)	Termite damage rating (test block)	Termite damage rating (untreated wood control block)	Termite survival
Wood (SYP)	None	0 ppm	4.4 Heavy attack	4.8 Heavy attack	85%
Wood (SYP)	CCA	0.22 pcf	9.0 Light attack	2.5 Moderate attack	40%
EPS	None	0 ppm	3.4 Heavy attack	2.0 Heavy attack	85%
EPS	PREVENTOL® TM Preservative Insecticide	860 ppm	9.0 Light attack	9.0 Light attack	0%

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0 = Failure

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Results
Two-choice laboratory test block EPS Comparison

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Results
Two-choice laboratory test blocks

Untreated EPS and wood control

PREVENTOL® TM treated EPS and wood control

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Conclusions
Two-choice laboratory test blocks

PREVENTOL® TM Preservative Insecticide EPS blocks were barely attacked

PREVENTOL® TM Preservative Insecticide EPS blocks caused 100% mortality of termites

Wood in same test unit as treated EPS block only lightly attacked

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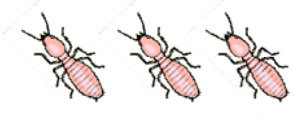
Efficacy Testing
Field stakes



AWPA E7 *Standard Method of Evaluating Wood Preservatives by Field Test with Stakes*

Test site in Gainsville, Florida

- "Very heavy" termite area, as defined by the Building Code

Three year test to determine efficacy of EPS treated with PREVENTOL® TM Preservative Insecticide

Rated on AWPA E1 scale (0 = failure, 10 = sound)

Focus termite species:

- *Reticultermes flavipes* (native subterranean termite)

Treatments included:

- EPS with PREVENTOL® TM Preservative Insecticide
- ACQ treated wood control
- Untreated wood control

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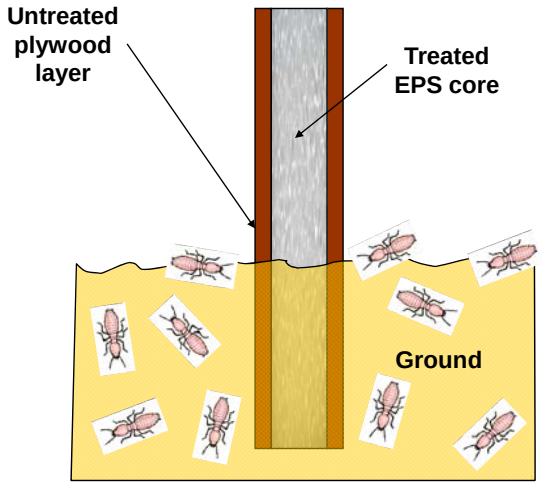
Field test assembly
Modified AWPA E7 method for EPS foam



"SIP-type" assembly, EPS exposed on two sides

EPS / plywood assemblies partially buried below ground for three year period

Assemblies evaluated for termite damage once per year for three years

AWPA termite ratings determined for both EPS and plywood buried below ground

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Gainsville, Florida
Field Stake Test Site

SIP-type Field Stakes

Three Year Field Stake Results

Matrix	Treatment	Concentration	Termite damage rating EPS core*	Termite damage rating Wood*
EPS	PREVENTOL® TM Preservative Insecticide	500 ppm	9.4	6.8
EPS	None	0 ppm	9.0	5.5
Wood	None	0 ppm	---	4.7
Wood	ACQ	6.4 kg/m^3	---	10

*Average of 15 replicates

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Conclusions
AWPA E7 three year field test

PREVENTOL® TM Preservative Insecticide provides an effective method for protection of EPS foam

EPS foam protected from native *R. flavipes* after three years of exposed below-ground exposure

Untreated wood controls show heavy attack after three years, indicating heavy termite pressure at the field site

Fulfills requirements in ICC-ES AC239, *Acceptance Criteria for Foam Resistant Plastics*

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PREVENTOL® TM Preservative Insecticide in EPS Summary

- Foam insulation market shows steady growth
- Building Code and customer requirements mandate protection of EPS from termite and other insect damage
- Easy to use, safe, organic molecule
- Non-abrasive, non-corrosive, pH neutral, low water solubility
- Effective at low concentrations
- Proven track record for wood protection, pest control, agriculture
- EPA registered by LANXESS for use in wood, plastics and textiles
- Highly effective systemic insecticide
- Effectiveness against termites demonstrated in lab and field testing of EPS and wood
- AC 239 testing completed

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