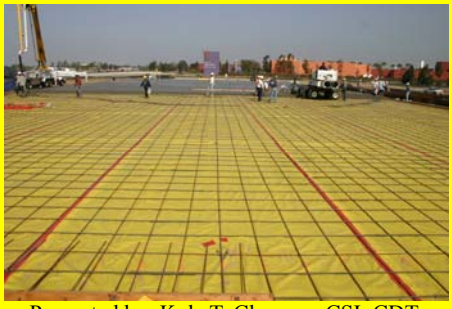
Below-Slab Moisture Protection



Presented by: Kyle T. Clemens, CSI, CDT

AIA / CES

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Seminar Overview

- Problem:
  - Industry Changes—Floor Failure & Mold Liability
- Cause:
  - Science of Moisture Migration
- Solution:
  - Comparing Vapor Barriers & Retarders
  - ASTM Standards & ACI Recommendations
  - Installation Procedures

Vapor Barrier Specification

Section 03300 or 07260

A. Vapor Barrier
1. Vapor Barrier must have all of the following qualities:
a. ASTM E 1745 Class A
b. Maintain permeance of less than 0.01 Perms [grains/(ft^2 *hr * in.Hg)] after mandatory conditioning tests per ASTM E 1745 (7.1.1 – 7.1.5)

Visqueen (poly) Breaks Down Over Time…

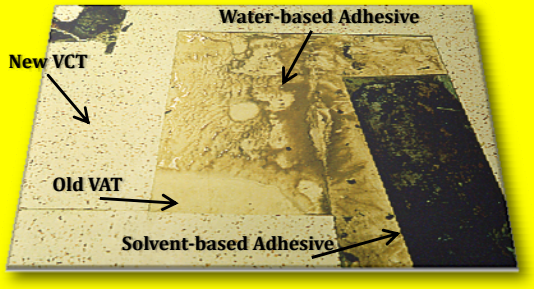
- Visqueen/Poly is composed of 85-100% reprocessed and reground material
- Recycled products lack protective anti-oxidants found in products made from virgin plastic resins

What constitutes "Moisture-Sensitive"?

- **American Concrete Institute – ACI 302.2R**
  - Sheet Rubber
  - Epoxy Coatings
  - Vinyl Composition Tile (VCT)
  - Sheet Vinyl
  - Carpet
  - Athletic Flooring
  - Laminates
  - Hardwood

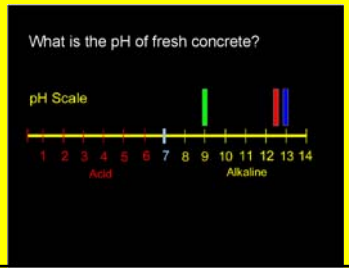
Cause and Effect:
Modern Floor Covering Failures

Water-based Adhesive vs. Solvent-based Adhesive

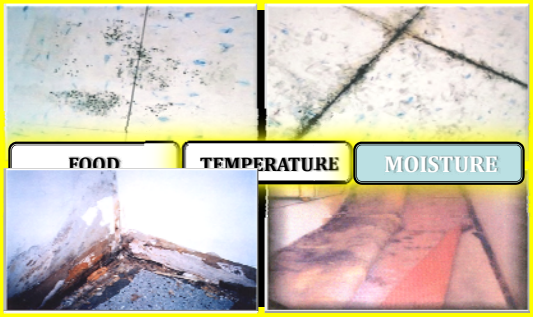


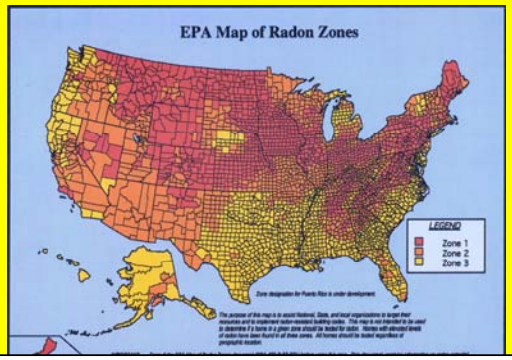
Cause and Effect:
Modern Floor Covering Failures

- EPA Regulation Change - Restricting Solvent Based Adhesion
- Modern Floor Coverings - Max pH for Water Based Adhesion



Mold & Floor Coverings





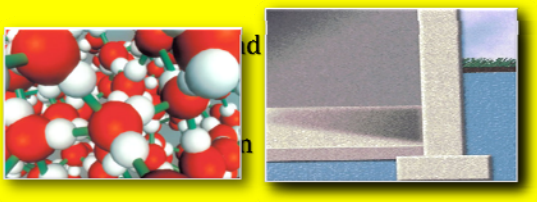
Zone 1 - Highest Potential - Predicted average indoor radon screening level greater than 4 pCi/L (pico curies/liter)
Zone 2 - Moderate Potential - Predicted average indoor radon screening level between 2 and 4 pCi/L
Zone 3 - Low Potential - Predicted average indoor radon screening level less than 2 pCi/L

Seminar Overview

- Problem:
  - Industry Changes—Failure & Liability
- **Cause:**
  - **Science of Moisture Migration**
- Solution:
  - Comparing Vapor Barriers & Retarders
  - Standards & Recommendations
  - Installation Procedures

Cause and Effect: Modern Moisture Problems

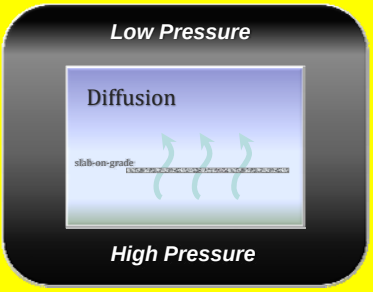
Liquid Water vs. Water Vapor



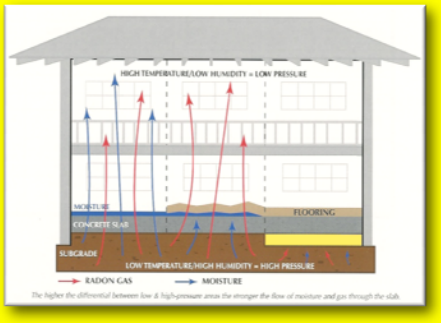
Liquid water is NOT the issue

Cause and Effect: Modern Moisture Problems

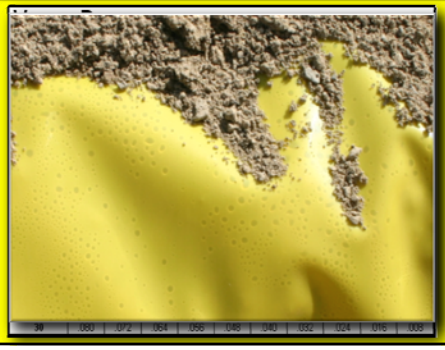
Liquid Water vs. **Water Vapor**



Cause and Effect: Modern Moisture Problems



Cause and Effect: Modern Moisture Problems



Questions?

Seminar Overview

- Problem:
  - Industry Changes—Failure & Liability
- Cause:
  - Science of Moisture Migration
- **Solution:**
  - **Comparing Vapor Barriers & Retarders**
  - **Standards & Recommendations**
  - **Installation Procedures**

Vapor Retarders vs. Vapor Barriers

- What is Permeance?

- Permeance ≈ 1.0 Waterproofing
  - 50 Gallons through 50,000 ft^2 in 1 week
- Permeance < or = 0.1 Vapor Retarder
  - 6 Gallons through 50,000 ft^2 in 1 week
- Permeance < or = 0.01 Vapor Barrier
  - Less than 1 Gallon through 50,000 ft^2 in 1 week

Performance Standard

ASTM E 1745

E 1745 – 09

TABLE 1 Properties for Specified Performance Classes*

	Class A		Class B		Class C	
	IP Units	SI Units	IP Units	SI Units	IP Units	SI Units
Water vapor permeance (Test Methods E 154, Section 7, or Test Method F 1249), max	0.1 perms (0.1 gr/(h·ft²·in.·Hg))	(6 ng/(s·m²·Pa))	0.1 perms (0.1 gr/(h·ft²·in·Hg))	(6 ng/(s·m²·Pa))	0.1 perms (0.1 gr/(h·ft²·in.·Hg))	(6 ng/(s·m²·Pa))
Tensile strength (Test Methods E 154, Section 9,[A] min	45.0 lbf/in.	7.9 kN/m	30.0 lbf/in.	5.3 kN/m	13.6 lbf/in.	2.4 kN/m
Puncture resistance (Test Methods D 1709, Test Method B), min	no inch-pound equivalent used	2200 g	no inch-pound equivalent used	1700 g	no inch-pound equivalent used	475 g

BENEFITS	DRAWBACKS
• Uniformity of testing	• Uniform Water Vapor Permeance
• Rigorous Conditioning Tests	• No class distinction
• ASTM E 154 Sections 8,11,12,13	
• Simulate under-slab conditions	

What do we know about 0.1?

- **Permeance < or = 0.1 *Vapor Retarder***
  - **6 Gallons through 50,000 ft² in 1 week**
- Permeance < or = 0.01 Vapor Barrier
  - Less than 1 Gallon through 50,000 ft² in 1 week

Where do we want to be?

- Permeance < or = 0.1 Vapor Retarder
  - 6 Gallons through 50,000 ft² in 1 week
- **Permeance < or = 0.01 *Vapor Barrier***
  - **< 1 Gallon through 50,000 ft² in 1 week**

CURRENT STANDARDS

ASTM E 154

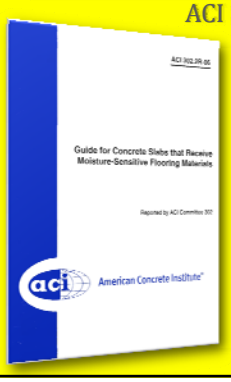
Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs

- **Section 8**
  Water-Vapor Transmission after Wetting and Drying and after Long-Time Soaking
- **Section 11**
  Resistance to Plastic Flow and Elevated Temperature
- **Section 12**
  Effect of Low Temperature on Bending
- **Section 13**
  Resistance to Deterioration from Organisms and Substances in Contacting Soil

Performance characteristics must be maintained ***after*** conditioning! Permeance = **0.01 or less**

EXPERT RECOMMENDATIONS

ACI 302.2R-06



"Any material used as a below-slab vapor retarder/barrier, should conform to the requirements of ASTM E 1745"

"It should be determined whether a vapor retarder with a 0.3 perm rating (passes 0.5 lb./1000 ft2/24h) is sufficient protection for the flooring material to be installed. If not, a vapor barrier with a perm rating of 0.01 perms or less (passes 0.02 lb./1000 ft2/24h) should be specified."

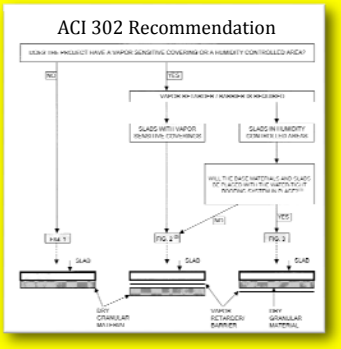
"Clearly, there is a substantial difference in water vapor transmission through a vapor retarder meeting the allowable ASTM E 1745 specification requirement of 0.3 perms and through a product with a maximum perm rating of 0.01 perms."

WHERE TO PLACE THE VAPOR BARRIER?

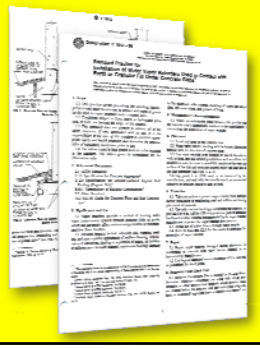
ACI 302

VS.

ACI 302 Recommendation



ASTM E 1643
Installation Standard



- Compact ground
- Unroll material parallel to pour
- Overlap edges 6 inches
- Apply manufacturers tape to seems
- Address all pipe penetrations / repair damaged areas
- Create monolithic membrane

Installation Principles
Compact Ground

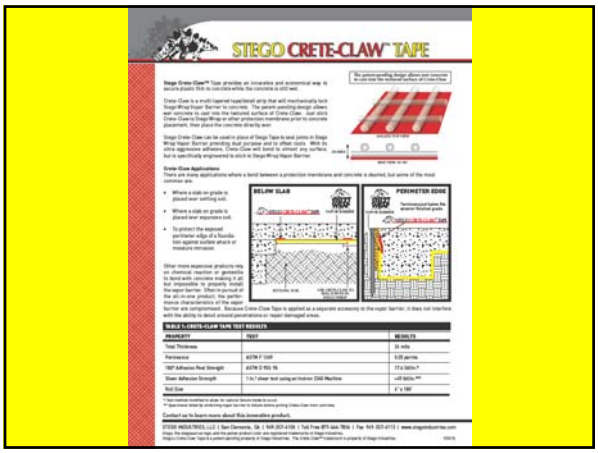
Installation Principles
Unroll the Vapor Barrier

Installation Principles

6 Inch Overlap

Installation Principles

Manufacturer's Tape



STEGO CRETE-CLAW™ TAPE

Stego Crete-Claw™ Tape provides an innovative and economical way to secure plastic film to concrete while the concrete is still wet.

Crete-Claw is a multi-layered topsheet strip that will mechanically lock Stego Wrap Vapor Barrier to concrete. The patent-pending design allows wet concrete to seal into the textured surface of Crete-Claw. Just stick Crete-Claw to one of the other products or membranes prior to concrete placement, then place the concrete directly over.

Stego Crete-Claw can be used in place of Stego Tape to seal joints in Stego Wrap Vapor Barrier, providing dual purpose and to offset costs. With its ultra aggressive adhesive, Crete-Claw will bond to almost any surface, but is specifically engineered to stick to Stego Wrap Vapor Barrier.

Crete-Claw Applications

There are many applications where a bond between a protection membrane and concrete is desired, but some of the most common are:

- Where a slab on grade is placed over earthing soil.
- Where a slab on grade is placed over expansive soil.
- To protect the exposed perimeter edge of a foundation against subterranean attack or moisture intrusion.

Other more expensive products rely on chemical reaction or geotextile to bond with concrete making it all but impossible to properly install the vapor barrier. Often in pursuit of the all-in-one product, the performance characteristics of the vapor barrier are compromised. Instead, Crete-Claw Tape is applied as a separate accessory to the vapor barrier. It does not interfere with the ability to detail around penetrations or repair damaged areas.

BELOW SLAB

PERIMETER EDGE

BUILT-N-CRETE-CLAW TAPE TEST RESULTS

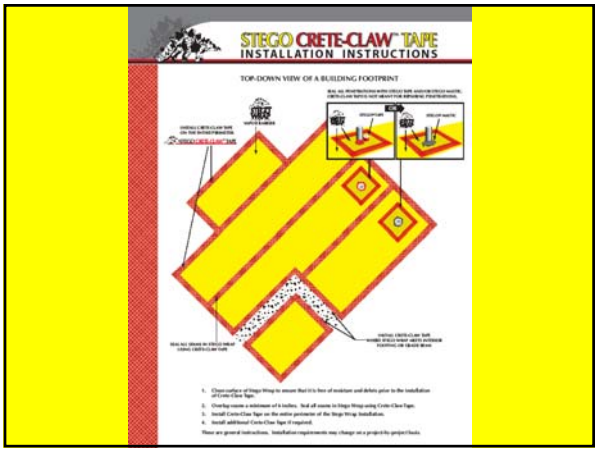
PROPERTY	TEST	RESULTS
Total Thickness		24 mils
Permeance	ASTM E 1249	0.05 perm
180° Adhesion Peel Strength	ASTM D 903-98	17 pli (60 N/*
Shear Adhesion Strength	1 in.² shear test using an Instron 3345 Machine	>40 lbf/in.***
Roll Size		4" x 180'

* Foam mastic modified to allow for natural failure mode to occur.
** Specimens failed by stretching vapor barrier to failure before peeling Crete-Claw from concrete.

Contact us to learn more about this innovative product.

STEGO INDUSTRIES, LLC | San Clemente, CA | 949.257.4130 | Toll Free (877-464-7834) | Fax 949.257.4112 | www.stegoindustries.com

Stego, the dinosaur logo and the patent product icons are registered trademarks of Stego Industries.
Stego's Crete-Claw Tape is a patent pending property of Stego Industries. The Crete-Claw™ trademark is property of Stego Industries. 03/10



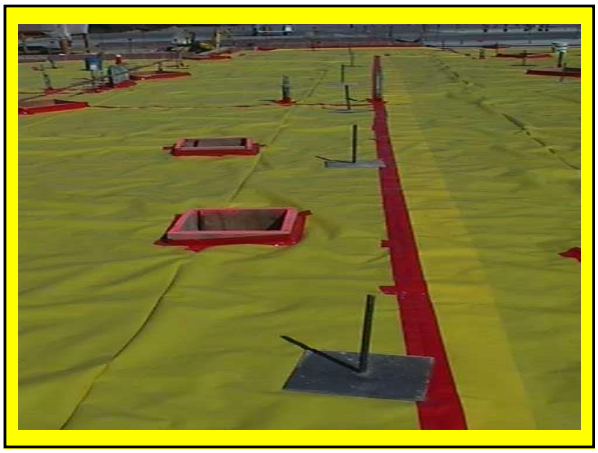
STEGO CRETE-CLAW™ TAPE
INSTALLATION INSTRUCTIONS

TOP-DOWN VIEW OF A BUILDING FOOTPRINT

1. Clean surface of Stego Wrap to ensure that it is free of moisture and debris prior to the installation of Crete-Claw Tape.
2. Overlap seams a minimum of 6 inches. Seal all seams in Stego Wrap using Crete-Claw Tape.
3. Install Crete-Claw Tape on the entire perimeter of the Stego Wrap Installation.
4. Install additional Crete-Claw Tape if required.

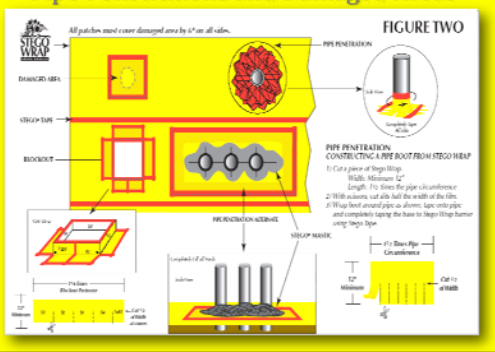
These are general instructions. Installation requirements may change on a project-by-project basis.

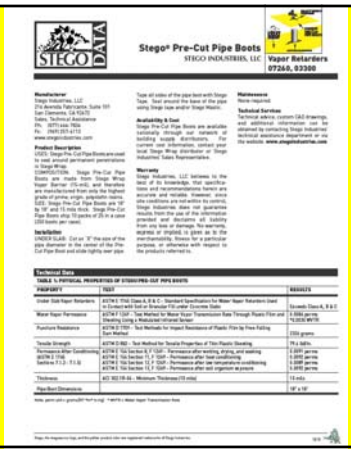

Punctured 6 mil poly



Installation Principles

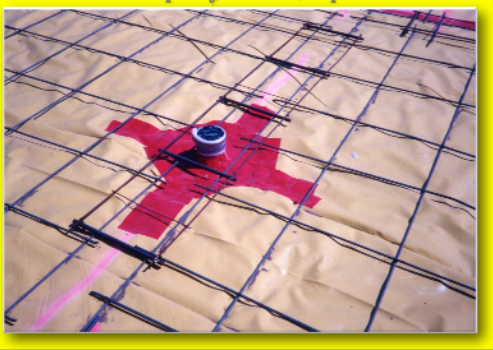
Pipe Penetrations and Damaged Areas





Installation Principles

Properly Sealed Pipe

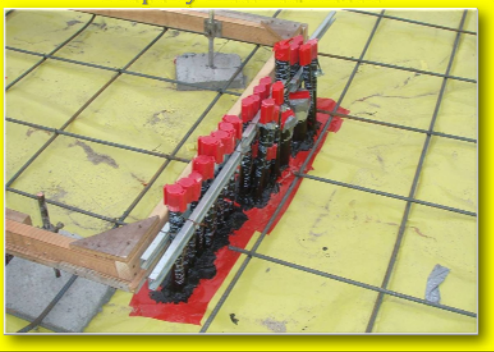


Installation Principles

Mastic

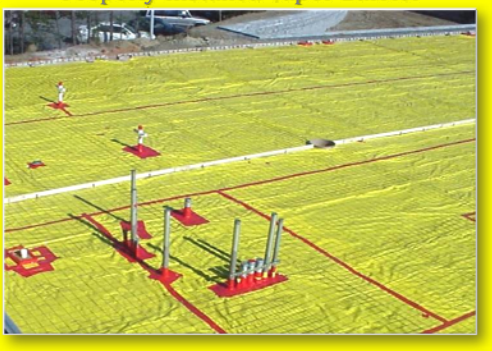
Installation Principles

Properly Installed Mastic



Installation Principles

Properly Installed Vapor Barrier



How to Specify a Vapor Barrier?

1. ASTM E 1745 Class A
   Puncture Resistance
   Tensile Strength
2. Add barrier permeance requirement of less than .01 perms
3. Barrier must maintain permeance of less than .01 perms after mandatory conditioning tests

Specify Performance Not Just "Barrier"

Stego Wrap Vapor Barrier Specification

Section 03300 or 07260

A. Vapor Barrier
   1. Vapor Barrier must have all of the following qualities:
      a. ASTM E 1745 Class A
      b. Maintain permeance of less than 0.01 Perms [grains/(ft^2 *hr * in.Hg)] after mandatory conditioning tests per ASTM E 1745 (7.1.1 – 7.1.5)
   2. Vapor Barrier Products
      a. Stego Wrap (15 mil) Vapor Barrier by STEGO INDUSTRIES LLC, (877) 464-7834 www.stegoindustries.com

Below-Slab Vapor Barrier University Study

Kyle Clemens, CSI, CDT

Foundations – 1999 - 2007

- 1999
  - 1st Company w/ High-Performance Polyolefin Vapor Retarder
- 2002
  - 1st Company w/ Polyolefin Vapor Barrier
- 2007
  - Market floods w/ Barrier-Level Products

Foundations – 2008

- 2008
  - Stego's In-House Audit
    - Results: Most products tested much worse than literature claims
  - Double Checking the In-House Audit
    - Our testing was confirmed

Foundations – 2009

- 2009
  - How to proceed?
    - Pursue legal action?
    - Caution design professionals directly?
    - Below-Slab Vapor Barrier Industry University Study

University Study Preparation – Clemson University

- Dr. Kay Cooksey, Ph.D
  - Chair – Packaging Science Department
- Relationship w/ Professional 3rd Party Testing Lab
  - Mocon
    - Inventor of the technology
    - Inventor of permeation testing equipment for ASTM F 1249

University Study Preparation – Obtaining Anonymity

- Anonymous Contact Info
  - Name: Mike Joseph Smith
  - Email: Blocked Gmail Account
  - Phone Number: Blocked
- Funding
  - Cashiers checks from individuals not employed by Stego Industries
  - Checks sent from various locations around the U.S.

The University Study

- Product Selection
  - Mike Joseph Smith contributes the list
- Obtaining the Products
  - No mention of testing or Clemson's involvement
  - Product purchased from local distributors or directly from manufacturer
- Testing
  - Products are sent to Mocon without:
    - Manufacturer/Product Names
    - Industry Affiliation
- Dr Cooksey releases her report
  - I'm leaving a copy today…

University Study Results – Stated in Literature

Manufacturer & Product Name	Stated
Layfield Vaporflex	0.020
[illegible]	[illegible]
Stego Wrap Vapor Barrier	0.0084
[illegible]	[illegible]
Reef Griffolyn G15	0.018
[illegible]	[illegible]
Tpro Eco shield E 15	0.009
[illegible]	[illegible]
Insulation Solutions Viper Vapor Check II 15 mil	0.0067
[illegible]	[illegible]
Insulation Solutions Viper Vapor Check II 15 mil	0.0043
[illegible]	[illegible]
Barrier Bac VB 350	0.0090
[illegible]	[illegible]
W.R. Meadows Perminator 10 mil	0.0043
[illegible]	[illegible]
Insulation Solutions Viper Vapor Check 16 mil	0.0015
[illegible]	[illegible]

University Study Results – Dates Procured

Manufacturer & Product Name	Stated	Procured
Layfield Vaporflex	0.020	11-2010
[illegible]	[illegible]	[illegible]
Stego Wrap Vapor Barrier	0.0084	12-2009
[illegible]	[illegible]	[illegible]
Reef Griffolyn G15	0.018	11-2010
[illegible]	[illegible]	[illegible]
Tpro Eco-shield E 15	0.009	11-2009
[illegible]	[illegible]	[illegible]
Insulation Solutions Viper Vapor Check II 15 mil	0.0067	9-2009
[illegible]	[illegible]	[illegible]
Insulation Solutions Viper Vapor Check II 15 mil	0.0043	11-2010
[illegible]	[illegible]	[illegible]
Barrier Bac VB 350	0.0090	10-2009
[illegible]	[illegible]	[illegible]
W.R. Meadows Perminator 10 mil	0.0043	2 2010
[illegible]	[illegible]	[illegible]
Insulation Solutions Viper Vapor Check 16 mil	0.0015	9 2009
[illegible]	[illegible]	[illegible]

University Study Results – Understanding the Numbers

Manufacturer & Product Name	Stated	Tested	Processed	% off
Layfield Vaporflex	0.020	0.0133	11 2010	Better
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Stego Wrap Vapor Barrier	0.0004	0.0082	12-2009	Same
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Reef Griffolyn G15	0.016	0.0182	11 2010	Same
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Epro Eco-shield E 15	0.009	0.0155	11-2009	72%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Insulation Solutions Viper Vapor Check II 15 mil	0.0067	0.0137	9 2009	104%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Insulation Solutions Viper Vapor Check II 15 mil	0.0043	0.0170	11 2010	295%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Barrier Bac VR 360	0.0080	0.0408	10 2009	347%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
W.R. Meadows Perminator 10 mil	0.0043	0.0201	8-2010	367%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Insulation Solutions Viper Vapor Check 16 mil	0.0015	0.0343	9-2009	2187%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

For More Information. . .

- www.vaporbarrierpermeancestudy.com