



Report Number: 0165

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## DIVISION: 07—THERMAL AND MOISTURE PROTECTION

### Section: 07210—Building Insulation

#### REPORT HOLDER:

ICYNENE INC.

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#### EVALUATION SUBJECT:

LD-C-50™ and LD-R-50™

Spray Foam Insulation and Air Barrier

### 1.0 EVALUATION SCOPE

#### 1.1 Compliance with the following codes:

- 2006 International Building Code® (IBC)
- 2006 International Residential Code® (IRC)
- 2006 International Energy Conservation Code® (IECC)

#### 1.2 Evaluated in accordance with:

- ICC AC 377 Dated July 2009

#### Property evaluated:

- Surface burning characteristics
- Thermal performance (R-value)
- Physical properties
- Air Infiltration
- Fungal Resistance

### 2.0 USES

Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation is spray-applied, semi-rigid, low-density, cellular polyurethane foam plastic that is installed as a nonstructural component of floor/ceiling and wall assemblies.

### 3.0 DESCRIPTION

#### 3.1 Product Information:

**3.1.1** Icynene LD-C-50™ and LD-R-50™ is a two-component, open cell spray-applied semi-rigid polyurethane foam plastic insulation system, fully water blown with a density of 0.42 – 0.55 lbs/ft<sup>2</sup> (6.7 – 8.8 kg/m<sup>2</sup>). The polyurethane foam is produced by combining a polymeric isocyanate (A) and a resin (B). By-products of the reaction include carbon dioxide and steam which act together as a blowing agent.

#### 3.2 Surface Burning Characteristics

**3.2.1** The Icynene LD-C-50™ and LD-R-50™, at a thickness of 5 inches (152 mm) and a density of 0.42 – 0.55 lbs/ft<sup>2</sup> (6.7 – 8.8 kg/m<sup>2</sup>) has a flame spread index of less than 25 and a smoke developed index of less than 450 when tested in accordance with ASTM E84.

#### 3.3 Thermal Resistance, R-Values

**3.3.1** The Icynene LD-C-50™ and LD-R-50™ has a thermal transmission (R-Value) of 3.7 ft<sup>2</sup>-h-°F/Btu (0.80 m<sup>2</sup>-K/W) at a 1-inch (25.4 mm) thickness and a density of 0.42 – 0.55 lbs/ft<sup>2</sup> (6.7 – 8.8 kg/m<sup>2</sup>). See Table 1 for R-value ratings at various thicknesses.

#### 3.4 Air Permeability:

**3.4.1** Icynene LD-C-50™ and LD-R-50™, when tested in accordance with ASTM E283 is air-impermeable when installed at 1.5 inch (38.1 mm) thickness or greater.

#### 3.5 Fungal Resistance:

**3.5.1** Icynene LD-C-50™ and LD-R-50™, when tested in accordance with ASTM C1338 exhibits no fungal growth.

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### 3.6 Intumescent Coatings:

**3.6.1 Aldocoat 757:** Aldocoat 757 Ignition Barrier Protective Coating® is a water based latex coating manufactured by Aldo Products Company Inc. Aldocoat 757 is supplied in 5-gallon (19L) pails and 55-gallon (208 L) drums. It has a shelf life of 6 months when stored in factory sealed containers at temperatures between 40°F (4.5°C) and 90°F (32°C).

**3.6.2 Magna Safecoat Latex:** Magna Safecoat Latex intumescent fire retardant coating is a latex based coating manufactured by Magna Coatings Technology Inc. Magna Safecoat is supplied in 1-gallon (4 L) or 5-gallon (19 L) pails and 55-gallon (208 L) drums. It has a shelf life of 24 months when stored in factory sealed containers at temperatures above 50°F (10°C).

## 4.0 INSTALLATION

### 4.1 General

**4.1.1 Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation** shall be installed in accordance with the manufacturer's published installation instructions and this report. The manufacturer's published installation instructions and this report shall be strictly adhered to and a copy of these instructions shall be available at all times on the jobsite during installation.

### 4.2 Application

**4.2.1 Icynene LD-C-50™ and LD-R-50™** are spray-applied on the jobsite using a volumetric positive displacement pump as identified in the Icynene application manual. The Icynene LD-C-50™ resin component shall not be stored, before installation, at temperatures below 50°F (10°C) or above 100°F (35°C). Icynene LD-C-50™ shall not be used in areas that have a maximum service temperature greater than 200°F (93°C). The foam plastic shall not be in contact with rain, water, or soil. The foam plastic shall not be sprayed onto a substrate that is wet or covered with frost or ice, loose scales, rust, oil, or grease. The insulation shall be protected from the weather after application.

**4.2.2 Aldocoat 757** When required by Sections 4.4.3, the Aldocoat 757 ignition barrier protective

coating is recommended to be applied by medium nap rollers, soft brushes or conventional airless spray equipment. Surface must be free of loose particles or other foreign matter that may inhibit proper adhesion and affect performance of the coating. Apply Aldocoat 757 in one coat at the rate of not less than 0.75 gallon per 100 sq. ft. Minimum dry mil thickness shall be 7.5 mils. Do not store material at temperatures below 45° F. Do not apply Aldocoat 757 when ambient air and substrate temperatures fall below 50° F.

**4.2.3 Magna Safecoat Latex:** When required by Sections 4.4.3, the Magna Safecoat Latex protective coating must be applied in accordance with the coating manufacturer's instructions. Surfaces to be coated must be dry, clean, and free of dirt, loose debris and any other substances that could interfere with adhesion of the coating. The Magna Safecoat Latex ignition barrier is applied by brush, roller or airless sprayer. Apply uniformly to entire surface in one coat at the rate of not less than 0.75 gallon per 100 sq. ft. The wet film thickness should be 11.7 mil yielding a dry thickness of 5.0 mil. A wet film thickness gauge can be used at the start of the application to check that sufficient SafeCoat Latex has been applied. Surface and ambient temperature must be maintained at greater than 50° F (10° C) during application and must remain so for at least 48 hours following the application. The application of SafeCoat Latex should be uniform and leave no exposed uncoated surfaces or edges.

### 4.3 Thermal Barrier

Icynene LD-C-50™ and LD-R-50™ shall be separated from the interior occupied area of the building by an approved thermal barrier of 0.5 inch (12.7mm) gypsum wallboard or an equivalent 15-minute thermal barrier complying with and installed in accordance with the applicable code, except where installation is in an attic or crawl space as described in Section 4.4.1 and 4.4.2 of this report.

### 4.4 Attics:

**4.4.1 Icynene LD-C-50™ and LD-R-50™** may be installed in unvented conditioned attics and unvented cathedral ceilings in accordance with IRC section R806.4 and IECC Section 502.5



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provided the Icynene LD-C-50™ and LD-R-50™ is applied in a thickness of 1.5 inches (38.1 mm) or more, and is applied in direct contact with the underside/interior of the structural roof deck. The maximum thickness shall be 11.25 inches (285.8mm) on roofs and 5.5 inches (139.7mm) on walls. The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.4.2 Application with prescriptive ignition barrier:** Icynene LD-C-50™ and LD-R-50™ may be installed within attics, when covered by a prescriptive ignition barrier, in accordance with IBC Section 2603.4.1.6 or IRC Section R314.5.3, under the following conditions:

- LD-C-50 may be applied at a maximum thickness of 11 inches (279.4mm) to the underside of the roof ceiling and 5 inches (127mm) on the walls.
- LD-R-50 may be applied at a maximum thickness of 15 inches (381mm) on the roof deck and 5 inches (127mm) on the walls.
- Entry to the attic is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- The Icynene LD-C-50™ and LD-R-50™ shall be protected against ignition by 1.5-inch-thick (38mm) mineral fiber insulation; 0.25-inch-thick (6.4mm) wood structural panel, particleboard or hardboard; 0.375-inch (9.5mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4mm), or other approved material installed in such a manner that the Icynene LD-C-50™ and LD-R-50™ is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.4.3 Application without a prescriptive ignition barrier:** Icynene LD-C-50™ and LD-R-50™ may be installed in attics without a

prescriptive ignition barrier subject to the following conditions:

- Entry to the attic is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- Air in the attic is not circulated to other parts of the building
- There are no interconnected attic areas.
- Combustion air is provided in accordance with Section 701.4.2 of the International Mechanical Code.
- The maximum thickness of the LD-C-50 foam on the ceiling or roof shall be 11 inches (279.4mm).
- The maximum thickness of LD-C-50 foam on the walls shall be 3.5 inch (88.9 mm).
- The maximum thickness of the LD-R-50 foam on the ceiling or roof shall be 15 inches (381mm).
- The maximum thickness of LD-R-50 foam on the walls shall be 3.5 inch (88.9 mm). The walls may be bare.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.4.3.1 Intumescent Coated:** Icynene LD-C-50™ and LD-R-50™ may be installed in attics without a prescriptive ignition barrier subject to the following conditions:

- Entry to the attic is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- Air in the attic is not circulated to other parts of the building
- There are no interconnected attic areas.
- Combustion air is provided in accordance with Section 701.4.2 of the International Mechanical Code.



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- The maximum thickness of the LD-C-50 foam on the ceiling or roof shall be 11 inches (279.4mm).
- The maximum thickness of the LD-R-50 foam on the ceiling or roof shall be 15 inches (381mm).
- The maximum thickness of LD-C-50 or LD-R-50 foam on the walls shall be 6 inches (152.4 mm).
- The foam on the walls shall be covered with Aldocoat 757 or Safecoat Latex per Sections 4.2.2 or 4.2.3 of this report.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.4.3.2** Icynene LD-C-50™ and LD-R-50™ may be installed in inaccessible attics without an ignition barrier. The maximum thickness shall be 11.25 inches (285.8mm) on roofs and 5.5 inches (139.7mm) on walls. The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

#### **4.5 Attic Floors:**

##### **4.5.1 Application with prescriptive ignition barrier:**

**4.5.1.1** Icynene LD-C-50™ and LD-R-50™ may be installed between and over joists in accessible attic floors at a maximum thickness of 5 inches (127mm) in accordance with IBC Section 2603.4.1.6 or IRC Sections R314.5.3 with a prescriptive ignition barrier, under the following conditions:

- Entry to the attic is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- Air in the attic is not circulated to other parts of the building
- There are no interconnected attic areas.
- Combustion air is provided in accordance with Section 701.4.2 of the International Mechanical Code.

- The Icynene LD-C-50™ and LD-R-50™ shall be protected against ignition by 1.5-inch-thick (38mm) mineral fiber insulation; 0.25-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; 0.375-inch (9.5mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4mm), or other approved material installed in such a manner that the Icynene LD-C-50™ and LD-R-50™ is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

##### **4.5.2 Application without a prescriptive ignition barrier or thermal barrier:**

**4.5.2.1** Icynene LD-C-50™ and LD-R-50™ may be installed between and over joists in attics and attic floors without an ignition barrier, at a maximum thickness of 3.5 inches (88.9mm) under the following conditions:

- Entry to the attic is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- Air in the attic is not circulated to other parts of the building
- There are no interconnected attic areas.
- Combustion air is provided in accordance with Section 701.4.2 of the International Mechanical Code.

The maximum thickness of spray foam shall be 6 inches (152mm) if covered with Aldocoat 757 or Safecoat Latex per Sections 4.2.2 or 4.2.3 of this report.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

## 4.6 Crawl Spaces:

**4.6.1. Application with prescriptive ignition barrier:** Icynene LD-C-50™ and LD-R-50™ may be installed within crawl spaces, when covered by a prescriptive ignition barrier, in accordance with IBC Section 2603.4.1.6 or IRC Section R314.5.3, under the following conditions:

- LD-C-50 may be applied at a maximum thickness of 11 inches (279.4mm) to the underside of the floor and 3.5 inches (88.9mm) on the walls.
- LD-R-50 may be applied at a maximum thickness of 15 inches (381mm) on the underside of the floor and 3.5 inches (88.9mm) on the walls.
- Entry to the attic is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- The Icynene LD-C-50™ and LD-R-50™ shall be protected against ignition by 1.5-inch-thick (38mm) mineral fiber insulation; 0.25-inch-thick (6.4mm) wood structural panel, particleboard or hardboard; 0.375-inch (9.5mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4mm), or other approved material installed in such a manner that the Icynene LD-C-50™ and LD-R-50™ is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.6.2 Application without a prescriptive ignition barrier:** Icynene LD-C-50™ and LD-R-50™ may be installed in crawl spaces without a prescriptive ignition barrier subject to the following conditions:

- Entry to the crawl space is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.

- Under-floor (crawl space) ventilation is provided in accordance with IMC Sections 701 and 703.
- Combustion air is provided in accordance with Sections 701 and 703 of the International Mechanical Code.
- The maximum thickness of the LD-C-50 foam on the ceiling shall be 11 inches (279.4mm).
- The maximum thickness of LD-C-50 foam on the walls shall be 3.5 inch (88.9 mm).
- The maximum thickness of the LD-R-50 foam on the ceiling shall be 15 inches (381mm).
- The maximum thickness of LD-R-50 foam on the walls shall be 3.5 inch (88.9 mm). The walls may be bare.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.6.2.1 Intumescent Coated:** Icynene LD-C-50™ and LD-R-50™ may be installed in crawl space without a prescriptive ignition barrier subject to the following conditions:

- Entry to the crawl space is limited to service of utilities, mechanical and electrical systems and the incidental access by the owner for storage purposes.
- Under-floor (crawl space) ventilation is provided in accordance with IMC Sections 701 and 703.
- Combustion air is provided in accordance with Sections 701 and 703 of the International Mechanical Code.
- The maximum thickness of the LD-C-50 foam on the ceiling shall be 11 inches (279.4mm).
- The maximum thickness of the LD-R-50 foam on the ceiling shall be 15 inches (381mm).
- The maximum thickness of LD-C-50 or LD-R-50 foam on the walls shall be 6 inches (152.4 mm).

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- The foam on the walls shall be covered with Aldocoat 757 or Safecoat Latex per Sections 4.2.2 or 4.2.3 of this report.

The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

**4.6.2.2** Icynene LD-C-50™ and LD-R-50™ may be installed exposed in inaccessible crawl spaces without an ignition barrier. The maximum thickness shall be 11.25 inches (285.8mm) on roofs and 5.5 inches (139.7mm) on walls. The Icynene LD-C-50™ and LD-R-50™ must be separated from the interior occupied area of the building by an approved thermal barrier in accordance with Section 4.3.

## 5.0 CONDITIONS OF USE

**5.1** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation described in this report complies with or is a suitable alternative to what is specified in the codes listed in Section 1.0 of this report, subject to the following conditions:

**5.1.1** This evaluation report and the manufacturer's published installation instructions, when required by the code official, shall be submitted at the time of permit application.

**5.1.2** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation shall be installed in accordance with the manufacturer's published installation instructions, this evaluation report and the applicable code.

**5.1.3** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation shall be separated from the interior occupied area of the building by an approved 15-minute thermal barrier, except when installed in attics and crawl spaces as described in Sections 4.2, 4.3, 4.4, 4.5, and 4.6 of this report.

**5.1.4** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation shall not exceed the thicknesses noted in Sections 4.2, 4.3, 4.4, 4.5, and 4.6 of this report.

**5.1.5** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation shall be protected from the weather after installation.

**5.1.6** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation shall be applied by contractors certified by Icynene Inc.

**5.1.7** In jurisdictions that have adopted the IRC, when installed in buildings of wood construction, the insulation shall not be installed on the exterior of foundation walls or below floor slabs on ground or in contact with ground. The insulation shall have a clearance above grade and exposed earth of 6 inches (152 mm) or greater.

**5.1.8** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation is limited to use in Types III-A, III-B, V-A, and V-B construction under the IBC and dwellings under the IRC except where a Fire Performance Evaluation in accordance with ASTM E119 and other applicable tests allows for use in other types of building construction.

**5.1.9** The Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation is produced in Mississauga, Ontario, Canada, under a quality control program with inspections by Intertek Testing Services NA, Ltd. (IAS AA-689).

**5.1.10** Use of Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation as fire blocking has not been evaluated and is beyond the scope of this report.

**5.1.11** Jobsite certification and labeling of the insulation must comply with IRC Sections N1101.4 and N1101.4.1 and IECC Sections 102.1.1 and 102.1.11 as applicable.

## 6.0 EVIDENCE SUBMITTED

See Table 2 for test reports analyzed and accepted for this Evaluation Report.

**6.1** Data in accordance with ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC377), dated July 2009.

**6.2** Engineering fire risk analysis of comparative crawl space fire testing.

**6.3** Reports of air leakage in accordance with ASTM E283.

**6.4** Reports of water vapor transmission in accordance with ASTM E96.

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## 7.0 IDENTIFICATION

7.1 Each package of components for the Icynene LD-C-50™ and LD-R-50™ Spray Foam Insulation is identified with the manufacturer's name (Icynene Inc.) the manufacturer's address and telephone number, the product trade name (Icynene LD-C-50™ and LD-R-50™), use instructions, the density, the flame spread and smoke developed indices, the evaluation report number (IAPMO-0165), and the name of the inspection agency (Intertek Testing Services NA, Ltd.).



IAPMO #0165

A handwritten signature in black ink, appearing to read 'Amir...'. The signature is written in a cursive style.

Director of Evaluation Services

TABLE 1 — THERMAL PERFORMANCE

Tested per ASTM C518	Thermal Resistance (R-value)	Thermal Resistance (R-value)
Thickness (Inch)	(°F-ft <sup>2</sup> -h/Btu)	(°F-ft <sup>2</sup> -h/Btu)
	<b>LD-R-50</b>	<b>LD-C-50</b>
1	3.9	3.7
3.5	13.6	13.0
5.5	21.3	20.4
6	23.3	22.2
7.5	29.1	27.8
9	34.9	33.3
10	38.8	37.0
11	42.6	40.7
15	58.1	55.5

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**TABLE 2—TEST DATA SUBMITTED**

TESTS REQUIRED	Requirement	Lab	Report	Date	Value	
<b>LD-R-50</b>						
Thermal Resistance	ASTM C518	As reported	Bodycote	08-06-M0048A-1-RV4	June, 2009	3.9 per inch
Core Density	ASTM D1622	As reported	Bodycote	08-06-M0048A-1-RV4	June, 2009	0.62 lb/ft <sup>3</sup>
Tensile Strength	ASTM D1623	3 lbf/in <sup>2</sup> , minimum	Intertek	3150624C0Q	May, 2008	3.4 lbf/in <sup>2</sup>
Closed Cell Content	ASTM D2856	<90%	Intertek	3150624C0Q	May, 2008	Open Cell >90%
Dimensional Stability	ASTM D2126	<15%	Bodycote	08-06-M0048A	June, 2009	Passed
Surface Burning Characteristics	ASTM E84	75/450	Bodycote	08-06-M0048A	June, 2009	Passed
Air Leakage	ASTM E283	<0.02 L/sm <sup>2</sup>	Bodycote	08-006-2142	June, 2009	<0.02 L/sm <sup>2</sup>
Critical Radiant Flux	ASTM E970	<0.12 w/cm <sup>2</sup>	Bodycote	08-006-2142	June, 2009	28 w/cm <sup>2</sup>
Attic and Crawl Space	SwRI 99-02	As Reported	Intertek	Numerous	Nov., 2007	Passed
Attic and Crawl Space Analysis	NFPA 286	>15 minutes	Intertek	31755666SAT-001	Mar., 2009	Passed
Fungal Resistance	ASTM C1338	No Growth	Bodycote	0-011-10657-1	Feb., 2009	No Growth
<b>LD-C-50</b>						
Thermal Resistance	ASTM C518	As reported	Bodycote	06-06-M007-B Rev. 3	June, 2009	3.7 per inch
Core Density	ASTM D1622	As reported	Bodycote	06-06-M007-B Rev. 3	June, 2009	0.53 lb/ft <sup>3</sup>
Tensile Strength	ASTM D1623	3 lbf/in <sup>2</sup> , minimum	Intertek	07-06-M0293	May, 2008	19.2 lbf/in <sup>2</sup>
Closed Cell Content	ASTM D2856	<90%	Intertek	07-06-M0293	May, 2008	Open Cell >90%
Dimensional Stability	ASTM D2126	<15%	Bodycote	06-06-M007-B Rev. 3	June, 2009	Passed
Surface Burning Characteristics	ASTM E84	75/450	Bodycote	06-06-03107	April, 2007	Passed
Air Leakage	ASTM E283	<0.02 L/sm <sup>2</sup>	Bodycote	01-06-M0345	June, 2002	<0.02 L/sm <sup>2</sup>
Water Vapor Transmission	ASTM E96	≤ 1 perm	Bodycote	06-06-M007-B Rev. 3	April, 2007	10 perms
Hot Surface Performance	ASTM C411	200°F (93°C)	Bodycote	08-06-M0022	Feb., 2008	Passed
Attic and Crawl Space	SwRI 99-02	As Reported	Intertek	Numerous	Nov., 2007	Passed
Attic and Crawl Space Analysis	NFPA 286	>15 minutes	Intertek	31755666SAT-001	Mar., 2009	Passed