Technical Evaluation Report

TO ASSIST WITH CODE COMPLIANCE

NFPA 285 Tested Wall Assemblies Using Kingspan GreenGuard® Insulation Boards & Kingspan GreenGuard® Building Wraps in Exterior Walls of Buildings of Type I-IV Construction

TER No. 1407-05

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DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION
Section: 07 21 00 – Thermal Insulation
Section: 07 24 00 – Exterior Insulation and Finish Systems
Section: 07 25 00 – Water-Resistive Barriers/Weather Barriers
Section: 07 27 00 – Air Barriers

1. Products Evaluated:

1.1. Kingspan GreenGuard® Insulation Board products identified as:

1.1.1. Kingspan GreenGuard® CM

1.1.2. Kingspan GreenGuard® SL

1.1.3. Kingspan GreenGuard® SB

1.2. Products referred to as Kingspan GreenGuard® Insulation Board in this report apply to any of the products listed in Section 1.1.

1.3. Kingspan GreenGuard® Building Wrap products identified as:

1.3.1. Kingspan GreenGuard® MAX

1.3.2. Kingspan GreenGuard® RainDrop

1.3.3. Kingspan GreenGuard® C2000

1.3.4. Kingspan GreenGuard® VW

1.3.5. Kingspan GreenGuard® Classic

1.3.6. Lowe's Wrap

1.4. Products referred to as Kingspan GreenGuard® Building Wrap in this report apply to any of the products listed in Section 1.3.

1.5. For the most recent version of this report, visit drjengineering.org. For more detailed state professional engineering and code compliance legal requirements and references, visit drjengineering.org/statelaw. DrJ is fully compliant with all state professional engineering and code compliance laws.

2. Applicable Codes and Standards:[1]

2.1. *2009*, *2012* and *2015 International Building Code* (*IBC*)

2.2. *2009*, *2012* and *2015 International Energy Conservation Code* (*IECC*)

2.3. *ANSI/AWC – National Design Specification (NDS) for Wood Construction*

2.4. *ASTM C518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*

2.5. *ASTM C578 – Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation*

2.6. *ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials*

2.7. *ASTM E136 – Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*

2.8. *ASTM E331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference*

2.9. *ASTM E1354 – Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*

2.10. *ASTM E2178 – Standard Test Method for Air Permeance of Building Materials*

2.11. *ASTM E2357* – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

2.12. *NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components*

2.13. *NFPA 286 – Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth*

3. Performance Evaluation:

3.1. Kingspan GreenGuard® Insulation Board products were evaluated to determine:

3.1.1. Material properties in accordance with *ASTM C578*.

3.1.2. Thermal resistance properties in accordance with *IECC* Section C402.

3.1.3. Use as a water-resistant barrier (WRB) in accordance with *IBC* Section 1404.2.

3.1.4. Use as an air barrier material in accordance with *IECC* Section C402.4.1.1[2].

3.1.5. Performance for use in buildings of Type I-IV construction in accordance with *IBC* Section 2603.5.

3.1.5.1. Performance in accordance with *ASTM E84* for flame spread and smoke development ratings in accordance with *IBC* Section 2603.3 and 2603.5.4.

3.1.5.2. Performance for use without a thermal barrier in accordance with *IBC* Section 2603.4 and 2603.5.2.

3.1.5.3. Performance with regard to the potential heat generated by the foam plastic insulated sheathing (FPIS) in accordance with *IBC* Section 2603.5.3.

3.1.5.4. Performance with regard to vertical and lateral fire propagation in accordance with *IBC* Section 2603.5.5[3].

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[1] Unless otherwise noted, all references in this code compliant research report (TER) are from the 2012 version of the codes and the standards referenced therein, including, but not limited to, *ASCE 7*, *SDPWS* and *WFCM*. This product also complies with the 2000-2009 and 2015 versions of the *IBC* and *IRC* and the standards referenced therein. As required by law, where this research report is not approved, the building official shall respond in writing, stating the reasons this research report was not approved. For variations in state and local codes, if any, see Section 8.

[2] *2015 IECC* Section C402.5.1.1.

[3] *2015 IBC* Section 2603.5.5.

3.1.5.5. Performance with regard to ignition in accordance with *IBC* Section 2603.5.7.

3.1.5.6. Use as part of an *NFPA 285* wall assembly in accordance with *IBC* Section 2603.5.5.

3.2. Kingspan GreenGuard® Building Wrap products were evaluated for:

3.2.1. Use as a WRB in accordance with *IBC* Section 1404.2 and 1403.5.

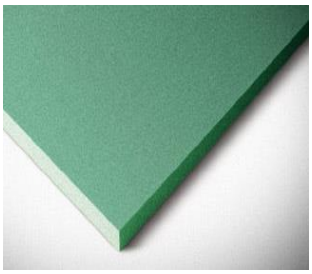
3.2.2. Use as an air barrier material in accordance with *IECC* Section C402.4.1.1.

3.2.3. Use as part of an approved *NFPA 285* wall assembly in accordance with *IBC* Section 2603.5.5[4].

3.3. Any code compliance issues not specifically addressed in this section are outside the scope of this evaluation.

4. Product Description and Materials:

GreenGuard® XPS label



GreenGuard® XPS CM

GreenGuard® XPS SB

GreenGuard® XPS SL

Figure 1: GreenGuard® XPS – CM, SB, SL

4.1. Kingspan GreenGuard® Insulation Board is:

4.1.1. A proprietary FPIS made from extruded polystyrene in accordance with *ASTM C578*, Type IV

4.1.2. Available with various edge treatments and facers as follows:

4.1.2.1. Kingspan GreenGuard® CM – square edges

4.1.2.2. Kingspan GreenGuard® SL – shiplap edges

4.1.2.3. Kingspan GreenGuard® SB – scoreboard

4.1.3. Material Availability

4.1.3.1. Thickness: 1/2" (13 mm) through 3" (76 mm)

4.1.3.2. Standard product width: 48" (1,219 mm)

4.2. Kingspan GreenGuard® Building Wrap products are polyolefin materials of varying thicknesses, weights and coatings as shown in Table 1 and are produced in various sized rolls.

[4] *2015 IBC* Section 2603.5.5.

Product Name	Material Type	Coating Type	Thickness (in.)	Weight (oz./yd.^{2})	Water-Resistive Barrier	Air Barrier
Kingspan GreenGuard® MAX	Cross woven, non-perforated polyolefin	Vapor permeable polyolefin	0.018	2.2	X	X
Kingspan GreenGuard® RainDrop			0.018	2.4	X	X
Kingspan GreenGuard® C2000	Spun-bonded vapor permeable polyolefin	NA	0.024	3.6	X	X
Lowe's Wrap	Cross-woven, micro perforated polyolefin	Polyolefin	0.008	2.2	X	–
Kingspan GreenGuard® VW			0.004	1.9	X	–
Kingspan GreenGuard® Classic			0.008	2.2	X	–

Table 1: Kingspan GreenGuard® Building Wrap Products

5. Applications:

5.1. General

5.1.1. Kingspan GreenGuard® Insulation Board is FPIS complying with *IBC* Section 2603.

5.1.1.1. Kingspan GreenGuard® Insulation Board is used in buildings of Type I through IV construction in accordance with *IBC* Section 2603.5.

5.1.2. The Kingspan GreenGuard® Building Wrap products used as WRBs in buildings of Type I through IV construction are in accordance with the *IBC* Section 1403.5 and 1404.2.

5.1.3. Kingspan GreenGuard® MAX, RainDrop and C2000 are air barrier materials used as a component of air barrier assemblies in buildings of Type I through IV construction in accordance with the *IECC* Section C403.4.1.1[5].

5.2. Water-Resistive Barrier

5.2.1. Kingspan GreenGuard® Insulation Board may be used as a WRB as prescribed in *IBC* Section 1404.2 and 1403.5.

5.2.2. Kingspan GreenGuard® Building Wrap may be used as a WRB as prescribed in *IBC* Section 1404.2.

5.2.3. Kingspan C2000, RainDrop®, Classic Wrap, and Max™ building wraps have been tested in accordance with *ASTM E1354* and *ASTM E 84* and meet the requirements of *IBC Section 1403.5*[6], Exception 2, for use in Type I, II, III or IV construction that are greater than 40 feet (12,192 mm) in height above grade plane when the water-resistive barrier is the only combustible component without the need for *NFPA 285* testing.

5.3. Air Barrier

5.3.1. Kingspan GreenGuard® Insulation Board may be used as an air barrier material as prescribed in *IECC* Section R402.4.1.1 and C402.4.1[7].

5.3.2. Kingspan GreenGuard® MAX, RainDrop and C2000 may be used as an air barrier material as prescribed in *IECC* Section R402.4.1.1 and C402.4.1.

[5] *2015 IECC* Section C403.3.4.1.
[6] 2015 IBC only
[7] *2015 IECC* Section C402.5.1.

5.4. Thermal Resistance

5.4.1. Kingspan GreenGuard® Insulation Board has the thermal resistance as shown in Table 2.

Product Name	Thickness (in.)	R-Value (°F.ft.²·h/Btu)
Kingspan GreenGuard® XPS [1]	1/2"	3
	3/4"	3.8
	1"	5
	1 1/2"	7.5
	2"	10
	3"	15
1. Tested in accordance with *ASTM C518* @ 75° mean temperature.		

Table 2: Thermal Resistance of Insulation Boards

5.5. Thermal Barrier

5.5.1. Industry testing on XPS insulation boards was evaluated in accordance with *NFPA 286* for equivalence to the prescriptive ignition barriers in in accordance with *IBC* Section 2603.4.1.6[8]. This testing met the acceptance criteria for use in attics and crawlspaces without a thermal barrier or ignition barrier.

5.5.2. In addition, engineering analysis was performed to compare Kingspan GreenGuard® Insulation Board to the tested assembly with respect to its flammability characteristics.

5.5.3. Testing in accordance with the following test methods was compared to determine the similarities between the products.

5.5.3.1. *ASTM E84 – Test for Surface Burning Characteristics of Building Materials*

5.5.3.2. *ASTM E1354 – Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products using an Oxygen Consumption Calorimeter*

5.5.4. Based on the similar performance of GreenGuard® Insulation Boards and the tested XPS, Kingspan GreenGuard® Insulation Board is approved for use without a thermal barrier or ignition barrier in attics and crawlspaces where entry is made only for the service of utilities in accordance with *IBC* Section 2603.4.1.6.

5.6. Potential Heat

5.6.1. Kingspan GreenGuard® Insulation Board was tested to assess the potential heat generated by the FPIS in accordance with *IBC* Section 2603.5.3 and are shown in Table 3.

Product	Potential Heat (Btu/lb.)[1]
Kingspan GreenGuard® XPS[1]	13,333
1. Potential heat calculated based on cone calorimeter testing using the minimum allowed product density.	

Table 3: Potential Heat of Insulation Boards

[8] *2015 IBC* Section 2603.4.1.6.

5.7. Surface Burn Characteristics

Product Name	Flame Spread	Smoke Developed
Kingspan GreenGuard® XPS[1]	< 25	< 450
1. Foam core tested in accordance with *ASTM E84*.		

Table 4: Fire Performance of Insulation Boards & Building Wraps

5.8. Vertical and Lateral Fire Propagation

5.8.1. Kingspan GreenGuard® Insulation Boards and Kingspan GreenGuard® Building Wraps were tested to assess their performance with regard to vertical and lateral fire propagation in accordance with *NFPA 285* and *IBC* Section 2603.5.5.

5.8.1.1. Engineering analysis also was conducted to assess substitution of other products within the approved wall assemblies.

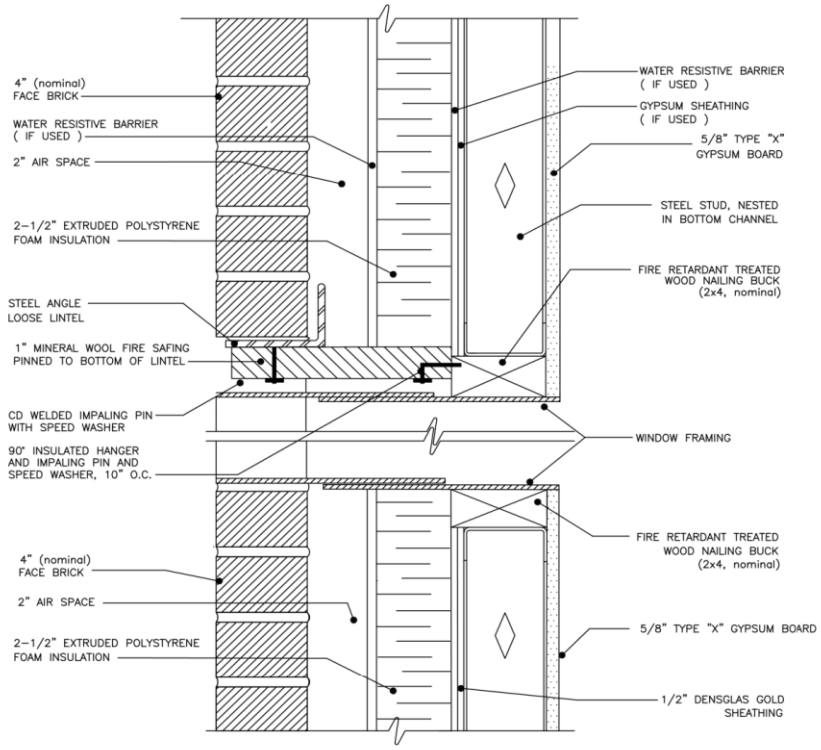
5.8.1.2. The wall assemblies listed in Table 5 are approved for use in buildings of Type I-IV construction.

***NFPA 285* Approved Wall Assemblies[1]**	
Wall Component	**Materials**
Base Wall System Use either 1, 2 or 3	1. Concrete Wall 2. Concrete Masonry Wall 3. 20-gauge (min.) 3 5/8" depth (min.) steel studs spaced at a maximum of 16" o.c. with lateral bracing every 4' vertically. a. 1 layer – 5/8"-thick Type X or 1/2"-thick Type X gypsum wallboard on interior
Floorline Firestopping	1. 4 lb./cu ft. mineral wool (e.g., Thermafiber) in each stud cavity at each floor line – attached with Z-clips or equivalent
Cavity Insulation Use either 1,2, or 3	1. None 2. Any noncombustible insulation per *ASTM E136* 3. Fiberglass (Batt type Class A *ASTM E84* faced or unfaced)
Exterior Sheathing Use either 1, 2 or 3	1. None 2. Minimum ½"-thick, exterior type gypsum sheathing 3. Minimum 5/8"-thick, Type X, exterior type gypsum sheathing
Air Barrier or Weather-Resistive Barrier Applied to Exterior Sheathing Use any of these options	1. None 2. BASF Enershield HP 3. BASF Energyshield 1 4. Carlisle CCW-705FR w/Primers 5. Carlisle Barritech™ VP 6. Carlisle Barritech™ NP 7. Cosella-Dörken Delta®-Foxx 8. Cosella-Dörken Delta®-Foxx Plus 9. Cosella-Dörken Delta®-Fassade S 10. Cosella-Dörken Delta®-Vent S/Plus 11. Cosella-Dörken Delta®-Maxx Plus 12. Dow Weathermate™ 13. Dow Weathermate™ Plus 14. Dryvit BackstopC NT 15. Dupont™ Tyvek CommercialWrap® 16. Dupont™ Tyvek CommercialWrap® D 17. Dupont™ Tyvek ThermaWrap™ 18. Dupont Fluid Applied Weather Barrier-nominal 25 mill (wet) thickness. 19. Henry Air-Bloc 32MR 20. Henry Air-Bloc 31MR 21. Henry Air-Bloc 33MR 22. Henry BlueskinVP™ 160 23. Henry Air-Bloc 21 FR 24. Henry Metal Clad™ 25. Henry Foilskin® 26. Hohmann & Barnard Enviro-Barrier™ 27. Hohmann & Barnard Enviro-Barrier™ VP 28. Momentive Performance Materials GE SEC2500 SilShield AWB 29. Momentive Performance Materials GE SEC2600 SilShield AWB 30. Momentive Performance Materials GE SEC2600-R SilShield AWB 31. Kingspan GreenGuard® Max Building Wrap 32. Kingspan GreenGuard® VW 33. Kingspan GreenGuard® Classic Wrap 34. Kingspan GreenGuard® RainDrop Drainage Wrap 35. Kingspan GreenGuard® C2000 36. Lowe's Wrap 37. Polyguard Airlok Flex® at 40 mils (wet) 38. Polyguard Airlok Flex® WG at 20 mils (wet) 39. Polyguard Airlok Flex® VP at 32 mils (wet) **Continued on next page**

	40. Sto Corp Sto Gold Coat® with StoGuard Fabric 41. Sto Corp Sto Emerald Coat® with StoGuard Fabric 42. Sto Corp Sto ExtraSeal™ w/StoGuard Mesh 43. STS Wall Guardian™ FW 100A 44. VaproShield WallShield® 45. VaproShield WrapShield® 46. VaproShield RevealShield™ 47. VaproShield RevealShield SA™ 48. W.R. Grace Perm-A-Barrier® Aluminum Wall Membrane 49. W.R. Grace Perm-A-Barrier® VPL 50. W.R. Grace Perm-A-Barrier® VPS 51. W.R. Grace Perm-A-Barrier® NPL 52. WR Meadows Air-Shield™ LMP (Gray) 53. WR Meadows Air-Shield™ LMP (Black) 54. WR Meadows Air-Shield™ TMP 55. WR Meadows Air-Shield™ LSR Note: All WRBs to be installed at the indicated or recommended application rates and per the manufacturer's installation instructions.
Exterior Insulation	1. Kingspan GreenGuard® XPS – ½" minimum and 3" maximum Seal all insulation joints with maximum 4"-wide asphalt or Butyl based flashing tape.
WRB Over Exterior Insulation Use any option 1-9	1. None 2. Dow Weathermate™ 3. Dow Weathermate™ Plus 4. Dupont™ Tyvek CommercialWrap® 5. Dupont™ Tyvek CommercialWrap® D 6. Dupont™ Tyvek ThermaWrap™ 7. Kingspan GreenGuard® Max Building Wrap 8. Kingspan GreenGuard® VW 9. Kingspan GreenGuard® Classic Wrap 10. Kingspan GreenGuard® RainDrop Drainage Wrap 11. Kingspan GreenGuard® C2000 12. Lowe's Wrap 13. VaproShield RevealShield™ 14. VaproShield RevealShield SA™
Exterior Veneer Use any of these options	1. Brick a. Standard nominal 4"-thick, clay brick b. Brick veneer anchors – standard types – installed maximum 24" o.c. vertically on each stud c. Maximum 2" air gap between exterior insulation and brick 2. Concrete a. Minimum 2" thick b. Maximum 2" air gap between exterior insulation and concrete 3. CMU-concrete Masonry Units a. Minimum 4" thick b. Maximum 2" air gap between exterior insulation and CMU 4. Stone Veneer a. Minimum 2"-thick limestone or natural stone veneer b. Minimum 1½"-thick cast artificial stone veneer c. Any standard non-open joint technique may be used (such as shiplap, etc.) 5. Terracotta cladding a. Minimum 1" thick b. Any standard non-open joint technique may be used (such as shiplap, etc.)
1. See header detail (Figure 2) for instructions on required treatment of window and door openings.	

Table 5: Approved *NFPA 285* Wall Assemblies

STEEL STUD/BRICK VENEER – WINDOW HEAD DETAIL



STEEL STUD/BRICK VENEER – WINDOW SILL & JAMB DETAIL

Figure 2: Header Detail for *NFPA 285* Wall Assemblies
(brick shown, other claddings similar)

5.9. Ignition

5.9.1. Kingspan GreenGuard® Insulation Boards were evaluated to assess performance with regard to ignition in accordance with *IBC* Section 2603.5.7.

5.9.1.1. Kingspan GreenGuard® Insulation Boards comply with this section when the exterior side of the sheathing is protected with one of the following materials:

5.9.1.1.1. A thermal barrier complying with *IBC* Section 2603.4.

5.9.1.1.2. A minimum 1" (25 mm) thickness of concrete or masonry.

5.9.1.1.3. Glass-fiber-reinforced concrete panels of a minimum thickness of $^3/_8$" (9.5 mm).

5.9.1.1.4. Metal-faced panels having a minimum 0.019"-thick (0.48 mm) aluminum or 0.016"-thick (0.41 mm) corrosion-resistant steel outer facings.

5.9.1.1.5. A minimum $^7/_8$" (22.2 mm) thickness of stucco complying with *IBC* Section 2510.

5.9.1.1.6. A minimum ¼" (6.4 mm) thickness fiber-cement lap, panel or shingle siding complying with *IBC* Section 1405.16[9].

[9] *2015 IBC* Section 1405.16.

6. Installation:

6.1. Installation shall comply with the manufacturer's installation instructions, and this TER. In the event of a conflict between the manufacturer's installation instructions and this TER, the more restrictive shall govern.

6.1.1. For Kingspan GreenGuard® Insulation Board installation instructions, see DrJ Installation Instructions, TER No. 1410-09.

6.1.2. For commercial building wrap applications, see the Commercial Installation Guide for Kingspan GreenGuard® Building Wraps.

6.2. See Table 5 for *NFPA 285*-compliant wall assemblies using Kingspan GreenGuard® Insulation Board and Kingspan GreenGuard® Building Wraps with non-combustible veneers. See Figure 2 for the "Window/Door Opening Detail" required for these assemblies.

6.3. For applications outside the scope of this TER, an engineered design is required.

7. Test and Engineering Substantiating Data:

7.1. Test reports and data supporting the following material properties and wall assembly performance:

7.1.1. Flame spread and smoke developed ratings in accordance with *ASTM E84/UL 273* by Underwriters Laboratories, Inc.

7.1.2. Air barrier performance of GreenGuard® Max Building Wrap in accordance with *ASTM E331* by Architectural Testing.

7.1.3. Air permeance of GreenGuard® Insulation Boards in accordance with *ASTM E2178* by RADCO.

7.1.4. Water-resistance barrier performance of GreenGuard® VW, GreenGuard® Classic Wrap, Lowe's, GreenGuard® RainDrop® 3D, GreenGuard® MAX™, and GreenGuard® C2000 Building Wraps as equivalent to Grade D paper and air barrier performance of GreenGuard® RainDrop® 3D, GreenGuard® MAX™ and GreenGuard® C2000 Building Wraps in accordance with *ASTM E2178* by Intertek.

7.1.5. Water-resistance barrier performance of GreenGuard® Insulation Boards in accordance with *ASTM E331* by ATI.

7.1.6. Material properties in accordance with *ASTM C578* by RADCO.

7.1.7. Vertical and lateral flame spread in accordance with *NFPA* 285; by SwRI and UL.

7.1.8. Exclusion of thermal and ignition barriers in attics and crawlspaces in accordance with *NFPA 286* by SwRI.

7.1.9. Surface burning characteristics evaluated in accordance with *ASTM E 84*/*UL723* by Underwriters Laboratories, Inc., File R11183, Project No. 09CA46361.

7.1.10. Southwest Research Institute, Final Report No. 01.06440.01.001.

7.1.11. Underwriters Laboratories, Inc., Final Report No. 05CA2541, NC2650.

7.1.12. Southwest Research Institute, Final Report No. 01.13537.01.106.

7.1.13. Hughes Associates, Engineering Evaluation for Comparative Fire Properties Relating to *NFPA 285*, HAI Project No. 5242-005.

7.1.14. Hughes Associates, Engineering Evaluation for Comparative Fire Properties Relating to *NFPA 286*, HAI Project No. 1JJB05192.001.

7.1.15. Hughes Associates, Engineering Evaluation for Comparative Fire Properties Relating to *NFPA 285*, HAI Project No. 1JJB00060.001.

7.2. Engineering analysis supporting the following material properties:

7.2.1. Engineering analysis comparing the fire resistance properties of GreenGuard® Insulation Boards and GreenGuard® Building Wraps by Hughes Associates for contribution of materials to room fire growth in accordance with *NFPA 286*.

7.2.2. Engineering analysis assessing the substitution of products within the approved *NFPA 285* tested wall assemblies by Hughes Associates for vertical and lateral flame spread.

7.2.3. Jensen Hughes, Analysis of Kingspan's Building Wraps and Section 1403.5 of the *IBC* (2015 edition), Project No. 1JJB05192.001

7.3. Manufacturer technical data sheets and installation instructions.

7.4. Manufacturer quality control manual and evidence of approved agency inspections.

7.5. Test reports and data for determining comparative equivalency for use as an alternative material in accordance with *IBC* Section 104.11.

7.6. The product(s) evaluated by this TER falls within the scope of one or more of the model, state or local building codes for building construction. The testing and/or substantiating data used in this TER is limited to buildings, structures, building elements, construction materials and civil engineering related specifically to buildings.

7.7. The provisions of model, state or local building codes for building construction do not intend to prevent the installation of any material or to prohibit any design or method of construction. Alternatives shall use consensus standards, performance-based design methods or other engineered alternative means of compliance. This TER assesses compliance with defined standards, generally accepted engineering analysis, performance-based design methods, etc. in the context of the pertinent building code requirements.

7.8. Some information contained herein is the result of testing and/or data analysis by other sources, which DrJ relies on to be accurate as it undertakes its engineering analysis.

7.9. DrJ has reviewed and found the data provided by other professional sources are credible. This information has been approved in accordance with DrJ's procedure for acceptance of data from approved sources.

7.10. DrJ's responsibility for data provided by approved sources is in accordance with professional engineering law.

7.11. Where appropriate, DrJ relies on the derivation of design values, which have been codified into law through codes and standards (e.g., *IRC*, *WFCM*, *IBC*, *SDPWS*, etc.). This includes review of code provisions and any related test data that helps with comparative analysis or provides support for equivalency to an intended end-use application.

8. Findings:

8.1. Kingspan GreenGuard® Insulation Boards and Kingspan GreenGuard® Building Wraps are approved for use in exterior walls without a thermal barrier in accordance with *IBC* Section 2603.4 and 2603.5.2.

8.2. Kingspan GreenGuard® Insulation Boards and Kingspan GreenGuard® Building Wraps are approved for use in exterior walls of buildings of Type I-IV construction in accordance with *IBC* Section 2603.5.

8.3. Kingspan GreenGuard® Insulation Boards and Kingspan GreenGuard® Building Wraps are approved for use in wall assemblies meeting the requirements of *NFPA 285* testing when constructed in accordance with Table 3.

8.3.1. Kingspan C2000, RainDrop®, Classic Wrap, and Max™ building wraps have been tested in accordance with *ASTM E1354* and *ASTM E 84* and meet the requirements of *IBC Section 1403.5*[10], Exception 2, for use in Type I, II, III or IV construction that are greater than 40 feet (12 192 mm). As such, where these Kingspan building wraps are the only combustible products in the wall assembly, NFPA 285 testing is not required.

8.4. Kingspan GreenGuard® Insulation Boards and Kingspan GreenGuard® Building Wraps described in this TER comply with, or are a suitable alternative to, the applicable sections of the codes listed in Section 2.

8.5. *IBC* Section 104.11 and *IRC* Section R104.11 (*IFC* Section 104.9 is similar) state:

> **104.11 Alternative materials, design and methods of construction and equipment.** The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been *approved*. An alternative material, design or method of construction shall be *approved* where the *building official* finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at

[10] 2015 IBC only

> least the equivalent of that prescribed in this code. … Where the alternative material, design or method of construction is not *approved*, the *building official* shall respond in writing, stating the reasons the alternative was not *approved*.[11]

8.6. This product has been evaluated with the codes listed in Section 2, and is compliant with all known state and local building codes. Where there are known variations in state or local codes that are applicable to this evaluation, they are listed here:

8.6.1. No known variations

8.7. This TER uses professional engineering law, the building code, ANSI/ASTM consensus standards and generally accepted engineering practice as its criteria for all testing and engineering analysis. DrJ's professional engineering work falls under the jurisdiction of each state Board of Professional Engineers, when signed and sealed.

9. Conditions of Use:

9.1. Where required by the authority having jurisdiction (AHJ) in which the project is to be constructed, this report and the installation instructions shall be submitted at the time of permit application.

9.2. Any generally accepted engineering calculations needed to show compliance with this TER shall be submitted to the code official for review and approval.

9.3. Design loads shall be determined in accordance with the building code adopted by the jurisdiction in which the project is to be constructed.

9.4. The products listed in this TER shall be installed in accordance with this TER and the manufacturer's installation instructions.

9.5. When the insulation boards or building wraps are used on exterior walls of buildings of Type I, II, III or IV, construction must be as described in Table 3.

9.6. In areas where the probability of termite infestation is very heavy and the building is wood-framed construction, the product must not be placed on exterior walls located within 6" (152 mm) of the ground and shall meet the requirements of *IBC* Section 2603.8.

9.7. Kingspan GreenGuard® Insulation Boards shall be separated from the interior of the building by an approved thermal barrier except as provided for in Section 5.3.

9.7.1. This product shall not be used as a nailing base for claddings.

9.8. The insulation boards shall not be used to resist lateral loads. Walls shall be braced by other materials in accordance with the applicable code, and the exterior wall covering shall be capable of resisting the full design wind pressure.

9.9. The insulation boards are manufactured in Winchester, VA, under a quality control program with quality control inspections in accordance with *IBC* Section 110.3.8 and 110.3.9.

9.10. When used as part of a continuous air barrier, Kingspan GreenGuard® Insulation Boards shall be a minimum 1" thickness and all sheathing panel edges at the top and bottom of the wall assemblies and all butted joints between sheathing panels shall be sealed with $1^{7}/_{8}$" GreenGuard® Seam Tape or equivalent.

9.11. Design

9.11.1. Building Designer Responsibility

9.11.1.1. Unless the AHJ allows otherwise, the Construction Documents shall be prepared by a Building Designer (e.g., Owner, Registered Design Professional, etc.) for the Building and shall be in accordance with *IRC* Section R106 and *IBC* Section 107.

9.11.1.2. The Construction Documents shall be accurate and reliable and shall provide the location, direction and magnitude of all applied loads and shall be in accordance with *IRC* Section R301 and *IBC* Section 1603.

9.11.2. Construction Documents

[11] The last sentence is adopted language in the 2015 codes.

9.11.2.1. Construction Documents shall be submitted to the Building Official for approval and shall contain the plans, specifications and details needed for the Building Official to approve such documents.

9.12. Responsibilities

9.12.1. The information contained herein is a product, engineering or building code compliance research report performed in accordance with the referenced building codes, testing and/or analysis through the use of accepted engineering procedures, experience and technical judgment.

9.12.2. DrJ research reports provide an assessment of only those attributes specifically addressed in the Products Evaluated or Code Compliance Process Evaluated section.

9.12.3. The engineering evaluation was performed on the dates provided in this TER, within DrJ's professional scope of work.

9.12.4. This product is manufactured under a third-party quality control program in accordance with *IRC* Section R104.4 and R109.2 and *IBC* Section 104.4 and 110.4.

9.12.5. The actual design, suitability and use of this research report for any particular building is the responsibility of the Owner or the Owner's authorized agent, and the report shall be reviewed for code compliance by the Building Official.

9.12.6. The use of this TER is dependent on the manufacturer's in-plant QC, the ISO/IEC 17020 third-party inspection process, proper installation per the manufacturer's instructions, the Building Official's inspection and any other code requirements that may apply to assure accurate compliance with the applicable building code.

10. Identification:

10.1. The insulation boards and building wraps described in this TER are identified by a label bearing the manufacturer's name, product name, label of the third-party inspection agency, and other information to confirm code compliance.

10.2. Additional technical information can be found at www.kingspaninsulation.us.

11. Review Schedule:

11.1. This TER is subject to periodic review and revision. For the most recent version of this report, visit drjengineering.org.

11.2. For information on the current status of this report, contact DrJ Engineering.

- Mission and Professional Responsibilities
- Product Evaluation Policies
- Product Approval – Building Code, Administrative Law and P.E. Law