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May 10, 2008

VIA: Email / Fax

To: ALL CANADIAN NUDURA® CLIENT GROUPS AND DESIGN AND REVIEWING PROFESSIONALS

From: Keven Rector B. Tech.ARSC.ARC, Technical Services Manager, NUDURA® Corporation

RE: VAPOR PERMEANCE OF NUDURA® INSULATED CONCRETE FORMS AND ITS COMPLIANCE WITH SECTION 9.25.4.2 OF THE NBC AND RELATED PROVINCIAL BUILDING CODES

One of the most common questions asked by both design professionals and building officials with respect to ICF construction is whether or not an additional vapor barrier or vapor retarder is required to be applied over the interior surface of the NUDURA® Insulated Concrete Form System.

This communication is issued to provide additional information with respect to the NUDURA® Integrated Building Technology Insulated Concrete Form System and our assertion that provisions for exemption from requirement of vapor barrier application are clearly outlined within Appendix (A) of the National Building Code of Canada under A-9.25.1.2 Page A-175 Division B and A-9.25.1.2 Page A-122 Volume 2 of the 2006 OBC Compendium) under the subtopic of Thermal Insulation which states:

> *"Where low permeance foam plastic insulation is the sole thermal insulation in the building assembly, the temperature of the inner surface of this element will be close to the interior temperature. In this case* ***no additional vapour barrier is needed to control condensation within the assembly due to vapour diffusion."****....*

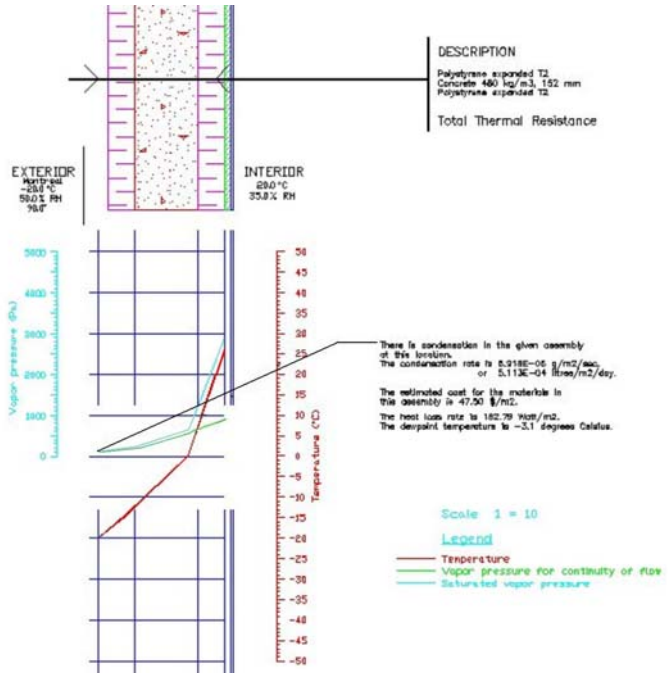
Where questions arise as to whether or not NUDURA® EPS foam qualifies as a low permeance insulation, the information contained in this communication and its attachments should assist the Designer and reviewing Building Official in being able to verify that NUDURA® EPS foam MORE THAN QUALFIES as meeting the requirements of a Vapour Barrier as noted UNDER Section 9.25.4.2 of both the National and Provincial Codes.

As you are already aware, Section 9.25.4.2 states that The MAXIMUM allowable vapor permeance of a wall assembly in Canada under the 2005 National Building Code of Canada and the new 2006 Ontario Provincial Building Code is noted as **60 ng.Pa.s.m^2** (nanograms per Pascal second meter squared) In layman's terms, this means that throughout Canada, a vapor retarder must be able to limit moisture penetration through a 1 meter square (10.76 SF) section of wall area to no more than 60 billionths of a gram (equal to 2.116416 x 10^{-9} of an ounce or .000000216 ounce of moisture) per second of time under a pressure differential of 1 Pascal or 0.000145 PSI. Since 1 Perm = 57.692 ng.Pa.s.m^2 we can therefore calculate that the equivalent maximum vapour permeance allowed under Canadian Code is equal to **1.004 perms**.

This communication verifies that the independent testing agency of ITS/ETL Semko has confirmed in the attached letter that the calculated vapor permeance of 2 5/8" (63.5 mm) thickness of NUDURA® foam on the interior panel of the concrete wall assembly achieves a MAXIMUM Vapor Permeance of **36 ng/Pa.s.m²** which, using the same conversion rate applied above verifies that the Permeance Rating of 2 5/8" (63.5 mm) of NUDURA EPS foam is therefore equal to **0.624 perm** and therefore achieves a resulting vapour permeance performance that is 38**% better than the MAXIMUM allowable vapour permeance set forth by the Canadian Codes.** Remember that this rate has been determined independent of any resistance to vapor permeance that the monolithic concrete wall itself provides within the wall assembly.

In addition, the risk of condensation development within the wall greatly depends upon where dew point will occur within a wall within any design given the most crucial performance conditions.

Below is copy of a "Dew Point" analysis that was performed on a NUDURA® Wall at the following conditions:



Exterior Environment: -4 degrees F, 80% relative humidity
Interior Environment 70 degrees F, 55% relative humidity

In this instance the dew point actually would occur within 1/8" (3.2mm) of the outside face of the exterior insulation panel of the NUDURA® form system.

To better appreciate the vapour retarding capabilities of the NUDURA® Wall system at its verified level of maximum vapour permeance, consider the wall surface of a typical 2 storey 3000 SF Home with a total above grade wall area of 2,945 SF or 274 m^2 wall areas. Using NUDURA's vapour permeance rating noted above as a basis for calculation, the MAXIMUM amount of moisture that could possibly migrate through a NUDURA® wall assembly of this area in a 24 hour period under a 1 Pascal air pressure differential would amount to a total of 0.8523 of a gram (or 0.030 of an once of water) – in fact less than a $1/5^{th}$ of a teaspoon!)*. Compared with the volume of water already contained within the concrete itself, as it cures over time, this amount of water is truly minuscule.

In addition, moisture studies on ICF wall assemblies using software such as "Condense" or "WUFFI" prove that for typical winter conditions for Canada, the dew point on the wall assembly consistently occurs at the exterior face of the exterior insulation panel where there is NO danger of condensation occurring.

*Calculation is based on (274 m^2 of wall area x 86,400 seconds/24 hour period x 36 ng/Pa/sm^2)/ (1 x10^9 Ng/gram of moisture)

Finally, consider the context with which the requirement of vapour barrier has been written into Part 9 of the Code in the first place. The requirement was instituted to protect the elements of the wall assembly that could potentially become susceptible to damage from moisture saturation or dry rot or could potentially propagate mould growth as a result of moisture penetrating the cavity – these most notably being:

(a) Wood Framing/Studs
(b) Steel Framing/Studs
(c) Mineral Wool Type Insulation Materials
(d) Exterior Plywood or OSB Wood Sheathing

All of these building elements are authorized building materials under Part 9 that can become seriously damaged if not protected by a vapour barrier that would prohibit moisture flow out through the wall assembly.

Now, consider the components of a standard NUDURA® Wall Assembly and their performance capability with respect to moisture.

(a) Expanded Polystyrene Foam cannot absorb more than .03% of it's own weight with moisture, does not propagate mould or spore or any other micro organism growth
(b) High Density Polypropylene Webs (Totally inert to moisture)
(c) Concrete (already contains moisture while curing over time – additional moisture simply re-hydrates concrete further) Not susceptible to damage from moisture.
(d) Studies using WUFFI software and thermal coupling show that the concrete core of ICFs never drops below 33 degrees F even in winter temperatures as a result of the room temperature modifying the core temperature of the concrete – thus exhibit no risk due to freezing.

Therefore, NUDURA® asks the approving official to give due consideration to the facts that there is ample evidence to support the elimination of the requirement for additional vapor barriers over our wall system and that their exemption for requirement is already provided for under Appendix Section A-9.25.1.2 of the NBC 2005 (Page A-175 Division B) and similar corresponding appendix sections of all other Canadian Provincial Building Codes.

Should you have any questions please feel free to contact our technical support staff at:

Email: techsupport@nudura.com
Barrie Office: 866-468-6299

Best Regards,

Keven Rector, B. Tech.ARSC.ARC
Technical Services Manager
NUDURA® Corporation

Intertek ETL SEMKO

January 14, 2005

Keven Rector, B. Tech.
Technical Services Manager
NUDURA Corporation

Re: Permeance of EPS @ 2.625" (67 mm)

Dear Mr. Rector,

Upon your request, Intertek has conducted an engineering review of your existing test data to determine the Permeance of the Nudura 2.625" (67 mm) EPS panel.

From Intertek Report 3025950-1, dated July 18, 2002, it is shown that at 25 mm the Permeance is 96 ng/Pa-s-m^2, when tested per ASTM E 96.

Per ASTM E 96, equation 3:	Permeability	= Permeance x Thickness
so,	Permeance	= Permeability / Thickness
where as,	Permeability	= (96 ng/Pa-s-m^2) x (25 mm) = 2400 mm-ng/ Pa-s-m^2
and @ 67 mm,	Permeance	= (2400 mm-ng/Pa-s-m^2) / (67 mm) = 36 ng/Pa-s-m^2

Therefore, the Permeance of your Nudura 2.625" (67 mm) EPS panel is **36 ng/Pa-s-m^2,** when tested and calculated following ASTM E 96. This value is less than the maximum of 45 ng/Pa-s-m^2 requirement in Section 9.25.4.2 of the National Building Code of Canada and respective provincial Codes, therefore satisfying the Code requirement.

If you have any questions or concerns regarding this matter, please do not hesitate to contact the undersigned at 1-800-668-TEST.

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Warnock Hersey

Chris Bowness, P.Eng.
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