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April 29, 2007

To: **ALL AMERICAN 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**

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 (or depending upon geographic location – on the exterior) of the NUDURA™ Insulated Concrete Form System.

The clauses of most American Building Codes (including the International Code Family) are structured in such a way that they provide for the fact that plain and reinforced concrete or masonry walls constructed in accordance with the Code (or constructed of materials that are not susceptible to damage from moisture) are not required to have additional vapor retarder materials applied to them (See IBC Section 1403.3.2 and IRC Section 318.1.1)

In Canada, (where risk of damage from moisture travelling through walls is much more severe than even the southerly climates of the USA), both the National and Provincial Building Codes specifically qualify vapor barrier performance for wall assemblies to a measured numeric standard in terms of "Permeance" or "Perm Rating".

The MAXIMUM allowable vapor permeance of a wall assembly in Canada under the National Building Code of Canada and the 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 in 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 (that's equal to 2.116416 x 10^{-9} of an ounce or .00000000216 ounce of moisture per second of time under a 1 pascal (.02 psf) air pressure differential from inside to outside. Since 1 Perm = 57.692 ng.Pa.s.m^2 we can therefore calculate that the maximum vapor permeance allowed under Canadian Code is equal to **1.004 perms**. To put this into perspective, the vapor retarding element of a Canadian building envelope (be it 6 mil polyethylene film, special paints membranes or an appropriate thickness of EPS foam) must be able to retard moisture to the extent that under .02 psf of air pressure differential, the TOTAL amount of vapor that could migrate through the walls of a typical 2,600 SF home (including the basement walls for this same area (totaling approx. 3,780 SF of wall)) over a 24 hour period- if condensated into liquid, would not exceed .065 oz. of moisture (less than 1/2 teaspoon). This level has been proven to eliminate the build up of condensation- even under extremely cold temperatures of -4 degree F.

This communication verifies that the independent testing agency of ITS/ETL Semko has confirmed in the attached letter that the calculated vapor permeance of a single panel of 2 5/8" thickness of NUDURA foam on the interior (or exterior) of the concrete wall assembly achieves a MAXIMUM Vapor Permeance of 36 ng/Pa.s.m^2 which, using the same conversion rate applied above verifies that the Permeance Rating of 2 5/8" of NUDURA EPS foam is therefore equal to **0.624 perm** and thus, achieves a resulting vapor permeance performance that is **38% better than the MAXIMUM allowable vapor 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.

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

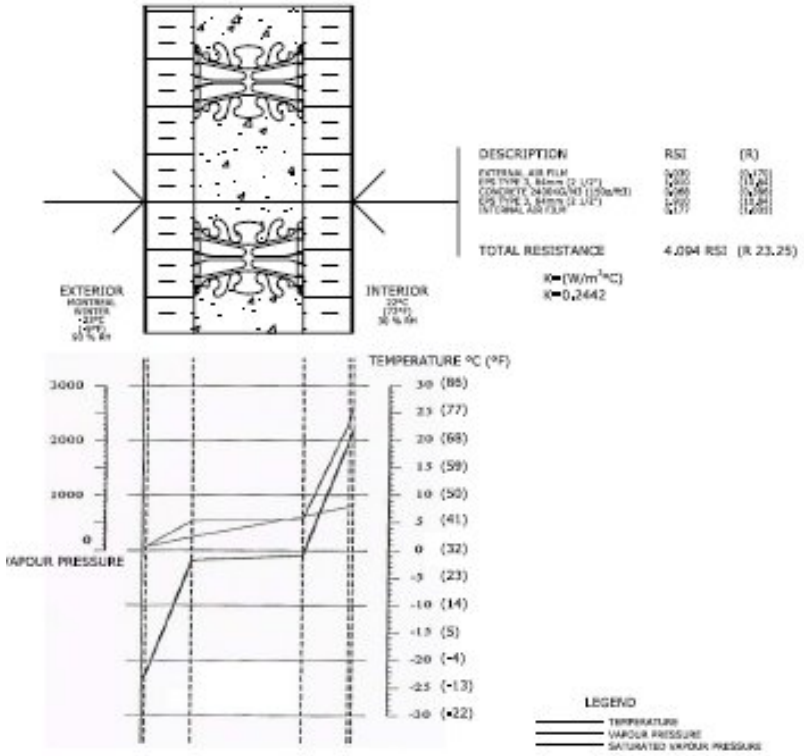
Exterior Environment:

- -4 degrees F,
- 65% relative humidity

Interior Environment

- degrees F,
- 50% relative humidity

The analysis shows the wet bulb temperature and vapor pressure line converging at a position at the very exterior surface of the form thus not within the wall assembly.



Because of the symmetry of design of a NUDURA Wall assembly, the vapor continuity of the EPS foam and its performance is consistent whether the temperature transition is from interior to exterior or vice-versa (as would be the case for a wall assembly facing hot humid conditions in more southerly climates with extreme humidity and interior walls are exposed to cooler air conditions as the result of air conditioning). Dew point analysis of such conditions has been proven to be less severe than the above illustrated condition with no risk of dew point developing within the wall thickness.

Therefore, based on analyses of the NUDURA Wall System's performance as a proven air barrier (as confirmed by CTL Group of Skokie, Illinois) as well as confirmation of the vapor retardant capabilities of the NUDURA's EPS foam panels (as provided by Intertek Testing Services N/A Inc.) when installed in full accordance NUDURA has been proven to not require the application of additional vapor retarders, air barriers or moisture barriers in either northerly or southerly climates.

The combination of 3 moisture INERT materials (EPS foam, Polypropylene Webs and concrete enable the assembly to be installed without the provision of these additional materials without risk of moisture condensation developing within the depth of the wall assembly.

It should be noted however, for above grade applications requiring applications of veneer masonry, the elimination of the need of a moisture barrier or exterior mounted vapor retarder membrane or air barrier does NOT warrant elimination of through-wall flashings at the base of these types of finishes. All base, opening and step wall flashing requirements as provided for within Building Codes MUST be followed by kerf cutting the flashing (continuous) into the foam approx. 6 inches (150mm) above the veneer finish base condition and providing a clear 1 inch (25.4 mm) minimum drainage (pressure equalization) cavity continuously behind the masonry veneer.

In addition, for NUDURA walls being installed to provide for usable floor spaces below grade – such as basements or crawl spaces used for formal continuous storage or mechanical equipment containment, the entire exterior wall surface from grade level to top of footing must be finished with either NUDURA Waterproofing Membrane or an approved equivalent continuous water o damp proofing membrane system.

Any questions with respect to this documentation should be directed to our technical support staff through your local NUDURA distributor.

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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