

# CCMC 14152-R

## CCMC Canadian code compliance evaluation

<b>CCMC number:</b>	14152-R
<b>Status:</b>	Active
<b>Issue date:</b>	2020-04-29
<b>Modified date:</b>	2024-02-14
<b>Evaluation holder:</b>	<p><b>BASF Canada Inc.</b>            10 Constellation Court            Toronto ON M9W 1K1            Canada            Website: <a href="http://www.basf.com">www.basf.com</a>            Telephone: 289-360-1300</p>
<b>Product name:</b>	WALLTITE® CM01 (Radon Control)
<b>Compliance:</b>	NBC 2015, OBC
<b>Criteria:</b>	CCMC-TG-072623.01-15, "CCMC Technical Guide for Medium Density (MD) Spray Polyurethane Foam Insulation (SPUF) for Soil Gas (Radon) Control beneath Concrete Slabs-on-Ground"

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## Compliance opinion

It is the opinion of the Canadian Construction Materials Centre that the evaluated product, when used as a soil gas (radon) barrier in accordance with the conditions and limitations stated in this evaluation, complies with the following code:

### National Building Code of Canada 2015

Code provision	Solution type
9.13.4.2.(1) All wall, roof and floor assemblies sepa ...	<u>Acceptable</u>
9.25.3.6.(1) Materials used to provide a barrier to t ...	<u>Alternative</u>

### Ontario Building Code

Ruling No. 21-01-364 (14152-R) authorizing the use of this product in Ontario, subject to the terms and conditions contained in the Ruling, was made by the Minister of Municipal Affairs and Housing on 2021-03-12 pursuant to s.29 of the Building Code Act, 1992 (see Ruling for terms and conditions). This Ruling is subject to periodic revisions and updates.

The above opinion(s) is/are based on the evaluation by the CCMC of technical evidence provided by the evaluation holder, and is bound by the stated conditions and limitations. For the benefit of the user, a summary of the technical information that forms the basis of this evaluation has been included.

# Product information

## Product name

WALLTITE® CM01 (Radon Control)

## Product description

The product is an under-slab barrier designed to restrict naturally occurring radon gas from migrating through the ground and concrete slab. It is a closed-cell, spray-applied rigid polyurethane foam of medium density, evaluated under CCMC 14100-L, and consists of two components that must be labelled as follows:

- Isocyanate (Component A): Elastospray® 8000A isocyanate; and
- Resin (Component B): Walltite® CM01 resin

The two components are mixed on site by BASF Canada Inc.-qualified installers (see Qualified installers section below) with fixed-ratio positive displacement equipment. The colour of the final cured product is purple.

## Qualified installers and site quality assurance program (SQAP)

WALLTITE® CM01 for radon control is a site-manufactured product, whereby BASF Canada Inc. requires that only specific qualified installers be authorized to install their proprietary spray polyurethane insulation in buildings. In accordance with the BASF Canada Inc. site quality assurance program (SQAP), the certification organization (CO) Caliber Quality Solutions Inc. (Caliber) has been commissioned to license the specified installers and issue them the requisite Caliber identification card. Note that the training and installer certification to install WALLTITE® CM01 for radon control is in addition to the base Caliber/BASF Canada Inc. training for the spraying of polyurethane foam as a thermal insulation only in accordance with CAN/ULC-S705.2-05(R2016), “Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density – Application”). As part of their SQAP, BASF Canada Inc. also stipulates site audit inspections be conducted by site inspectors licensed by Caliber. Upon completion of the site audit, Caliber will report the product’s conformity results and any corrective action required, if necessary, to BASF Canada Inc. Building officials who would like site-audit inspections to be conducted on specific building sites can contact Caliber (see details in CCMC 14100-L).

All specified installers must present a Caliber identification card to the building official that indicates the installer is certified to install the spray foam for both intended functions; that is, as a thermal insulation (CAN/ULC-S705.2-05(R2016)) and as an air/radon barrier.

## Thickness – spray foam and gravel drainage layer

The WALLTITE® CM01 for radon control requires a minimum of 50-mm spray polyurethane to be installed. The spray polyurethane may be sprayed directly over the NBC-specified 100-mm gravel bed or onto a geotextile. When applied directly over the gravel bed, the foam resin may penetrate up to 15 mm into the cavities between the surface gravel. For direct gravel applications, the gravel bed shall be increased to 115 mm to ensure a minimum 100-mm gravel bed as the gas-permeable layer to evacuate the radon gas.

## Radon resistance

It should be noted that Sentence 9.13.4.2.(1) of Division B of the NBC 2015 requires an effective air barrier system be installed as a barrier to soil gas. WALLTITE® CM01 has been evaluated beyond the qualification as an air barrier system required by the NBC 2015 for soil gas, as outlined in the "Other technical evidence" section of this Report, as WALLTITE® CM01 has qualified as an effective barrier to, specifically, radioactive radon. WALLTITE® CM01, when installed at 50 mm, shows better resistance to radon than 6-mil polyethylene (that is, the NBC 2015 benchmark acceptable solution).

## Manufacturing plants

This evaluation is limited to products produced at the following plants:

Product name	Manufacturing plants	
	Blackie, AB, CA	Toronto, ON, CA
WALLTITE® CM01 (Radon Control)	☑	☑

☑ Indicates that the product from this manufacturing facility has been evaluated by the CCMC

## Conditions and limitations

The CCMC's compliance opinion is bound by this product being used in accordance with the conditions and limitations set out below.

- The system must be applied on site by qualified installers who are BASF-trained and Caliber-certified and who possess a Caliber identification card. <sup>(1)</sup> The SQAP and installation manual shall be available on site for review by the local authority having jurisdiction (AHJ).
- The thickness of the specified medium-density spray polyurethane foam shall be a minimum of 50 mm when installed over geotextile. When sprayed directly onto the gravel, the NBC-specified 100-mm gravel bed shall be increased to 115 mm. Per Sentence 9.16.2.1.(1), Required Installation of Granular Material, of Division B of the NBC 2015, the specified gravel shall consist of coarse, clean granular material containing not more than 10% of material that will pass a 4 mm sieve.
- A minimum of 24 hours shall pass before the installation of the 100-mm concrete floor slab.
- As with the 6-mil polyethylene sheet, care shall be taken to not damage the spray polyurethane surface during the installation of the concrete slab; in particular, damage from any reinforcement mesh.
- WALLTITE® CM01 has shown ability to seal around penetrations of 100-mm ABS, PVC and steel pipes, and 6.35 mm copper pipes, without need for sealant. Other materials may require additional sealant (that is, polyethylene pipes).

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### Note

- <sup>1</sup> Periodic site-audit inspections of the installer are conducted by Caliber. Building officials may contact Caliber (telephone: 888-572-7435) and require an inspection for a specific job site if the building official deems it necessary.
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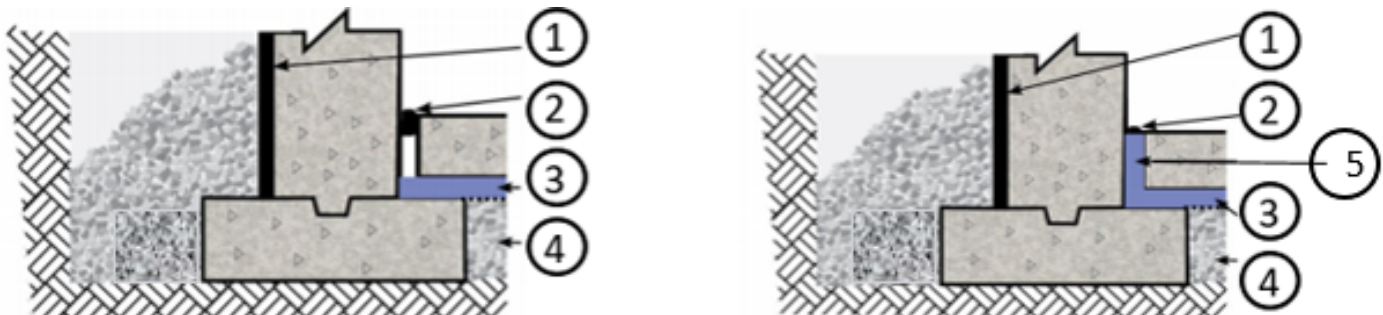


Figure 1. Application of WALLTITE® CM01 for radon control beneath concrete slab, with geotextile/100 mm gravel or without geotextile/115 mm gravel bed.

1. Exterior wall damp proofing
2. Flexible sealant (as per NBC)
3. WALLTITE® CM01
4. 100 mm granular fill with geotextile, or 115 mm granular fill
5. WALLTITE® CM01 as a thermal break

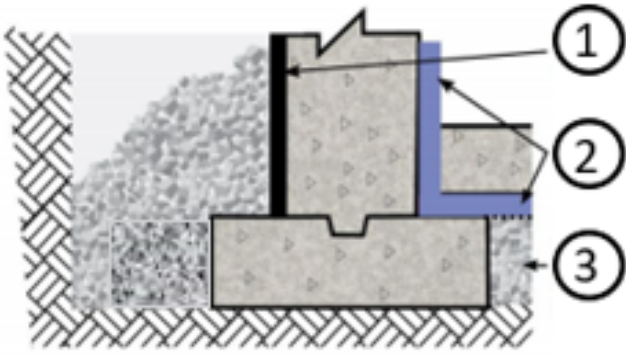


Figure 2. Application of WALLTITE® CM01 for radon control beneath concrete slab, with geotextile/100 mm gravel or without geotextile/115 mm gravel bed.

1. Exterior wall damp proofing
2. WALLTITE® CM01
3. 100 mm granular fill with geotextile, or 115 mm granular fill

# Technical information

This evaluation is based on demonstrated conformance with the following criteria:

Criteria number	Criteria name
CCMC-TG-072623.01-15	CCMC Technical Guide for Medium Density (MD) Spray Polyurethane Foam Insulation (SPUF) for Soil Gas (Radon) Control beneath Concrete Slabs-on-Ground

The Report Holder has submitted technical documentation for CCMC's evaluation. Testing was conducted at laboratories recognized by CCMC. The corresponding technical evidence for this product is summarized below.

## Performance requirements

The following were the key performance requirements for the evaluation:

- Material qualification:** Medium-density spray polyurethane foam (SPUF) complying with CAN/ULC-S705.1, and installation as per CAN/ULC-S705.2. Confirmed through possession of active CCMC Listing;
- Air barrier system:** The air barrier system for floors-on-ground qualification through testing. The NBC 2015 benchmark is 6-mil polyethylene as per Sentence 9.25.3.6.(1) of Division B of the NBC 2015;
- Soil gas barrier:** The barrier performance against soil gas, specifically radon, based on qualification testing, small-scale and large-scale. The NBC 2015 benchmark is 6-mil polyethylene as per Sentence 9.13.4.2.(1) of Division B of the NBC 2015, referring to Sentence 9.25.3.6.(1);
- Resistance to mechanical damage:** Repeat small-scale radon-barrier testing with indented SPUF by simulated concrete pour/workman load damage.
- Dampproofing:** The dampproofing function as a requirement for the SPUF beneath the slab is optional, as dampproofing is waived when 100 mm of coarse, clean granular material is installed beneath the slab as per Clause 9.13.2.1.(3)(c), Required Dampproofing, of Division B of the NBC 2015. See the Other technical evidence (optional testing) section.

**Table 1. Material qualification**

SPUF product CAN/ULC-S705.1 compliance	Thermal insulation in field (CAN/ULC-S705.2) site quality assurance program (SQAP)	Radon barrier in field WALLTITE® CM01 site quality assurance program (SQAP)
CCMC 14100-L (WALLTITE® CM01)	BASF-trained and Caliber-certified installers	BASF-trained and Caliber-certified installers

**Table 2. Air barrier system performance**

Material	Test procedure	Unit	Requirement	Result
SPUF product CCMC 14100-L sealing around pipe penetrations <sup>(1)</sup>	ASTM E 2178/D 2178M-13 <sup>(1)</sup>	L/(s·m <sup>2</sup> )	0.02 <sup>(2)</sup>	0.0074 – 0.0099 <sup>(3)</sup>
6-mil polyethylene	NBC 2015 Table A-9.25.5.1. <sup>(1)</sup>	L/(s·m <sup>2</sup> )	NBC-acceptable solution benchmark	negligible

### Notes

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- 1 The tested 1 m × 1 m specimens of 50-mm-thick SPUF contained a 100-mm-diam ABS pipe and a 100-mm steel pipe to verify the SPUF sealing to elements that may penetrate WALLTITE® CM01 in the field. The 6-mil polyethylene with a pipe penetration and tape/sealant was not tested.
- 2 The derivation of the criterion is based on the permitted air leakage of a fixed window per length of seal/joint (that is, 0.068 L/s/m). The circumference of the 100-mm pipe is 319 mm, resulting in a criterion of 0.319 m × 0.068 l/s/m = 0.0217 L/s.
- 3 Although this air leakage performance is not as low as the negligible performance for a 6-mil polyethylene sheet without a pipe penetration, this air leakage performance is still extremely low. This testing used air as the medium to compare SPUF to 6-mil polyethylene, the comparison in the table Radon barrier performance for BASF SPUF product CCMC 14100-L at 50-mm thickness below using radioactive radon (Rn) gas as the medium for comparison is the key performance indicator for evaluating/comparing the performance as a barrier to radon gas.

**Table 3. Radon barrier performance for BASF SPUF product CCMC 14100-L at 50-mm thickness**

Property	Unit	Requirement <sup>(1)</sup>	Result
<b>Small-scale tests</b>			
<b>Radon diffusion coefficient (D) <sup>(2)</sup></b>	m <sup>2</sup> /s	< 8.05 × 10 <sup>-12</sup> m <sup>2</sup> /s 6-mil polyethylene NBC benchmark	negligible <sup>(3)</sup>
<b>Radon resistance (R<sub>radon</sub>) <sup>(4)</sup></b>	s/m	≥ 1.90 × 10 <sup>7</sup> s/m 6-mil polyethylene NBC benchmark	– <sup>(3)</sup>
<b>Radon diffusion coefficient (D) after mechanical damage</b>	m <sup>2</sup> /s	< 8.05 × 10 <sup>-12</sup> m <sup>2</sup> /s 6-mil polyethylene NBC benchmark	1.59 × 10 <sup>-10</sup> <sup>(5)</sup>
<b>Radon resistance (R<sub>radon</sub>) after mechanical damage</b>	s/m	≥ 1.90 × 10 <sup>7</sup> s/m 6-mil polyethylene NBC benchmark	8.48 × 10 <sup>9</sup>
<b>Large-scale tests</b>			
<b>Radon infiltration (BASF WALLTITE® CM01 and floor assembly)</b>	%	< 6.6 % (RnR/RnD) <sup>(6)</sup> 6-mil polyethylene NBC benchmark	2.0

**Notes**

- 1 The radon diffusion coefficient represents a material property that depends primarily on its chemical composition and is not affected by its thickness. A new product parameter known as radon resistance was defined in order to more accurately evaluate the effectiveness of material in reducing or preventing radon entry. Materials with higher radon resistance are considered less permeable to radon and therefore can prevent or reduce radon entry more effectively.
- 2 Testing was conducted using NRC Radon Diffusion Test Chamber (RDTC) (see Appendix A for schematic of test apparatus).
- 3 The radon diffusion coefficient for the SPUF products could not be obtained, and, as such, the radon resistance could not be calculated, since no significant amount of radon diffused through the SPUF samples during the radon diffusion tests. Therefore, the SPUF at 50-mm thickness is better than the 6-mil polyethylene benchmark as a barrier to radon in this small-scale test.
- 4 Testing was conducted using NRC Radon Infiltration Building Envelope Test Systems (RIBETS) (see Appendix A for schematic of test facility).



- 5 A comparison between the radon diffusion coefficients of material of different thicknesses may not represent the effectiveness of a material in reducing or preventing radon entry. The calculated radon resistance of the WALLTITE® CM01 SPUF sample after mechanical damage is the preferred property for assessing the performance.
- 6 The radon-measured levels ratio ( $R_{nR}/R_{nD}$ ) is for comparison of the alternative solution to the benchmark acceptable solution. The numerator with subscript "R" represents the radon in the receiving chamber. Therefore, the SPUF at 50-mm thickness is better than the 6-mil polyethylene benchmark as a barrier to radon in this large-scale test, which is representative of the installation in the field.

## Other technical evidence

## Additional performance data requested by the Report Holder

Data in this section does not form part of CCMC's opinion in the [code compliance opinion](#) section.

## Dampproofing (optional)

**Table 4. Dampproofing performance of SPUF <sup>(1)</sup>**

Property	Unit	Test procedure	Requirement	Result
<b>Coefficient of water absorption @ 72-h</b> <sup>(1)</sup>	kg/(m <sup>2</sup> · s <sup>1/2</sup> )	ISO 15148:2002	< 0.0040	0.0002
<b>Water vapour permeance</b>	ng/(Pa·s·m <sup>2</sup> )	ASTM E 96/E 96M, Procedure B (wet cup method)	≤ 43	46.08 <sup>(2)</sup> <sub>(3)</sub>

### Notes

- 1 Minimum 72 hours as per ISO 15148:2002, "Hygrothermal performance of building materials and products – Determination of water absorption coefficient by partial immersion." The criterion has been met, which demonstrates that the polyurethane surface provides good water resistance.
- 2 The ASTM E 96/E 96M-13, "Water Vapor Transmission of Materials," specimens were selected from three (3) 1 m × 1 m sprayed panels of 50-mm thick and tested with skins removed, resulting in 40-mm thick tested specimens with a water vapour permeance of 57.6 ng/(Pa·s·m<sup>2</sup>). As is it a homogenous material, the water vapour permeance of the 50-mm thick foam can be estimated to be approximately 46 ng/(Pa·s·m<sup>2</sup>).
- 3 The criterion specified in Section 8.1.6, Dampproofing (Optional), of the CCMC Technical Guide has not been met at the 50-mm thickness with the top and bottom skins removed. For the product to meet the criterion, the thickness shall be increased proportionally (i.e., add: [(46.08-43)/46.08] × 50 mm = 3.34 mm).

# NRC Construction Research Centre Radon Testing Facilities

## (1) Small-scale Tests Radon Diffusion Test Chamber (RDTC)

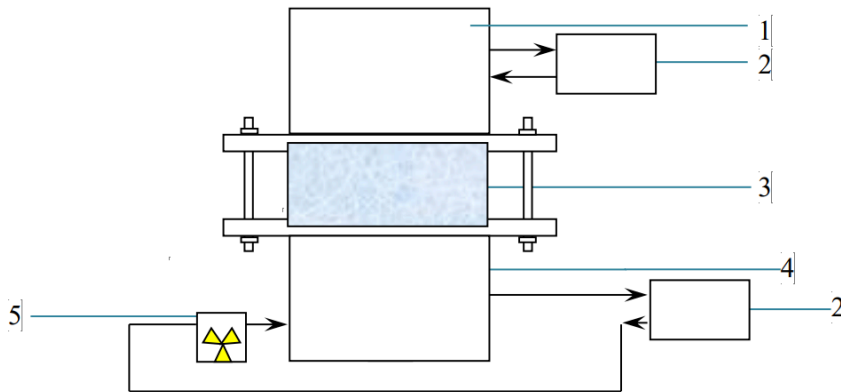


Figure 3. Schematic of RDTC

1. Receiving compartment
2. Radon monitor
3. Test sample
4. Dosing compartment
5. Radon source

## (2) Large-scale Tests Radon Infiltration Building Envelope Test Systems (RIBETS)

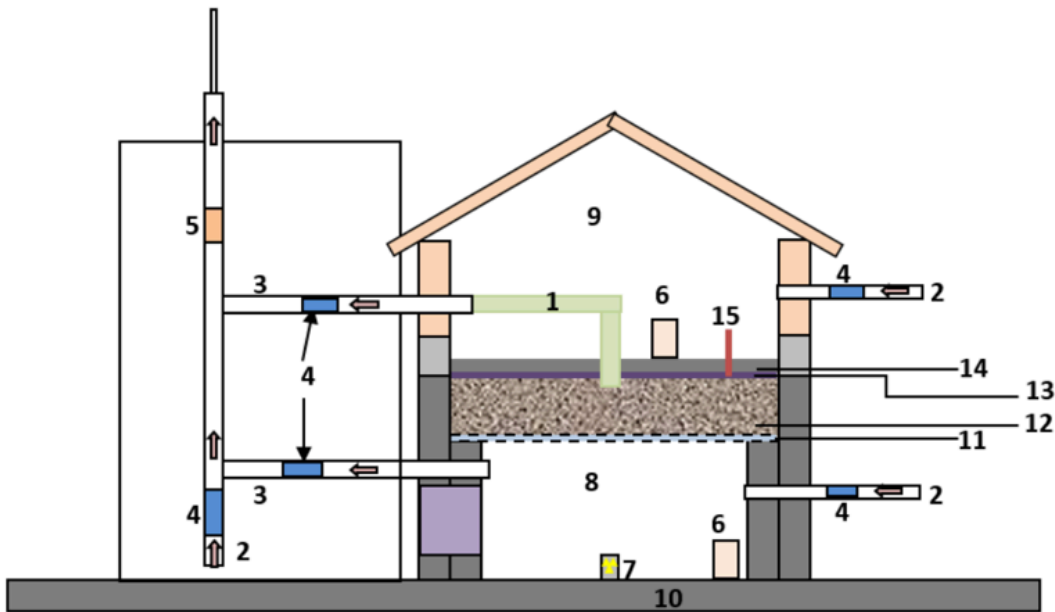


Figure 4. Conceptual design of the RIBETS

1. Sub-slab radon (Rn) exhaust stack (100 mm PVC pipe)
2. Make-up air stack
3. Exhaust stack
4. Control damper
5. In-line fan
6. Baseboard heater

7. Radon source
8. Dosing compartment
9. Receiving compartment
10. Concrete pad
11. Perforated stainless steel plate
12. Gravel (100 mm), specification as per NBC 2015
13. Air barrier (6-mil polyethylene or spray foam products)
14. Concrete slab (101.6 mm)
15. Copper tubing for pressure measurement

## Administrative information

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(Alliance of Canadian Building Official Associations (ACBOA))

First Nations National Building Officers Association (FNNBOA)



(First Nations National Building Officers Association (FNNBOA))

Canadian Home Builders' Association (CHBA)



(Canadian Home Builders' Association (CHBA))

Alberta Building Officials Association (ABOA)



(Alberta Building Officials Associations (ABOA))

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# Code compliance as an acceptable solution

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## Code Compliance via Acceptable Solutions

If a building design (e.g. material, component, assembly or system) can be shown to meet all provisions of the applicable **acceptable solutions** in Division B (e.g. it complies with the applicable provisions of a referenced standard), it is deemed to have satisfied the objectives and functional statements linked to those provisions and thus to have complied with that part of the Code.

— National Building Code of Canada, Sentence A-1.2.1.1.(1)(a)

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Acceptable Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

### CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

- complying with the applicable acceptable solutions in Division B, or
- using an alternative solution that will achieve at least the minimum level of performance required by Division B in the areas defined by the objective and functional statements attributed to the applicable acceptable solutions.

The CCMC assesses compliance with Canadian building, energy and safety codes, and is trusted by over 6,000 regulators across Canada.

# Code compliance as an alternative solution

## Code Compliance via Alternative Solutions

Where a design differs from the acceptable solutions in Division B, then it should be treated as an **"alternative solution."** A proponent of an alternative solution must demonstrate that the alternative solution addresses the same issues as the applicable acceptable solutions in Division B and their attributed objectives and functional statements. However, because the objectives and functional statements are entirely qualitative, demonstrating compliance with them in isolation is not possible. Therefore, Clause 1.2.1.1.(1)(b) identifies the principle that Division B establishes the quantitative performance targets that alternative solutions must meet. In many cases, these targets are not defined very precisely by the acceptable solutions [...] Nevertheless, Clause 1.2.1.1.(1)(b) makes it clear that an effort must be made to demonstrate that an alternative solution will perform as well as a design that would satisfy the applicable acceptable solutions in Division B—not “well enough” but “as well as.”

— National Building Code of Canada, Sentence A-1.2.1.1.(1)(b)

The CCMC has determined that compliance with this provision of the Code has been demonstrated as an **Alternative Solution**. The evaluation report provides a summary of the basis of CCMC's compliance opinion.

### CCMC's code compliance opinions

All CCMC evaluation reports are opinions of code compliance established in accordance with the National Building Code of Canada, Subsection 1.2.1. "Compliance with this Code," which requires compliance to be achieved by:

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