



## Determination 2015/048

# Regarding the compliance with the Building Code of proposed retrofitted urea formaldehyde foam wall insulation in a 60-year-old weatherboard clad house at 26 Porritt Street, Paeroa

### Summary

This determination considers whether there was sufficient information provided in a building consent application to establish the compliance of the proposed building work. The determination discusses the approach to be taken in assessing alterations to existing buildings against the requirements of the Building Act, and applies this in respect of the proposed retrofitting of urea formaldehyde foam insulation to the 60-year-old weatherboard clad house.

### 1. The matter to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004<sup>1</sup> (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations and Assurance, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry.

1.2 The parties to the determination are:

- The owners of the property, E & G Fenton (“the applicants”) acting through the insulation installer as their agent. The installer also represented the applicants for the purposes of the building consent application.
- Hauraki District Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.

1.3 The determination arises from a decision made by the authority to refuse to grant a building consent for proposed building work that consisted of retrofitting urea formaldehyde foam insulation (“the insulation”) in the external walls of the applicants’ house. Based on the information provided in the consent application the authority was not satisfied on reasonable grounds that compliance with the relevant clauses<sup>2</sup> of the Building Code (Schedule 1, Building Regulations 1992) had been demonstrated.

1.4 The matter to be determined<sup>3</sup> is whether the proposed building work complies with the Building Code. In making my decision I have considered whether there was sufficient information in the building consent application to form a view on reasonable grounds that the proposed building work and the existing building as altered would comply

<sup>1</sup> The Building Act, Building Code, compliance documents, past determinations and guidance documents issued by the Ministry are all available at [www.building.govt.nz](http://www.building.govt.nz) or by contacting the Ministry on 0800 242 243.

<sup>2</sup> In this determination, unless otherwise stated, references are to sections of the Building Act and references to clauses are references to the Building Code.

<sup>3</sup> Under section 177(1)(a) of the Act.

with the Building Code to the extent required by the Act if completed in accordance with the plans.

- 1.5 In making my decision, I have considered the submissions of the parties, and the other evidence in this matter.

## **2. The building work**

- 2.1 The house was built sometime around the 1950s. It is a single-level detached townhouse, built on perimeter and internal timber piles, with timber subfloor and framing. Given the age of construction, I consider it is like that the framing timber is untreated Rimu or Pine sapwood.
- 2.2 The house is clad in timber weatherboards, directly fixed to the framing, without the use of building paper. The weatherboards were described in the insulation installer's assessment as being 'in good condition with no evidence of rot', and I assume the weatherboards are untreated painted bevel back timber.
- 2.3 The house appears from photos to have aluminium joinery throughout and is fully lined with plasterboard. The roof appears from photographs to be concrete tiles, with eaves projections of approximately 400mm.
- 2.4 The building work consists of making a series of 25mm holes in the external walls and pumping the insulation into the walls to improve the thermal performance of the house. The holes in the external walls are subsequently plugged and a drying regime is followed while the insulation cures.

## **3. Background**

- 3.1 On 16 September 2014 the insulation installer applied for a building consent on behalf of the applicants to retrofit insulation into the walls of the applicants' house. The application sets out the scope of the building work, stating that it consists of
- Drill a series of holes through the external timber weatherboard cladding. Fill wall cavity with [proprietary insulation] material to improve thermal efficiency. This will require the holes to be plugged, sealed, sanded and primed, ready for new paintwork.
- 3.2 The documents that were part of the building consent application, were
- proof of ownership
  - a 'summary assessment of existing building suitability; which noted that no work was required prior to the installation of the insulation, and that the exterior must be sealed (i.e. painted) by the applicants after the holes have been filled
  - a 'report of assessment of existing building', completed following an inspection of the applicant's house to determine if it was suitable to have insulation installed ("the inspection"). The report covered items relating to the performance of the existing building, including the electrical wiring, fire rated walls, fixed appliances and smoke alarms, structural stability, internal moisture and weathertightness
  - a floor plan indicating locations of three moisture readings taken and the location of windows and an existing smoke alarm
  - photographs of the exterior of the house

- a compliance statement, documenting how the building work and existing building would achieve compliance with clauses B1, B2, C2, C3, E2, F2, F7, G9 and H1 of the Building Code
  - a copy of the proprietary insulation supplier's manual ("the manual"), version 5.0 dated March 2013
  - an agreement to provide a Producer Statement Construction – PS3
- 3.3 The application also referred to a number of previous Determinations available on the Ministry's website that included consideration of compliance for proposed retrofitting of urea formaldehyde foam insulation in houses with various types of cladding systems.
- 3.4 In addition, the insulation installer set out the documentation that would be filed with its application for a code compliance certificate for the building work, which included
- results from invasive moisture testing carried out to ensure construction moisture was dissipating
  - statement that the installation holes had been properly repaired
  - statement that there was an absence of odour
  - statement that work identified in the summary report had been completed.
- 3.5 On 7 October 2014, the authority wrote to the insulation installer to request further information. The letter noted that an error had been made in the consent application as it had been marked with the Acceptable Solution to be used as a means of establishing compliance when the proposed installation was an alternative solution.
- 3.6 The authority went on to state that the application provided sufficient information in respect of compliance with Clauses E2 and F7, but that
- A compliance path has not been established in respects to the following code clauses:
- a) B1 Structure
  - b) B2 Durability
  - c) F2 Hazardous building materials
  - d) H1 Energy efficiency
- 3.7 I have seen no further correspondence between the parties, however in responding to a request by me for more information the authority stated that a further request for information was sent by the authority on 1 December 2014, and that the authority also wrote to the installation installer on 14 April 2015 to advise that insufficient information had been supplied to support the application for building consent.
- 3.8 The application for a determination was received by the Ministry on 16 April 2015.
- 3.9 On 1 May 2015 I wrote to the authority seeking further information on the assessment the authority had undertaken in regards to the proposed building work on this particular building, and on what basis the authority considers the consent application had not established compliance, referring to specific building elements where appropriate and referencing either section 112 or section 17. I consider that this information should have been provided to the applicant in order that the applicant would have the opportunity to address concerns the authority held regarding compliance to the extent required by the Act.

3.10 The authority responded by email on 15 May 2015 as follows (in summary):

B1 Structure / B2 Durability

...structural and durability performance of existing building elements will be reduced when building elements come into contact with the [proprietary] foam wall insulation system given the high moisture content of the product

Manufacturers of plaster board, timber framing, timber weather board cladding all required for the products to be kept dry

...[the] consent application calls for monitoring of the moisture levels after the consent has been issued

The [proprietary] insulation system has not demonstrated that condensation, fungal growth or the degradation of building elements will not happen. No evidence has been provided to show this will not happen.

F2 Hazardous building materials

The [approach outlined in the consent documentation] does not identify the amount of formaldehyde present at the time of installation ... it does not identify the rate of formaldehyde dissipation expected by way of test result (sic) from previous installations.

[The consent application has] not stated what levels of formaldehyde are contained in [the proprietary insulation]. ... no evidence has been provided to show the product will meet the acceptable level set by the Ministry.

No test results in regards to volatile organic chemical emissions have been provided for the [proprietary] insulation.

H1 Energy efficiency

1. New building work must comply with the Building code. Insulation of external walls is new building work. No test results have been supplied to show that [the proposed insulation] meets the requirements of H1 energy efficiency in respect to R values.
2. In samples tested by BRANZ every example of the product when installed experienced cracking, shrinkage and voids.

The authority noted that BRANZ study reports 233 and 234 had been considered as part of the technical assessment of the application, along with a recent determination.

3.11 I note here that the authority's response also referred to Clause E2; however this conflicts with its earlier advice to the insulation installer that the application had provided sufficient evidence to establish compliance with Clause E2.

3.12 On 4 June 2015 I requested confirmation from the authority that the documents provided in support of the building consent application were the same as those provided in the determination application. The authority confirmed that was the case and reiterated that in the authority's view the compliance path was not clearly identified in the application.

## 4. The submissions

4.1 The application included copies of the following documents:

- The building consent application which included the covering letter to the application and supporting documents referred to in paragraphs 3.2 and 3.4:
- The letter from the authority dated 7 October 2014
- A 'Summary of Airfoam Determinations' from the Ministry, dated 26 May 2014

- Determination 2013/050
- 4.2 The authority acknowledged the application for determination by returning a completed form, and provided information in response to my requests as noted in paragraphs 3.10 and 3.12 above.
- 4.3 A draft determination was issued to the parties for comment on 8 July 2015.
- 4.4 In a response received on 13 July, the authority accepted the draft without further comment.
- 4.5 A response was received from the agent acting for the owners on 30 July 2015. The agent accepted the draft, subject to the following comment (in summary):
- The agent had visited the property and took new moisture readings, all of which were below 16%. The lower readings are likely due to a heat pump that was installed after the initial investigation.
  - The ‘Summary assessment of existing building suitability’ confirmed the applicants are aware of the ventilation requirements and that the electrical wiring is PVC. However if required the floor plan can be resubmitted to indicate the reduced moisture readings and the external ventilated openings, and a photo provided to confirm presence of PVC wiring.
- 4.6 The agent also noted that relevant adjustments to the installer’s documentation would be made to take into account the discussion in this determination.

## 5. Discussion

### 5.1 The approach for assessing the matters to be determined

- 5.1.1 I have issued a number of determinations about the requirements of the Act, as they relate to alterations to existing buildings, including repairs and remedial work. These determinations include 2010/130, 2010/139, 2010/080, 2011/117, 2012/026 and 2012/027. The Ministry has also issued guidance under section 175 of the Act on Building Code compliance for retrofitting insulation in external walls that is relevant to this determination.
- 5.1.2 As established in the earlier determinations, the Building Code obligations for the building work (the installation of the insulation) that falls under section 17 of the Act are clauses B2.3.1, E2.3.2, E2.3.6, and F2.3.1.
- 5.1.3 The relevant Building Code obligations as required by section 112 that relate to compliance of the existing building are B1.3.1, B2.3.1, C2, C3, E2.3.2, E2.3.5, G9 and H1.
- 5.1.4 The authority has stated in its email of 15 May 2015 the insulation must comply with H1 to the extent required by section 17 of the Act. I disagree with the authority’s approach in that respect. I continue to hold the views expressed in a previous determination<sup>4</sup>, where I stated

6.3.3 Clause H1.3.2E requires that ‘Buildings must be constructed to ensure that their building performance index does not exceed 1.55’; this clause is relevant to the performance of buildings. Therefore Clause H1.3.2E is not applicable to the retrofitting of insulation as this building work is an alteration to the existing thermal envelope, but not a replacement of the thermal envelope. Accordingly the performance of the retro-fitted insulation need only comply to the extent required by

<sup>4</sup> Determination 2013/078 The code-compliance of retrofitting foam wall insulation in a split-stone veneer house at 75 Thurleigh Grove, Karori, Wellington *Ministry of Business, Innovation and Employment* 12 December 2013

section 112(1)(b), in that the thermal envelope must be no worse than before the alteration.

## 5.2 The 'new' building work (section 17)

5.2.1 The relevant Building Code requirements under section 17 of the Act that relate to the installation of the insulation are B2.3.1, E2.3.2, E2.3.6, and F2.3.1. I discuss each in the paragraphs below:

### *Clause E2 – External moisture*

5.2.2 With respect to Clause E2.3.2 and E2.3.5, the compliance requirements are:

- Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to building elements or both.
- Excess moisture present at the completion of construction must be capable of being dissipated without permanent damage to building elements.

5.2.3 I am satisfied that the process generally described in the building consent application to make good the penetrations to the external envelope and the process described for monitoring post-construction moisture levels are acceptable. In this case however there is no building paper present in the building envelope and I note that this may impact on ventilation and the time before the insulation fully cures. In addition the apparent lack of building paper means the applicator would need to fill any gaps to the exterior, such as under window sills, to prevent leakage.

### *Clause F2 – Hazardous building materials*

5.2.4 The compliance requirements under clause F2.3.1 are that

... the quantities of gas, liquid, radiation or solid particles emitted by materials used in the *construction of buildings*, shall not give rise to harmful concentrations at the surface of the material where the material is exposed, or in the atmosphere of any space.

5.2.5 In its email of 15 May 2015 the authority has expressed concerns regarding the evidence pertaining to the levels of formaldehyde from the insulation at the time of installation, the rate of dissipation expected, and how it will be established that the product will meet the acceptable level set by the Ministry.

5.2.6 In response I quote from the Ministry's guidance document on retrofitting insulation:

A number of different chemicals are used in various types of insulation materials and in the binders that hold some types of insulation together. While such chemicals can be hazardous in high concentrations, generally the concentrations that are associated with thermal insulation are not high enough to be considered problematic. Formaldehyde is such an example, and while relatively common in many different building products it is generally not found in sufficiently high concentrations to be considered hazardous.

5.2.7 Taking into account previous determinations, I have formed the view that the process described for monitoring post-construction formaldehyde levels is acceptable.

5.2.8 In the consent documentation provided to the authority the supplier's manual outlined the steps to be taken to ventilate the house to remove odours or concentrates released from the insulation, and a procedure<sup>5</sup> for what will happen if there are any post-installation issues with smell indicating formaldehyde levels are not returning to ambient house levels. The manual also included the article *Health effects of urea*

<sup>5</sup> I note here that the installer should satisfy themselves as to the document being up to date and information contained within it remaining relevant since it was last updated.

*formaldehyde foam insulation: evidence of causation*<sup>6</sup> which discussed levels of formaldehyde over time in a number of studies.

- 5.2.9 However, I note that the installer has not followed the supplier's manual. The manual states that 'at the pre-installation building assessment the [insulation] installer will have

Agreed with the owner which windows/doors would be left ajar or opened ...

[And] identified where the openings will be on the floor plan of the consent drawing and obtain the owners signature of approval.

- 5.2.10 A site plan has been included in the consent application that shows the location of windows and doors only; there is no indication of which of these are to be left open. Though the owner has signed against the statement that 'owner understands the importance of ventilation' there is no signature indicating the owner's agreement in regards to which of the windows/doors are to be left ajar or opened after the insulation has been installed.

- 5.2.11 In this respect I consider the applicant did not provide sufficient information to establish on reasonable grounds that the building work would comply with Clause F2.3.1.

*Clause B2 – Durability*

- 5.2.12 Clause B2.3.1 requires building elements must continue to satisfy the performance requirements of the Building Code for the periods set out in B2.3.1.

- 5.2.13 I have received no information to indicate that the insulation once installed will not meet the requirements of the clauses discussed above for the periods set out in Clause B2.3.1.

### **5.3 The existing building after the alteration (section 112)**

*Clause B1 – Structure*

- 5.3.1 With respect to Clause B1.3.1 the requirements relating to the compliance of the external wall framing, and internal linings (bracing and normal loads) are:

- The structural performance of the framing is not reduced, with respect to the accumulated moisture causing damage to the framing (relates to Clause E2)
- The structural performance of claddings and internal linings for withstanding normal loads in use and providing bracing units where relevant is not reduced. (I note in this case due to the age of the original construction it is unlikely that the internal linings are providing bracing.)

- 5.3.2 The authority has concerns about the effect of moisture from the foam insulation on the existing timber framing and the plasterboard linings, in particular that the introduction of moisture into the building envelope through installation of the foam insulation will mean that moisture has penetrated the building elements. The authority believes this will result in damage, being decay in timber framing, cupping and warping of weather boards, and the integrity of the plasterboard compromised.

- 5.3.3 The insulation is a type of foam that goes in 'wet', expands rapidly through chemical reaction to fill the void, and continues to react until the foam is fully cured; at which point the insulation is no longer 'wet'. I do not consider the moisture introduced to the building envelope for the period of time between the insulation being in a 'wet'

<sup>6</sup> CNAJ Canadian Medical Association Journal 1986 Apr 1; 134(7): 733–738. G Norman (PhD) M Newhouse (MD)

state and being fully cured to be such that there would be a detrimental effect on the framing timbers or plasterboard lining.

- 5.3.4 With regard to the weatherboards, given the lack of building paper and that the back of the weatherboards is unlikely to be primed/painted and may also be rough sawn, I acknowledge the authority's concerns regarding moisture introduced by the insulation in its wet state. I hold the view that this issue can be addressed in a similar manner to the moisture levels for framing post installation: the consent application could be amended to include a period of monitoring and recording of the ongoing condition of the weatherboards, for perhaps one solar cycle (i.e. one year) before an application for a code compliance certificate is made.
- 5.3.5 I also note that the fungicides present in the insulation provide a compensating feature. However, the structural performance may be affected by excessive or prolonged moisture being present in the cavity. Therefore, the inspection process should establish acceptable existing moisture levels in the framing, and confirmation that excess moisture present at the completion of construction has dissipated should be provided prior to the issue of a code compliance certificate. The insulation installer has undertaken to provide this.
- 5.3.6 I hold the view that in general terms the methodology for inspection and the process of assessing the suitability of walls for the insulation as outlined in the manual will enable any issues that may adversely affect the drying ability of the insulation to be identified and installation into unsuitable locations to be avoided.
- 5.3.7 The manual states that after the installation process the moisture levels are to be monitored, and that the levels 'must be <18% mc for the installer to be confident of E2.3.6 compliance'. However, I hold the view that the manual does not adequately address elevated moisture levels that may be present in the existing building. I note that the 'risk score' for the durability of timber, which largely considers the treatment level, indicates the score could be affected by "moisture, rot or decay detected". Though in regards to the assessment of the existing building there is no indication in the manual at what level a moisture content reading would indicate the risk score should be altered to 'very high', or further investigation is required, or that it would not be appropriate to go ahead with installing the insulation.

*Clause E2 – External moisture*

- 5.3.8 With respect to Clause E2.3.2 and E2.3.5 for the external wall and cladding system, the compliance requirements are:
- The ability of the external wall to prevent the penetration of moisture that could cause undue dampness or damage must not be reduced.
  - The ability of the concealed space or cavity to prevent external moisture being accumulated or transferred must not be reduced.
- 5.3.9 With respect to Clause E2.3.2 I am satisfied that the process generally described in the building consent application to make good the penetrations of the external and the process described for monitoring post-construction moisture levels are acceptable.
- 5.3.10 With respect to E2.3.5, I am not satisfied that the inspection has adequately considered the effect of the proposed building work on the external envelope in this case.

- 5.3.11 As part of the inspection process, the manual calls for a minimum of two readings on ‘the southern side (or wall exposed to prevailing weather) at the bottom plates.’ The site plan provided in the consent documentation indicates one reading has been taken on each elevation.
- 5.3.12 The readings on the north, east and west elevations, as marked on the plan included in the building consent application, fall between 14.2 and 15.2%; however the reading on the south elevation was slightly elevated at 18.6%. While this is not a wide variation or a very high reading, it does indicate the post-installation requirement of levels being <18% would not be achieved. In addition, if there is moisture ingress that has led to a raised level of moisture content in the framing timber, even if limited, it may be exacerbated over time with the installation of the insulation. The framing has been well ventilated over the years since construction and this may have mitigated the effects of any moisture ingress; the installation of the insulation into the cavity will significantly reduce the cyclical drying capacity of the external envelope, particularly as there is no building wrap.
- 5.3.13 I note here that the applicants have subsequently installed a heat pump and the agent has carried out further moisture content readings that indicate a lower level of moisture at the south elevation than that first obtained for the building consent application.

*Clause B2.3.1*

- 5.3.14 I note here that if the current requirements of Clause B2.3.1 were applied to the existing building from the date of its construction, the relevant durability periods for the building would already have been surpassed.

## 5.4 Departures from the insulation supplier’s manual

- 5.4.1 In note that the information provided by the installer as part of the supporting documentation for the application for building consent departed from the requirements of the manual. In addition I consider the manual is deficient in some respects.
- 5.4.2 I provide the following comment on the departures from the manual and my concerns regarding deficiencies as follows (with paragraph references in this determination):

Clause	The manual	Building consent application	
F2.3.1	Agreed with the owner which windows/doors would be left ajar or opened ...  [And] identified where the openings will be on the floor plan of the consent drawing and obtain the owners signature of approval	Site plan shows the location of windows and doors only; there is no indication which of these are to be left open.  Signature obtained, but no indication of which of the windows/doors are to be left ajar or opened after the insulation has been installed.	5.2.8 5.2.11
E2.3.5	Minimum of two readings on ‘the southern side (or wall exposed to prevailing weather) at the bottom plates	One reading taken on each elevation.	5.3.11 and 5.3.12
E2.3.6	Moisture levels must be <18% mc for the installer to be confident of E2.3.6 compliance	Moisture level at inspection over this level.  Subsequent reading (after draft determination was issued) lower than 18%	5.3.7 and 4.5
G9	Confirm the presence of PVC coated electrical wiring at the circuit board,	No photograph provided	

	notate and photograph and make comment in respect to upgrade		
Clause	The manual	My comment	
B1.3.1	The 'risk score' for the durability of timber, which largely considers the treatment level, could be affected by "moisture, rot or decay detected	The manual does not adequately address elevated moisture levels that may be present in the existing building.	5.3.7
B1.3.1	There is no threat in collapsing with the [insulation] process	Threshold is inadequate. The application should consider performance in relation to Building Code.	5.3.12
E2.3.4	Refer separate assessment sheet	Reference inadequate to establish where information is provided	
F2.3.1	Table 'Existing Building'	Code clause does not apply to existing building; information should be moved to table 'New Building Work'	
H1		Thermal envelope will be improved	

## 5.5 Conclusion

5.5.1 In conclusion, I am of the view that the information provided in the building consent application was not sufficient to establish compliance with the Building Code.

## 6. The decision

6.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the information provided in the building consent application was not sufficient to establish on reasonable grounds that the proposed building work would comply with the relevant clauses of the Building Code.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 5 August 2015.

John Gardiner  
**Manager Determinations and Assurance**