



Determination 2010/004

Firecell requirements for proposed alterations to a meatworks plant at Hokio Beach Road, Levin

1 The matters to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations, Department of Building and Housing (“the Department”), for and on behalf of the Chief Executive of the Department.
- 1.2 The parties to the determination are:
- The owner of the building, Alliance Group Ltd (“the applicant”) acting through a firm of building consultants (“the consultants”)
 - The Horowhenua District Council (“the authority”) carrying out its duties and functions as a territorial authority or a building consent authority.
- 1.3 The New Zealand Fire Service Commission (“the NZFS”) has been included as being a department with which the Chief Executive must consult under section 170² of the Act.
- 1.4 The matter for determination³ is whether the proposed alterations to a meat processing plant (“the proposed alterations”) comply with Clause C of the Building Code (Schedule 1, Building Regulations 1992).
- 1.5 The application for determination asked the Department to consider:
- the compliance with the Building Code of the proposed alterations to the building, which would increase the meatworks fire cell to an area greater than 5000m²
 - the decision of the authority, who indicated it would refuse to issue a building consent for the proposed alterations if no additional fire safety precautions were proposed.
- 1.6 While I can consider the code-compliance of the proposed alterations, the question of an authority’s proposed future decision about a future building consent is not a

¹ The Building Act, Building Code, Compliance documents, past determinations and guidance documents issued by the Department are all available at www.dbh.govt.nz or by contacting the Department on 0800 242 243.

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

³ In terms of section 177(a).

matter that I can determine in terms of section 177. However, I do discuss aspects/factors that might well be considered in any such future decision.

- 1.7 In making my decision, I have considered the submissions of the parties, the reports of two independent experts commissioned by the Department (“the experts”) to advise on this dispute, and the other evidence in this matter.

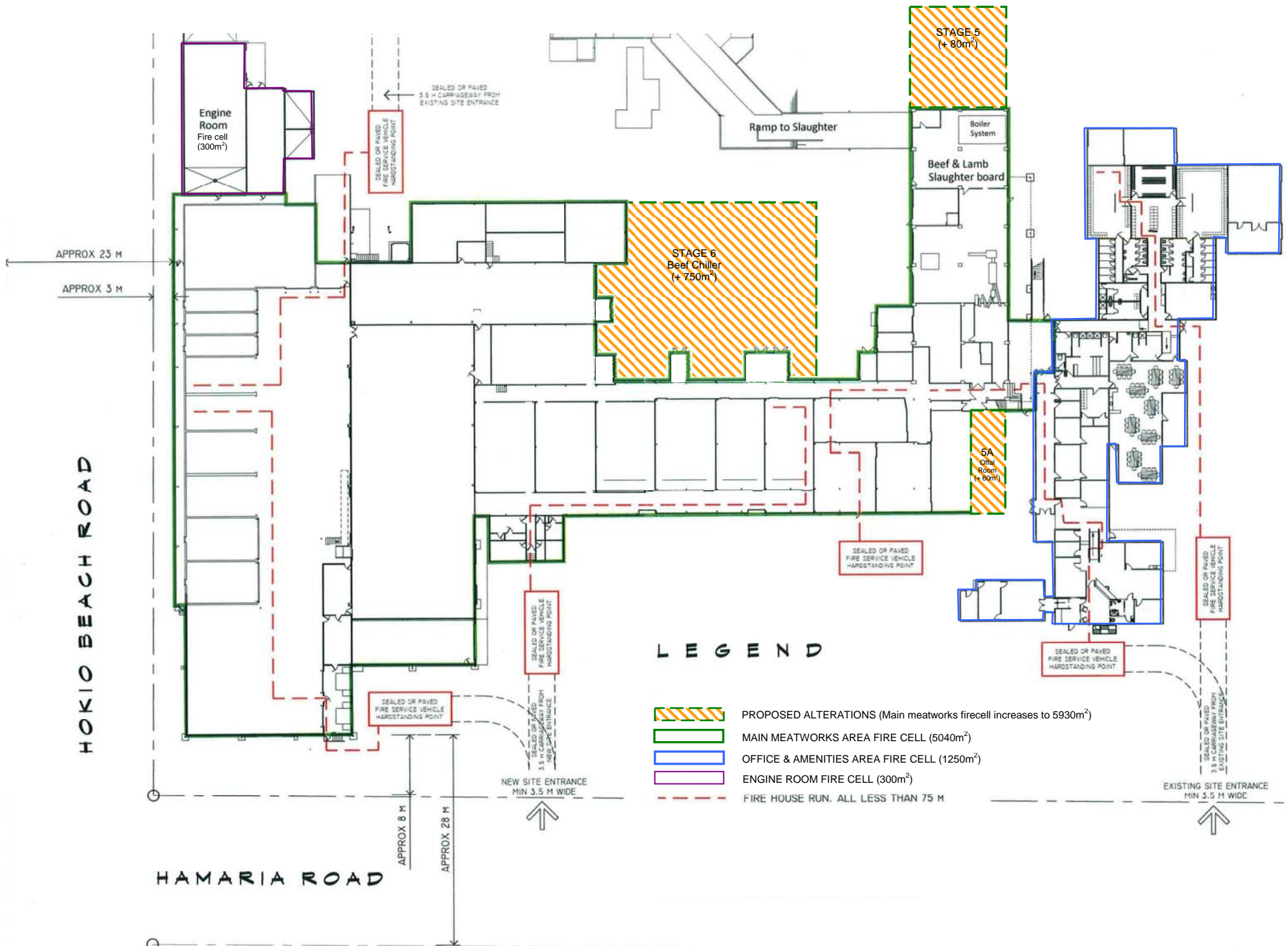
2 The building work

- 2.1 The existing building is a meat processing plant, constructed in approximately 1960. The building is undergoing alteration and upgrading work, which is occurring in stages.
- 2.2 The construction of the first three stages of the work has been completed. This work has not yet received code compliance certificates. Stages 4 to 6 of the alterations are the proposed alterations.
- 2.3 The existing building of the processing plant has a concrete floor, steel skin polystyrene foam (EPS) wall and ceiling panels supported by structural steelwork. The proposed alterations will be constructed of similar materials.
- 2.4 With the completion of the recent alterations, the main existing building has a total floor area of 6290m². This area is divided into two fire cells of:
- the main meatworks area fire cell with a floor area of 5040m², and which contains two separate mezzanine floors with areas of 386m² and 608m².
 - the office and amenities area fire cell with a floor area of 1250m².

There is also a small engine room to the west of the main processing plant building that is a separate fire cell, with an area of 300m².

The proposed alterations

- 2.5 The proposed alterations, which equate to Stages 5-6, (Stage 4 is a rendering building away separate from the main complex) involve extending the main meatworks area with the addition of a room to the west side at the north end near the boiler system, a small offal room to the east side at the north end, and a beef chiller on the west side near the blast chillers.
- 2.6 The proposed alterations are intended to be part of the main meatworks area firecell. The main meatworks area firecell with the proposed alterations (“the proposed main meatworks firecell”) will increase the firecell from 5040m² to 5930m².
- 2.7 The applicant states that the fire safety design and construction of the proposed alterations will be in accordance with the Approved Document C/AS1.
- 2.8 The authority has indicated to the applicant that it would require additional fire safety precautions.
- 2.9 The following plan shows the main meatworks area firecell and the proposed alterations.



HOKIO BEACH ROAD

HAMARIA ROAD

LEGEND

- PROPOSED ALTERATIONS (Main meatworks firecell increases to 5930m²)
- MAIN MEATWORKS AREA FIRE CELL (5040m²)
- OFFICE & AMENITIES AREA FIRE CELL (1250m²)
- ENGINE ROOM FIRE CELL (300m²)
- FIRE HOUSE RUN. ALL LESS THAN 75 M

APPROX 23 M
APPROX 3 M

APPROX 8 M
APPROX 28 M

SEALED OR PAVED
3.5 M CARRIAGEWAY FROM
EXISTING SITE ENTRANCE

SEALED OR PAVED
FIRE SERVICE VEHICLE
HARDSTANDING POINT

NEW SITE ENTRANCE
MIN 3.5 M WIDE



Ramp to Slaughter

STAGE 5
(+ 80m²)

STAGE 6
Beef Chiller
(+ 750m²)

5A
Optal Room
(+ 80m²)

SEALED OR PAVED
FIRE SERVICE VEHICLE
HARDSTANDING POINT

SEALED OR PAVED
FIRE SERVICE VEHICLE
HARDSTANDING POINT

EXISTING SITE ENTRANCE
MIN 3.5 M WIDE



3 The submissions

- 3.1 The consultants provided a detailed application on behalf of the applicant that was dated 29 June 2009. The application set out the background to the dispute, provided copies of some plans and raised issues relating to the compliance of their proposed fire design. The consultants contended that ‘C/AS1 allows a floor area to be unlimited for a FHC1 unsprinklered firecell that does not require S rating.... the purpose of arbitrarily limiting floor area to 5,000m² to facilitate Fire Service rescue operations and to limit firecell fire load is not reasonable or practical.’
- 3.2 In a letter to the Department dated 6 July 2009, the authority explained their view was that the proposed fire design did not comply with C/AS1, in particular, Subparagraph 4.2.4 of C/AS1.
- 3.3 The NZFS provided the Department with a submission dated 5 August 2009, which also commented on the first expert’s report (refer to paragraph 4).
- The Fire Service agrees with the [authority] and considers that the applicant and expert are incorrect in their interpretation of [Subparagraphs] 4.2.3 and 4.2.4 of C/AS1 as applicable in this particular case.
- 3.4 On 21 August, the consultants provided a report in reponse to the NZFS submission. On 3 September 2009, the consultants provided additional information about the activities and storage within the main meatworks firecell area. On 14 September 2009, the consultants provided comments about the second expert’s report (refer to paragraph 4), on 30 September 2009, a detailed response to the second expert’s report and on 6 October, a further response to the second expert’s report.
- 3.5 The applicant requested a hearing, which was held at Porirua on 22 October 2009 before me. I was accompanied by a Referee engaged by the Chief Executive under section 187(2) of the Act, and in attendance were the applicant, its consultants and legal adviser, a representative of the authority, two officers of the NZFS and officers of the Department. All of the parties spoke at the hearing and the evidence presented enabled me to amplify or clarify various matters of fact. The hearing consisted of an explanation of the existing building layout, including the recent alterations and the details of each stage of the proposed alterations and other future stages of upgrade. An interpretation of the Act, the Code, and C/AS1 put forward by the legal adviser to the applicant focussed on the interpretation of Part 4 of C/AS1, and a discussion of the building, characteristics of the fire design, the fire loading, and the application of the as nearly as reasonably practicable test.
- 3.6 The NZFS provided a post hearing submission dated 29 October 2009, responding to the issues raised at the hearing.
- 3.7 In reponse to the submission by the NZFS, the legal adviser to the applicant provided a submission dated 2 November 2009.
- 3.8 A draft determination was issued to the parties on 27 November 2009.
- 3.9 The consultants did not accept the draft determination, and provided an extensive submission discussing the draft determination.
- 3.10 The NZFS agreed with the draft determination in a submission dated 15 December, with a note that it was not up to the draft determination to suggest a design solution, but ‘up to the designer to generate whatever solution they choose and to show that it works.’

- 3.11 The authority accepted the draft determination in a submission dated 18 December 2009, subject to the determination noting its view as described in paragraph 0 and noting that ‘The determination was not asked to look at the fire hazard category’.
- 3.12 The following tables summarise the content and detail of the submissions described above and collated by topic.
- 3.13 **The Act, Clause 3.3.9 and compliance with C/AS1**

Submission and date	Summary of comment
NZFS, 5 August 2009 submission	‘...the applicant has the opportunity to provide an alternative solution to the requirements of C/AS1 under the [Building Code] framework. However, no alternative solution has been presented. ...the issues of [Clause] C3.3.9 have not been addressed at all [and] the proposed design does not facilitate the needs of fire service personnel. It must be demonstrated that fire fighters are not at risk of illness and injury due to fire spread or structural failure should they enter the building in an attempt to conduct firefighting and rescue operations. The provisions of the Building Code are also clear that rescue and fire fighting operations must be included in building design.’ ...
Consultants, 20 August 2009 and 6 October 2009 submissions	‘The [Act]... studiously avoids mentioning any requirement to limit the quantum of an owner’s loss through fire. Protection of the owner’s own property is not a Building Code requirement. This principle was a founding tenet of the Building Act 1991, and is also incorporated in the [Act]. Limitation of the fire cell size is not a part of the Building Act, nor is it a part of the Building Code...’
Legal adviser to the applicant, 22 October 2009 Hearing	Where a building has undergone alteration, the emphasis is on means of escape, not fire fighting, and section 4(2) takes into account the reasonable expectations that authorised fire fighters are protected from injury or illness when carrying out their rescue operations or fire fighting. ‘What is “reasonable” will depend on the particular circumstances. A building that is on fire is expected to have inherent risks, otherwise there would not be an evacuation or a fire emergency. The analysis cannot proceed on an assumption that fire fighters must enter a building, and/or save it come what may. What happens to a building itself is not the concern of the [Act].
Consultants, 10 December 2009 submission	‘This determination is in relation to an acceptable solution. Therefore, for the determination to be granted in our favour; we must demonstrate how we comply with C/AS1...’

3.14 **Interpretation of Subparagraphs 4.2.3 and 4.2.4 of C/AS1**

Submission and date	Summary of comment
Consultants, 29 June 2009 application	<p>A reading of all the requirements of Paragraph 4.2 of C/AS1 in context is critical to determining the level of protection for large fire cells. The proposed alterations satisfy the requirements of Subparagraph 4.2.1 of C/AS1. As the building has adequate boundary separation and compliance with Subparagraphs 4.2.3 to 4.2.5 of C/AS1 are satisfied, an S rating does not apply.</p> <p>An arbitrary restriction of the proposed main meatworks firecell floor area for the purpose of Fire Service rescue will provide little benefit, and the cost to provide this restriction is not commensurate with any perceived benefit. The proposed main meatworks firecell complies with Part 8 Fire Fighting of C/AS1 and subdividing a firecell will not improve Fire Service response times, nor will it increase the volume of water available to fight a fire. Fire Service personnel within the proposed main meatworks firecell will be exposed to the same risk regardless of firecell size and the acceptable level of safety complies with C/AS1.</p>
NZFS, 5 August 2009 submission	‘...the building does not comply with C/AS1 [Subparagraph] 4.2.4. ...[Subparagraph] 4.2.4 requires that where buildings are not sprinkler protected and exceed the fire cell floor area limitations set out in [Subparagraph] 4.2.3, the building is required to be

	provided with "effective fire venting".'
Consultants, 20 August 2009 and 6 October 2009 submissions	<p>'... the section headed Compliance documents contains five separate parts. All of these parts are to be read together, and together they constitute the Act sections regarding compliance documents. Nothing permits any person to choose any single part, and to ignore other parts. This is no different to any other document that has headings and subheadings. The heading for [Subparagraphs] 4.2.3 to 4.2.5 is 'Firecell floor area limits', therefore all three paragraphs need to be considered with reference to the heading, and not individually.'</p> <p>'The [Act], the Building Code, and therefore the Compliance Documents have no requirement for a limitation to the quantum of loss that can be suffered by the owner of a building, presuming that an S rating does not apply. As a consequence, [Subparagraph] 4.2.4 is not applicable, and it is the choice of the owner as to whether a limitation in the level of fire loss is to be incorporated in the fire safety design. It is debatable as to whether [Subparagraph 4.2.3] actually complies with the requirements of the [Act], and the Building Code i.e. so long as any exposure to the neighbour is controlled within acceptable limits, then according to the legislation there should be no limit to the quantum of loss that can be suffered by the owner of the property on fire.'</p>
Legal adviser to the applicant, 22 October 2009 Hearing	The focus of Subparagraphs 4.2.3 to 4.2.5 of C/AS1 must be on the actual words used. Subparagraph 4.2.4 is not a stand alone criteria and it has to be considered in the alternative to the provisions of Subparagraph 4.2.3. The focus of Subparagraph 4.2.4 is on building elements supporting the roof that are not fire rated at all. The paragraphs assist in providing protection to fire fighters when the floor area of the building will exceed the limits in Subparagraph 4.2.3 and the building requires fire rated construction to prevent external spread of fire to other property or household units, or the building contains car parking, or the building has an escape height exceeding 25 metres. Any comments set out below the Paragraph 4.2 provisions cannot replace such provisions and Subparagraph 1.1.4 of C/AS1 describes the significance of comments in that they are not part of the acceptable solution.
NZFS, 29 October 2009 submission	'...[Subparagraph] 4.2.4 can operate as an exception to [Subparagraph] 4.2.3. That is a clear consequence of the opening words of [Subparagraph] 4.2.3. However, the [NZFS] does not accept that this means that [Subparagraph] 4.2.4 can only be read in conjunction with [Subparagraph] 4.2.3. On the contrary, the [NZFS] considers that [Subparagraph] 4.2.4 also operates as a standalone provision that may be applied to relevant buildings, independently from [Subparagraph] 4.2.3.
Legal adviser to the applicant, 2 November 2009 submission	<p>'The natural inference to be drawn from clauses cross-referenced to each other, and placed in an adjacent order, is that they are to be read together. A stark contrast to the model used [for Paragraph 4.2] is the model used where alternatives are intended...' The NZFS submission does not respond to this point.</p> <p>'It is clear that the two [Subparagraphs] do not provide a complete code (e.g. [Subparagraph 4.2.4 would not apply to a building with more than a single floor, unsprinklered; and similarly, [Subparagraph] 4.2.3 does not apply if an S rating does not apply). Consequently, the two [Subparagraphs] cannot be interpreted as if a complete code is intended.</p>
Consultants, 10 December 2009 submission	<p>If the [draft determination] is correct; and in the absence of a sound fire engineering floor area limited being provided in [Subparagraph] 4.2.4, the applicant considers a reasonable and adequate floor area limited for the [main meatworks] firecell (being a single floor unsprinklered firecell that does not require S rated construction, that does not have fire rated building elements supporting the roof, and does not have effective roof venting) will be a floor area limit based upon:</p> <ol style="list-style-type: none"> 1. Localised knowledge of NZFS attendance capability to this site; and 2. The training that staff receive on evacuation procedures and the frequency of trial evacuations held by building management, and 3. Compliance with the escape route and evacuation requirements of [C/AS1]; and 4. Any additional fire safety features installed that are additional to the requirements of [C/AS1]...

3.15 The application of section 112

Submission and date	Summary of comment
Consultants, 22 October 2009 Hearing	The issue raised by the determination application rested squarely on Paragraph 4.2 of C/AS1 and not on a consideration of an alteration under section 112. It would be very difficult and expensive to install sprinklers in the building, due to the age of the building and its panel construction, the rail systems used in the buildings, the air sealing of the chillers, and the configuration of the machinery. There would also be major hygiene problems as all pipework reticulation would have to be outside the building hygiene areas. As the complex is a fully operational plant so there would be a high cost to keep it functioning during any major internal alteration, and that aspect needed to be incorporated into any assessment of practicability.
Authority, 22 October 2009 Hearing	The 1000m ² additional area could be reasonable. There was more than adequate separation between the proposed building work and all site boundaries to allow the proposed work to be built without an S rating.
Legal adviser to the applicant, 2 November 2009 submission	With respect of considering whether the proposed alterations comply as nearly as is reasonably practicable, 'The problem about this approach is that in order to assess what is "reasonably practicable" the [authority] has to know what the effect of the various provisions, and in this case the provisions as to firecells areas, actually are. That is, one cannot address "reasonably practicable" criteria until it is clear what the correct interpretation is of [Subparagraphs] 4.2.3 and 4.2.4.'

3.16 Other issues

Submission and date	Summary of comment
Consultant, 29 June 2009 application	The construction and the layout of the chillers in the proposed main meatworks firecell provide effective smoke separation. The balance of the proposed main meatworks firecell can be extended to 14,840m ² and 'still have a total fuel load that is less than the 2,000,000 MJ recommended limit' by adopting a FLED of 120 MJ. The EPS panels will pass the ten minute flame barrier test criteria, signalling the acceptability of providing a ten minute window for evacuation from a cool store that has complying escape route attributes.
NZFS, 5 August 2009 submission	'Whilst C/AS1 defines cool stores as FHC1 we note this is not necessarily appropriate for many cool store design situations. ...in some instances, especially where certain goods are stored or [EPS] panels are used, the fire load is sufficient to increase the FHC to greater than that of a FHC1 firecell. The applicant has stated that 365m ² of the building will include 600Mj/m ² fire load. In accordance with C/AS1 this is a FHC2 designation. In accordance with [Subparagraph] 2.2.2 the design and fire safety precautions required for the whole of the building should be based on that of a FHC2 purpose group.' The applicant has not addressed the requirements for the provision of smoke control for the two intermediate floors. In accordance with Subparagraph 2.2.2 of C/AS1, the fire safety precautions required for the whole building should be based on that of a FHC2 purpose group and accordingly, the firecell area should be restricted to no more than 2,500m ² . The building could be considered to be a single firecell. Accordingly, the fire safety precautions associated with it should be based on the escape height of the intermediate floors rather than a 0 metre escape height.
Consultants, 6 October 2009 submissions	The majority of the main meatworks firecell area is FHC1 and the cold storage area is FHC4.
NZFS 22 October 2009 Hearing	The fire loading limitation stated in the note to Subparagraph 4.2.3 of C/AS1 was to protect firefighters who will make a decision whether to enter a building when a fire is in progress.

Consultants, 22 October 2009 Hearing	2,050,000MJ is the fire load for the total firecell of 5040m ² based on the existing building (including the recent additions) but not the proposed alterations. A building constructed from polystyrene panels would likely be destroyed in about 10 minutes. The NZFS could get their fire trucks into the building area, the building also had some nine entry points, and there was a 75 metre hose run to all points of the building. Therefore, the building complies with the performance requirements of Clause 3.3.9.
Consultants, 10 December 2009 submission	The [draft determination] does not acknowledge the points made by the applicant relating to the NZFS Dynamic Risk Assessment practices that requires deliberate and professional analysis of fire severity, rate of spread, and available resources before entering a building. Any professional analysis of any C/AS1 complying building containing EPS panel automatically limits fire rescue operation to 10 minutes (regardless of firecell size).

4 The experts' reports

4.1 As stated in paragraph 1.7, I commissioned two fire safety engineers who are chartered professional engineers and experts in fire-safety design. The first expert ("the first expert") provided me with a report dated 17 July 2009 and the second expert ("the second expert") provided me with a report dated 11 September 2009. The reports provided observations about the proposed alterations.

Issue	Observations of the first expert	Observations of the second expert
Firecell floor area	<p>Subparagraphs 4.2.3, 4.2.4, and 4.2.5 of C/AS1 provide different scenarios where a firecell may be unlimited in floor area. The basic premise of Subparagraph 4.2.3 is that if a firecell requires an S rating, then there are limits on the firecell area. However, if an S rating does not apply to the firecell, then Subparagraph 4.2.3 is not applicable and the firecell may be unlimited.</p> <p>As the building is located a sufficient distance from the boundaries, the exterior walls can be 100% unprotected and none of the additional circumstances requiring an S rating as set out in Subparagraph 5.3.2 apply to the building.</p> <p>Based on guidance information provided by the Department, if a building does not require an S rating it is permitted to be unlimited in firecell floor area.</p>	<p>Based on current practice and the Department's interpretations, Subparagraphs 4.2.3 and 4.2.4 of C/AS1 are to be read in isolation. The proposed and future operations could have on the fire load energy density imposed on the building and the entire firecell can not be designated as a 'slaughterhouse'.</p> <p>Given that an S Rating does not apply, the firecell floor area limitations of C/AS1 do not apply, no matter what is the assessed FHC of the building. However, Subparagraphs 4.2.3 and 4.2.4 should be read in isolation. Accordingly, the firecell size cannot be unlimited without either effective venting or sprinklers being provided. An alternative solution is acceptable to show that the firecell fire load is less than 2,000,000 MJ as allowed by the comment in C/AS1 without providing sprinklers or effective venting. The alternative solution must be well specified and calculated.</p>

Number of storeys	<p>Neither the Act, nor the Building Code, nor C/AS1 define 'single storey'. As it is considered acceptable that a single storey building can have an intermediate floor, the term single storey implies that there is not a separate firecell above a lower level. C/AS1 requires the escape height for determining fire safety precautions to be based upon the height of the intermediate floor, which is consistent with Comment 2 in C/AS1 regarding the definition of escape height.</p> <p>The use of an escape height greater than 0m for Table 4.1 of C/AS1 does not mean the building is two storeys. Supporting this interpretation is Subparagraph 6.21.5 of C/AS1. For this building, the applicant has applied the fire safety precautions required based upon the height of the intermediate floor.</p>	<p>There is a lack of detail regarding the intermediate floors in the building.</p>
Other	<p>It is inappropriate to use one paragraph of C/AS1 and state that this is the means of complying with the NZ Building Code. C/AS1 is to be considered in its entirety and as such is deemed to have demonstrated compliance with the NZ Building Code.</p> <p>The radiation analysis and the smoke separation and protection provided by the EPS panels and door seals are inadequate.</p>	<p>It is unclear as to the actual area of the proposed alterations.</p> <p>The hose distance measurements have been taken from many entry points rather than one main fire service entry point.</p> <p>The proposed main meatworks firecell exceeds a FHC1 designation in many of the areas of the building. Most significantly, this occurs in the blast chillers, holding chillers, and carton packaging area. The proposed alterations, could quite conceivably have uses which would lead to a fire load that exceeds the designation for FHC1. The design therefore needs to take into account the higher fire loads in all areas of the building. Fire safety precautions together with firecell sizes and ratings need to be designed to suit.</p> <p>The calculations provided for the fire load in the firecell have not been undertaken accurately, the uses in the building have not been detailed well, and the calculations have not been well justified. If the applicant wishes to justify a larger firecell without sprinklers or effective venting by calculating the fire load and comparing it with the 2,000,000MJ as detailed in C/AS1, then further work is required.</p>

Framework for assessing the compliance of the proposed alterations

5 Discussion

- 5.1 The building work is alterations to an existing building. It is necessary for the new work to comply fully with the Building Code, and for the building, after the alterations to comply as nearly as reasonably practicable with the provisions of the Building Code relating to means of escape from fire.
- 5.2 The matter in dispute is the size of the firecell.
- 5.3 Therefore, I consider it necessary to assess the compliance of the proposed main meatworks area firecell as follows:
- Step 1 Assessment of the main meatworks area firecell against C/AS1 (refer to paragraph 6).
- If the proposal complies with C/AS1, full compliance is achieved and there is no further assessment necessary.
- Step 2 Assessment of the main meatworks area firecell as a proposed alternative solution against the Building Code, using C/AS1 as a benchmark (refer to paragraph 7).
- If full compliance is achieved as an alternative solution there is no further assessment necessary.
- Step 3 Assessment of the main meatworks area firecell against the ‘as nearly as is reasonably practicable’ standard, taking into account the level of upgrading that would be necessary for complete compliance (refer to paragraph 8).
- Compliance to as nearly as is reasonably practicable in accordance with section 112 of the Act is achieved if reasonable justification can be provided as to why the proposal cannot comply fully with the Building Code.
- 5.4 I have set out the relevant section of the Act and clauses of the Building Code in Appendix A.

The compliance of the proposed alterations with C/AS1

6 Discussion

The compliance document framework

- 6.1 Compliance Documents provide one means of compliance with the clauses of the Building Code and generally take the form of a prescriptive solution. Buildings built to the Acceptable Solution method described in the Compliance Document are automatically deemed to comply with the Building Code.
- 6.2 With respect to the design of buildings, a design proposal that complies with a compliance document is deemed to comply with the Building Code. A proposal that does not comply fully with a compliance document is not an Acceptable Solution design, and must be evaluated as a proposed alternative solution.

Analysis of Paragraph 4.2 of C/AS1

- 6.3 Part 4 of C/AS1 provides a number of safeguards to control fire spread. I note that the General Principles of Part 4 consider firecells to which F ratings and S ratings apply.
- 6.4 Subparagraph 4.1.2 states:
- To prevent fire spread or structural collapse, building elements are constructed with a fire resistance rating (FRR) appropriate to the perceived risk. For some situations the FRR has been prescribed, for others it is derived from either the firecell rating (F rating) or the structural fire endurance rating (S rating).
- 6.5 Subparagraph 4.2.3 states:
- Except as permitted by Paragraph 4.2.4, the floor area of an unsprinklered firecell to which an S rating applies, shall not exceed the maximum firecell floor area given in the following table.
- For content of the abovementioned table, refer to Appendix A.
- 6.6 Subparagraph 4.2.4 states:
- In an unsprinklered single floor *building*, where the *building elements* supporting the roof are not *fire* rated, the *firecell* floor area may be unlimited provided that no less than 15% of the roof area (distributed evenly throughout the *firecell*) is designed for effective *fire* venting.
- 6.7 With regards to the fire ratings that apply for Subparagraph 4.2.3 and 4.2.4, I note the following:
- The provisions of Part 4, defined in the Part 4 General Principles, pertain to prescribed FRRs, or FRRs derived from F ratings or S ratings.
 - Paragraph 4.2, relating to the provision of firecells, and Subparagraph 4.2.1, relating to the number of firecells, take into account the definitions of both F rated and S rated firecells.
 - Subparagraph 4.2.3 is the only part in Paragraph 4.2 that specifies the fire rating to which it applies.
 - Subparagraph 4.2.4 is very specific in its requirements and application, however, does not distinguish between fire rating types.
- 6.8 There is a link between Subparagraph 4.2.3 and Subparagraph 4.2.4, in that Subparagraph 4.2.4 clearly offers an exception for Subparagraph 4.2.3. However, I am of the view that this link does not limit Subparagraph 4.2.4 to only being read as an exemption to Subparagraph 4.2.3 and therefore being excluded from being read independently.
- 6.9 Clearly Paragraph 4.2 does not provide a complete set of rules for all possible sets of design characteristics, and Paragraph 4.2 cannot be interpreted as if this is intended.
- 6.10 The floor limits of Subparagraph 4.2.3 apply to buildings with S rated construction. If a design outside the requirements of Subparagraph 4.2.4 or 4.2.5 is to be used where an S rating is not required, sound fire engineering practice connecting the expected performance of the firecell with its design features and floor area should be undertaken. I have discussed the performance of firecells with their features and floor areas in the general case in paragraphs 6.11 to 6.20.

Performance of firecells with S ratings applied and with no S ratings applied

- 6.11 Examples of the expected performance of a firecell roof in severe fire conditions, taking account of the different characteristics of the roof design are described in Table 1 and Table 2.
- 6.12 Table 1 refers to performance of firecells to which an S rating applies to the firecell wall elements:

Table 1: Expected performance of firecells with an S rating applied

Example	Fire rating to elements supporting the roof	Design of roof area for venting	Expected performance	Applicable Subparagraph from paragraph 4.2
Case 1	Rated roof support elements	15% of roof area for venting provided	Roof structure remains in tact due to fire rating of elements supporting the roof and the provision of 15% of the firecell roof area for venting.	Subparagraph 4.2.4, firecell size unlimited
Case 2	Non rated roof support elements	15% of roof area for venting provided	Roof structure remains in tact due to the provision of 15% of the firecell roof area for venting.	Subparagraph 4.2.4, firecell size unlimited
Case 3	Rated roof support elements	No provision of 15% of roof area for venting	Roof structure remains in tact due to fire rating of elements supporting the roof.	Subparagraph 4.2.3, firecell size limited
Case 4	Non rated roof support elements	No provision of 15% of roof area for venting	Catenary sag between the firecell walls may help limit the collapse if the firecell wall columns are rated and have base fixity.	Subparagraph 4.2.3, firecell size limited

- 6.13 Table 2 refers to performance of firecells to which no S rating applies to the firecell wall elements:

Table 2: Expected performance of firecells with no S rating applied

Example	Fire rating to elements supporting the roof	Design of roof area for venting	Expected performance	Applicable paragraph
Case 5	Non rated roof support elements	15% of roof area for venting provided	Roof structure remains in tact due to the provision of 15% of the firecell roof area for venting.	Subparagraph 4.2.4, firecell size unlimited
Case 6	Non rated roof support elements	No provision of 15% of roof area for venting	The roof structure will typically collapse. This case matches the proposed main meatworks firecell.	None

Analysis of design features for firecells designed in accordance with Subparagraph 4.2.4 of C/AS1

- 6.14 Subparagraph 4.2.4 permits firecells to be unlimited in floor area for unsprinklered, single floor buildings, with non rated roof support elements, where 15% of the firecell roof area is designed for effective venting.

Roof design for severe fire

- 6.15 Where a firecell has fire rated roof elements, this provides a mechanism for allowing the roof structure to sustain its capacity in severe fire conditions, for example, Case 3 (refer to paragraph 6.12).
- 6.16 Where the firecell has an S rating applied, the column elements supporting the roof may require rating (refer to Table 1). Where the firecell does not have an S rating applied, the column elements supporting the roof will not be fire rated, as to do otherwise would contravene Building Code Clause 4.3.3.
- 6.17 The provision of effective venting to 15% of the firecell roof area is an overarching temperature control device, which provides a mechanism for allowing a non rated roof structure to maintain its capacity in severe fire conditions, for example, Case 2 (refer to paragraph 6.12). It can also provide some smoke venting from the firecell.

Performance of a firecell in severe fire conditions

- 6.18 Typically, a firecell roof will collapse in severe fire conditions where:
- there is no S rating applied (i.e. in the remote from boundary case and therefore the elements supporting the roof are not fire rated); and
 - there is not 15% effective venting provided to the firecell roof area.
- 6.19 Subparagraph 4.2.4 applies to Case 2 and Case 5 (refer to paragraphs 6.12 and 6.13), and in these cases the firecell is permitted to be unlimited in area. I am of the view that provision of effective venting is a critical performance characteristic for Subparagraph 4.2.4, unless there is another safety mechanism to control firecell temperature and fire size.
- 6.20 I also note that Case 1 provides a design solution that is within the Acceptable Solution, as Subparagraph 4.2.4 permits an unlimited floor area where there are non rated roof support elements, provided 15% of the firecell roof area is designed for venting. For Case 1, 15% of the firecell roof area is designed for venting and the roof elements are rated, so the roof structure has a higher level of performance in severe fire conditions i.e. it exceeds the performance requirements of the Building Code.

Application of C/AS1 Paragraph 4.2 to the proposed main meatworks area firecell

- 6.21 The proposed main meatworks firecell has the design characteristics (being the characteristics described in Subparagraphs 4.2.3, 4.2.4, and 4.2.5 of C/AS1) of Case 6 (refer to paragraph 6.13) as follows:
- it is single storey in part, with two intermediate floor areas of 386m² and 608m²
 - it is unsprinklered
 - the building elements supporting the roof are not fire rated
 - there is no 'effective' fire venting provided to the roof area

- the firewalls do not require an S rating, due to the building being remote from other property
 - the proposed floor area is 5930m².
- 6.22 In comparing the proposed main meatworks firecell to the firecells described in Paragraph 4.2 of C/AS1, I note that the proposed main meatworks firecell does not meet Subparagraphs 4.2.3, 4.2.4, or 4.2.5 of C/AS1. I therefore consider that the proposed main meatworks firecell does not meet Part 4 of C/AS1, and therefore is not a design that can be offered in terms of the Acceptable Solution.
- 6.23 I note that part of the contention of the applicant is that as Subparagraph 4.2.4 does not apply to the firecell because the elements supporting the roof are not rated, and Subparagraph 4.2.3 does not apply to the firecell because the firecell does not require an S rating, then C/AS1 permits the firecell to be unlimited.
- 6.24 I note that while Paragraph 4.2 of C/AS1 does not prescribe a limit for the firecell with the characteristics for this design, it does also not follow that it may be unlimited.
- 6.25 I take the view that Paragraph 4.2 of C/AS1 provides a design solution for this firecell but that solution requires the building to be sprinklered (refer to C/AS1 Subparagraph 4.2.5). However, the design choice for this proposal has been that the building will not have roof venting to 15% of the roof area, and not be sprinklered, therefore the design does not fall within the set of parameters prescribed within Paragraph 4.2 of C/AS1. It is not a requirement that a design complies with the Acceptable Solution. A design must comply with the Building Code, and compliance with an Acceptable Solution is not the only way to achieve this.

The compliance with the Building Code of the proposed alterations as an alternative solution

7 Discussion

- 7.1 The relevant provisions of C/AS1 amount to a means of compliance with the performance requirements of Clauses C of the Building Code.
- 7.2 One way of evaluating compliance with the Building Code is to benchmark the design against the Acceptable Solution. In comparing a proposed alternative solution with an Acceptable Solution, it is useful to bear in mind the objectives of the relevant Building Code clauses. The approach in determining whether the design complies with Clauses C is to examine the design features that are intended to resist the spread of fire.
- 7.3 I note that in a Determination 2004/5, the Building Industry Authority (“the BIA”), the antecedent of the Department said:
- 5.2.2 As for the proposed alternative solutions, the [BIA's] task is to determine whether they comply with the performance based Building Code. In doing so, the [BIA] may use the Acceptable Solution as a guideline or benchmark⁴.
 - 5.2.3 The [BIA] sees the Acceptable Solution C/AS1 as an example of the level of fire safety required by the Building Code. Any departure from the Acceptable Solution must achieve the same level of safety if it is to be accepted as an alternative solution complying with the Building Code.

⁴ Auckland City Council vs Selwyn Mews Limited and Ors 18/6/2003 Judge F W M McElrae, DC Auckland CRN 2004067301-19.

- 5.2.4 As in several previous Determinations the [BIA] makes the following general observations about Acceptable Solutions and alternative solutions:
- (a) Some Acceptable Solutions cover the worst case so that in less extreme cases they may be modified and the resulting alternative solution will still comply with the Building Code.
 - (b) Usually, however, when there is non-compliance with one provision of an Acceptable Solution it will be necessary to add some other provision to compensate for that in order to comply with the Building Code.

7.4 The proposed main meatworks firecell does not incorporate the critical performance characteristic of roof venting to 15% of the firecell roof area (refer to Case 6 in paragraph 6.13). The supporting elements to the roof are not fire rated, and as discussed in paragraph 6.18 covering the general case, this will typically lead to roof collapse in severe fire conditions. Modification of its design would be required in order for the proposed main meatworks firecell to fall within the set of parameters prescribed within paragraph 4.2 of C/AS1.

7.5 The proposed main meatworks firecell has the following compensating features:

- approximately 75% wet area
- a chilled environment, so there is little potential for hot surfaces coming into contact with EPS panels
- flame and ignition barriers to the EPS panels
- fire separation to the electrical switch room

It is my view that these features mean there is a reasonable probability the temperature of the firecell will not reach a level sufficient to collapse the primary roof structure, but I am not convinced that these, on their own, will be sufficient to state that the proposal complies fully with the Building Code.

7.6 In taking account of the design and the compensating features, it is my view that this design is not a code-compliant solution. In this case, one possible solution to comply with the Building Code would be to prevent portal frame collapse. As an example, the prevention of portal frame collapse may be possible by providing fire rated portal columns with base fixity, as if properly designed, this may be able to provide a capacity for ensuring catenary sag between the firecell walls.

7.7 Evidence about any design solution chosen and its compensating features to support a proposed alternative solution will need to be presented with the building consent application to justify that solution.

The compliance of the proposed main meatworks firecell to the ‘as nearly as is reasonably practicable’ standard

8 Discussion

8.1 While I have considered the compliance of the proposed main meatworks firecell with C/AS1 and with the Building Code, I note that the building work of the proposed main meatworks firecell will be an alteration to an existing building.

8.2 I therefore consider that the existing building, after the alteration, will be required to comply as nearly as is reasonably practicable with the provisions of the Building Code that relate to means of escape from fire.

- 8.3 In order to assess whether a building, after its alterations, will comply with the Building Code as nearly as is reasonably practicable, it is necessary to identify what upgrading would be necessary for complete compliance. One way of identifying what is necessary for complete compliance is to benchmark the building against the acceptable solution.
- 8.4 Applying that approach, I conclude that:
- (a) Under section 112(1)(a)(i), a building consent for any alteration must not be granted or amended unless, after the alteration, the entire building will comply as nearly as is reasonably practicable with the provisions of the Building Code that relate to means of escape from fire.
 - (b) The proposed alterations, with the main meatworks firecell being unsprinklered, with no S rating to the wall elements, non rated roof elements, no 15% effective roof venting provided, and two intermediate floors, will not achieve compliance with Part 4 of C/AS1 and will not achieve full compliance with the relevant provisions of the Building Code.
 - (c) Given the configuration, and current and future use of the building, I accept the applicant's assertion that it is not reasonably practicable to install a sprinkler system, install firecell separations, or install 15% effective roof venting. In weighing the costs and benefits, I consider the cost of installing these items, the nature of the existing building and the operation, including significant hygiene restrictions, the cost of altering the equipment and machinery, and the business disruption costs whilst the alteration work is being undertaken present significant sacrifices.
 - (d) It is therefore necessary to consider whether other items of upgrading I have described would be reasonably practicable. I note that the applicant has maintained the proposal complies with C/AS1. As discussed in paragraph 6.22, I am of the view that the design for the main meatworks firecell does not comply with Part 4 of C/AS1, and so while it is clearly not reasonably practicable to install a sprinkler system, install fire separations, or install 15% effective roof venting, the applicant may consider a wide range of upgrading options to comply with the Building Code. This may include investigating providing fire rated portal columns with base fixity, and whether this will be practicable and provide benefits, as discussed in paragraph 7.6, or investigating the practicability of providing venting in some other way to achieve a similar performance.

9 The decision

- 9.1 In accordance with section 188 of the Act I determine that the proposed alterations do not comply with Clause C of the Building Code.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 26 January 2010.

John Gardiner
Manager Determinations

Appendix A The legislation

Relevant provisions of the Act are:

17 All building work must comply with building code

All building work must comply with the building code to the extent required by this Act, whether or not a building consent is required in respect of that building work.

19 How compliance with building code is established

(1) A building consent authority must accept any or all of the following as establishing compliance with the building code:

(b) Compliance with the provisions of a compliance document:

112 Alterations to existing buildings

(1) A building consent authority must not grant a building consent for the alteration of an existing building, or part of an existing building, unless the building consent authority is satisfied that, after the alteration, the building will—

(a) comply, as nearly as is reasonably practicable, with the provisions of the building code that relate to—

(i) means of escape from fire; and

(ii) access and facilities for persons with disabilities (if this is a requirement in terms of section 118); and

(b) continue to comply with the other provisions of the building code to at least the same extent as before the alteration.

The relevant clauses of the Building Code are:

C4 - STRUCTURAL STABILITY DURING FIRE

OBJECTIVE

C4.1 The objective of this provision is to:

(a) Safeguard people from injury due to loss of structural stability during fire, and...

FUNCTIONAL REQUIREMENT

C4.2 Buildings shall be constructed to maintain structural stability during *fire* to:

(b) Allow people adequate time to evacuate safely,

PERFORMANCE

C4.3.1 Structural elements of buildings shall have fire resistance appropriate to the function of the elements, the fire load, the fire intensity, the fire hazard, the height of the buildings and the fire control facilities external to and within them.

The relevant paragraphs of C/AS1 are:

4.2 Provision of Firecells

Number of firecells

4.2.1 A *building* may comprise one or more *firecells* depending on the *fire hazard*. *Firecells* are required to contain a *fire* for sufficient time to

allow safe evacuation, and to prevent *fire* spreading to other *firecells* or *adjacent buildings*.

4.2.2 *Firecells* may also be divided into *smokecells* to restrict the spread of smoke and hot gases during escape.

Firecell floor area limits

4.2.3 Except as permitted by Paragraph 4.2.4, the floor area of an unsprinklered *firecell* to which an *S rating* applies, shall not exceed the maximum *firecell* floor area given in the following table.

Fire hazard category (from Table 2.1)	Maximum firecell floor area (m ²)
1	5000
2	2500
3	1500
4	Specific fire engineering design required

4.2.4 In an unsprinklered single floor *building* where the *building elements* supporting the roof are not *fire* rated, the *firecell* floor area may be unlimited provided that no less than 15% of the roof area (distributed evenly throughout the *firecell*) is designed for effective *fire* venting.

4.2.5 Where a *firecell* is sprinklered, except when *purpose groups* require subdivision or other area limitations are imposed by this Compliance Document, the *firecell* floor area may be unlimited.