Determination

under the

Building Act 1991

No. 97/008: Light fittings in a bulk grain and meal store

1. GENERAL

1.1 The matter to be determined

1.1.1 The matter before the Authority is whether the atmosphere in a bulk grain and meal store was potentially explosive, and if so whether the proposed electrical light fittings adequately guarded against ignition.

1.1.2 The Authority takes the view that it is being asked in effect to determine whether the proposed light fittings comply with clause G9.3.1(g) of the building code (the First Schedule to the Building Regulations). The determination involves two questions:

(a) Is the store a hazardous area?

(b) If it is, are the specified light fittings appropriate for use in a hazardous area?

1.1.3 In making its determination, the Authority has not considered whether the building, including the proposed electrical system, complies with any other provisions of the building code.

1.2 The parties

1.2.1 The applicant is the owner of the building. The only other party is the territorial authority.

1.2.2 Neither of the parties wished the Authority to hold a hearing at which they could speak and give evidence.

1.3 The building and the sequence of events

1.3.1 The building is essentially a single-span portal frame structure with a clear floor area of approximately 3,500 m^2 and an available storage height of up to 9 m in which approximately 31,000 m^3 of grain or meal can be stored in bulk. The stored product is handled by diesel powered front-end loaders and diesel truck and trailer units.

1.3.2 The only electrical fittings proposed for the building are light fittings and a motor and limit switches for roller shutter doors (supply cables and control equipment for the doors are outside the building). The building was constructed under a building consent on the basis that

"light fittings were to be sealed in dust proof covers", with specified fittings to be covered with armour plated glass.

1.3.3 The drawings submitted to the Authority called for a particular proprietary fitting. In the course of construction the electrical subcontractor refused to install the specified fittings because it considered that the building was a hazardous area for which those fittings were not appropriate.

1.3.4 The applicant submitted the matter to the Authority for determination.

1.3.5 The building has been completed, except that no electrical fittings have been installed, and is in use.

1.4. The legislation

1.4.1 Section 2 of the Building Act includes the following definitions:

> "Building work" means work for or in connection with the construction, alteration, demolition, or removal of a building; and includes sitework:
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> "Energy work" means -
>
> (a) Gasfitting:
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> (b) Prescribed electrical work:
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> "Energy work certificate" means a certificate of the kind referred to in paragraph (e) or paragraph (f) of section 50(1) of this Act:
>
> "Prescribed electrical work" has the same meaning as in section 2 of the Electricity Act 1992:

1.4.2 The installation of the electrical system is "building work" and is also "prescribed electrical work" and therefore "energy work".

1.4.3 Section 7(1) of the Building Act provides:

> (1) All building work shall 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.

and section 32A provides:

> (1) Subject to subsections (2) to (4) of this section, energy work does not require a building consent.
>
> (3) Subsection (1) of this section does not apply in respect of any energy work in any case where, if that work required a building consent, such a consent could not be granted unless it were granted subject to a waiver or modification of the building code or any document for use in establishing compliance with the building code.
>
> (4) Where any owner wishes to obtain a building consent in respect of any energy work that does not require a building consent, the owner may apply for a building

consent in respect of that work (whether or not the application also relates to any other building work), and in any such case this Act shall apply in all respects as if the energy work to which the application relates required a building consent.

It is common ground that the applicant wished to obtain a building consent in respect of the installation of the electrical system as well as the rest of the building work.

1.4.4 Section 34A of the Building Act provides:

> **34A. Referral of application relating to energy work** - (1) Notwithstanding anything in section 34 of this Act, where an application for a building consent is made to a territorial authority in respect of any energy work, then, in so far as the application involves the grant or refusal of a waiver or modification of the building code, or any document for use in establishing compliance with the building code, in respect of that energy work, the territorial authority shall refer the application to the Authority for a decision on -
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> (a) Whether or not that waiver or modification should be granted; and
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> (b) If the Authority determines that the waiver or modification should be granted, whether or not any conditions should be imposed in respect of that grant, and, if so, the terms of the conditions.
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> (2) A referral to the Authority pursuant to subsection (1) of this section shall be deemed to be an application made to the Authority under section 17 of this Act by the applicant for the building consent to which the referral relates, and Part III of this Act, so far as applicable and with all necessary modifications, shall apply accordingly.
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> (3) In determining, in relation to any application referred to the Authority pursuant to subsection (1) of this section, whether or not a waiver or modification of the building code or any document for use in establishing compliance with the building code should be granted, the Authority shall consult with the Secretary of Commerce, and shall have due regard to any advice received from the Secretary in relation to the matter.

1.4.5 Clause G9 "Electricity" of the building code provides:

> **G9.3.1** The electrical installation shall incorporate systems to:
>
> (g) Safeguard against ignition of the surrounding atmosphere where it is potentially flammable or explosive.

1.4.6 The relevant document for use in establishing compliance with the building code is Approved Document G9, in which G9/VM1 provides:

> 1.0.1 The following documents shall be accepted as a method of verifying compliance with the relevant Performances of NZBC G9:
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> New Zealand Electrical Codes of Practice numbers ECP1, ECP2, ECP3, ECP4, ECP5, ECP7, ECP11, ECP12, ECP 19, ECP21.2, ECP24, ECP28, ECP29, ECP33, ECP34, ECP35, ECP36 and ECP41.

1.4.7 ECP 24, for the safety of electricity in hazardous areas provides that hazardous areas are to be classified in accordance with NZS 6101 Classification of hazardous areas Part 2: 1990 Combustible dusts. Two hazardous areas are defined: zone 11, where combustible dust in normal concentrations is present during normal operations, and zone 12, defined as follows:

> Zone 12 (Where combustible dust in explosive concentrations is present only under abnormal conditions or fibres or flyings are present)
>
> i.e. where:
>
> (a) Outlets from cyclone and bag filter vents occur, because in the event of a malfunction there may be an emission of dust.
>
> (b) There are straining and filtering devices which need to be opened at frequent intervals for cleaning.
>
> (c) There are located safety valves and vents associated with bursting discs and bursting disc devices or explosion doors that could give rise to a release of dust should they operate.
>
> (d) Housekeeping problems exist.
>
> Zone 12 shall be the entire room where such equipment is contained.
>
> NOTE- Dispensation of the requirements for Zone 12 may be given where good housekeeping and/or improved design is evident.

1.4.8 ECP 24 also provides that the installation of fittings in hazardous areas shall be in accordance with AS 2381.1 - 1991 Electrical equipment for explosive atmospheres. It is common ground that the specified fittings are not in accordance with AS 2381.1.

1.4.9 In essence, therefore:

(a) If the store is not a hazardous area, the specified fittings comply with ECP 24 and therefore with clause G9.3.1(g) of the building code.

(c) If the store is a hazardous area the specified fittings do not comply with ECP 24 and may be used only pursuant to a waiver or modification of that document, which may be issued only by way of a determination by the Authority made after the Authority has consulted the Secretary of Commerce.

2. IS THE STORE A HAZARDOUS AREA?

2.1 Summary

2.1.1 The question was whether the store is a hazardous area in terms of NZS 6101 Part 2 (see 1.4.7 above).

2.1.2 The applicant submitted evidence that it does not come within the definition of zone 11, and argued that the definition of zone 12 did not apply to this particular building, but if it did then a dispensation should be granted on the grounds of good housekeeping. The territorial

authority commented on that argument. The Authority decided that the building came within the definition of zone 12 and that a dispensation was not justified.

2.2 The applicant's submissions

2.2.1 The application was accompanied by the relevant plans and the manufacturer's literature relating to the specified fittings, together with:

(a) A report on dust monitoring and assessment of explosion risk undertaken by a research organisation;

(b) Technical submissions prepared for the applicant by a consulting engineer; and

(c) Technical literature and specific comments on the specified fittings from the manufacturer of those fittings, see 3.1.1 below.

2.2.2 The research organisation visited the store while soya meal was being loaded. The dust concentration was measured at two sample locations where it was considered likely to be at its highest, and at another location away from the highest dust concentration. The organisation reported that:

(a) The samples collected were "several orders of magnitude" below the minimum explosive concentration given in NZS 6101 Part 2.

(b) "From the observations made during the site visit the indications were that it would be unlikely that concentrations of soya dust would reach the minimum explosive limit."

(c) "Based upon the results of this sampling exercise conducted during normal loading conditions, it is concluded that the risk of a primary dust explosion due to general atmospheric dust concentrations is very low."

The Authority accepts that report as establishing that dust is not present in explosive combinations during normal operations and that therefore the building does not come within zone 11 as defined in NZS 6101 Part 2.

2.2.3 The applicant's consulting engineer submitted that:

(a) "NZS 6101: Part 2:1990 [is] written about small enclosed spaces having high dust concentrations primarily resulting from mechanical loading and/or dust extraction equipment. None of the listed devices under Zone 12 are present in the building."

The Authority takes that to be an argument that the building does not come within the definition of zone 12. It disagrees for the reasons set out in 2.5.2.2.

(b) If the building was considered to come within the definition of zone 12, a dispensation on the grounds of good housekeeping was justified because Appendix A to NZS 6101 Part 2 listed five conditions necessary for a dust explosion, but in this case two of those conditions did not apply because:

(i) The dust was not present in an explosive concentration during normal operations, as evidenced by the research organisation's report, and "will not reach these levels during cleaning operations if proper housekeeping methods are employed".

- As to housekeeping, the structure provided minimal dust ledges, and cleaning would be on a 4 to 6 month cycle depending on the type of product stored. Over the first 5 months of operation soya-meal dust had reached a maximum thickness of 8 mm. Soya-meal dust is coagulative and will be removed by brushing not by compressed air. If products for human consumption are stored, cleaning to prevent infection from bird droppings must take precedence with regard to the cleaning cycle.

- Furthermore, any grain products (as distinct from soya meal) in the store would have been aspirated to remove dust as a precaution against dust explosions in the silos in which they would have previously been stored.

(ii) There would be no source of ignition:

- The exhaust temperatures of the diesel-powered trucks and loaders "are unlikely to reach" the ignition temperature of stored product.

- The specified light fittings would not reach those ignition temperatures, see 3 below.

- "Should the dispensation for the Zone 12 hazard zone not be granted, the existing motor, gear box and limit switch to each door be removed and be replaced with a D.I.P. rated equivalent." (See 3 below.)

The Authority was not willing to grant a dispensation for the reasons set out in 2.5.2.3 below.

2.3 The territorial authority's submissions

2.3.1 The territorial authority submitted:

(a) Technical submissions in response to the applicant's submissions prepared for the territorial authority by another consulting engineer; and

(b) A communication from the manufacturer of the specified fittings in response to an inquiry from the territorial authority's consulting engineer (see 3.2 below).

2.3.2 The territorial authority's consulting engineer submitted that:

(a) Soya meal produces low dust concentrations, but there is nothing to prevent the store from being used for other materials.

- Some of those products "have very low explosive concentrations". NZS 6101 Part 2 lists grain products with explosive concentrations as low as one third that of soya meal.

- There is no certainty that grain products will always be aspirated to remove dust.

- There is no regulatory mechanism to control the materials which will be stored in the building.

(b) As to ignition sources:

- For the trucks and loaders, the critical temperature is not that of the exhaust but that of the highest temperature location which can impact upon the dust laden environment. "It is not at all uncommon for exhaust manifolds to operate in the 300°C - 400°C range, and the exhaust portion of turbocharger bodies can reach 500°C."

- The specified fittings were not appropriate, see 3 below.

2.4 Report from OSH

2.4.1 To assist it in making its determination, the Authority asked OSH (the Department of Labour's Occupational Safety and Health Service) to visit the store and report to the Authority. Representatives of each of the parties were present during the visit. The OSH report on the visit was copied to the parties.

2.4.2 The OSH inspector who made the visit reported that:

(a) At the time of the visit the store was filled to approximately three-quarter capacity with two products, wheat and soya meal.

(b) No measurements of dust concentration were made, but:

- "The stored soya meal appears to be constantly shifting which is most evident at the face being worked. This shifting cause small puffs of dust clouds to be produced."

- "The loading of a transport truck, using a front-end loader was observed. During this operation it was noted considerable dust was produced."

(c) "The structural beams, ledges and other surfaces in one half of the building had recently been cleaned down. However, ledges and other surfaces in the other half of the building, over the stored soya meal were heavily laden with dust."

2.4.3 The applicant commented that the report "constituted more of an OSH audit procedure than an investigation into the workability and viability of the building". The applicant drew particular attention to the differences between the OSH visual inspection and the research organisation's scientific sampling and measurement.

2.5 Discussion

2.5.1 General

2.5.1.1 The Authority comments that it is unfortunate that, as mentioned in 1.3.2 above, the building consent was issued on the basis that "light fittings were to be sealed in dust proof covers". This determination might not have been necessary if there had been a specific mention of AS 2236 or at least ECP 24.

2.5.1.2 The Authority makes its determinations on the same basis as a territorial authority issues a building consent or a code compliance certificate, in that it must be "satisfied on reasonable grounds" as to compliance with the building code.

2.5.1.3 On that basis therefore, the Authority considers that its task is to decide on reasonable grounds whether combustible dust in explosive concentrations is likely to be present in abnormal events.

2.5.1.4 The Authority takes "abnormal" events to be confined to reasonably foreseeable events. It is reasonably foreseeable that a product with a comparatively low explosive concentration, such as grain which has not been aspirated, might be stored in the building. It is reasonably foreseeable that good housekeeping procedures might not be properly followed for a number of reasons as well as management error.

2.5.1.5 The Authority considers that an abnormal event is "likely" if it "could well happen", see *Auckland CC v Weldon Properties Ltd* 8 October 1996, Judge Boshier, District Court Auckland NP 2627/95.

2.5.2 The applicant's submissions

2.5.2.1 As to the research organisation's report outlined in 2.2.2 above, the Authority comments that the report is essentially concerned with normal conditions on one particular occasion whereas the Authority is concerned with whether combustible dust in explosive concentrations is likely to be present under abnormal conditions, which would make the store a zone 12 hazardous area in terms of NZS 6101 Part 2.

2.5.2.2 As to the applicant's consulting engineer's argument that the definition of zone 12 does not apply to the building, see 2.2.3 above:

(a) Although NZS 6101 lists certain devices which are not present in the building, those devices are usually associated with containers for dust-producing material. In this case, the material is not in containers, which would appear at first sight to increase rather than reduce the likelihood of ambient dust.

(b) The Authority does not read the general words "Where combustible dust in explosive concentrations is present only under abnormal conditions" as being limited by the references to the listed devices.

2.5.2.3 As to the request for a dispensation on the grounds of good housekeeping:

(a) The Authority is always reluctant to take account of management practices unless there is some assurance that such practices will be followed throughout the life of the building.

(b) The only relevant management practice was in relation to cleaning. Precautions against the presence of ignition sources are irrelevant because they make no difference to whether or not dust will be present in explosive concentrations.

2.5.3 The territorial authority's submissions

2.5.3.1 As to the territorial authority's consulting engineer's submissions outlined in 2.3.2 above, the Authority agrees that it is likely that the store will be used for other than soya meal and aspirated grains. In theory it is possible for the code compliance certificate to define the building's intended use as "storage of soya meal and aspirated grain products only". That would mean that it was not lawful to store other products without the territorial authority being advised of a change of use under section 46 and without any upgrading required under that section. In practice, however, the Authority expects that course would not be acceptable to the applicant and in any case would be virtually impossible to enforce.

2.5.4 The report from OSH

2.5.4.1 As to the report from OSH outlined in 2.4 above, the Authority comments that the inspector's visual observations must be read in conjunction with the dust concentrations measured by the research organisation and the 8 mm thickness and the coagulating nature of soya meal dust mentioned by the applicant's consulting engineer.

2.5.5 Conclusion

2.5.5.1 The Authority concludes that the building is a zone 12 hazardous area as defined in NZS 6101 Part 2.

2.5.5.2 It follows that because the specified light fittings do not comply with ECP 24 they may not be used unless there are reasonable grounds on which they can be accepted as complying with Approved Document G9, which is the relevant document for use in establishing compliance with the building code issued or approved by the Authority under section 29 of the Building Act.

3. ARE THE SPECIFIED LIGHT FITTINGS AN ALTERNATIVE SOLUTION?

3.1 The applicant's submissions

3.1.1 As mentioned in 2.2.1 above, the applicant submitted technical literature and specific comments on the specified fittings from the manufacturer of those fittings.

3.1.2 ECP 24 requires compliance with AS 2381.1, which in turn requires containment in DIP ("dust excluding ignition proof") enclosures in accordance with AS 2236 or BS 6467 (other options are irrelevant).

3.1.3 The manufacturer identified the main differences between the specified fittings and fittings complying with AS 2236, and expressed the opinion that the specified fittings could be altered to comply with DIP requirements. The manufacturer did not claim that the specified fittings were equivalent to AS 2236 fittings.

3.2 The territorial authority's submissions

3.2.1 As mentioned in 2.3.1 above, the territorial authority's consulting engineer also made inquiries to the manufacturer of the specified fittings. The manufacturer provided technical information about the fittings, and concluded by saying that its UK branch:

> . . . have responded to our enquiry and state the [specified fittings'] design has been considered against British standards for equipment used in areas having combustible dust. The design of the fitting was not considered appropriate due to surfaces/cavities (eg between reflector and gear housing) that are not easily cleaned and where dust can accumulate in thick layers.

3.3 Advice received from the Secretary of Commerce

3.3.1 As required by section 34A(3) of the Building Act, the Authority consulted the Secretary of Commerce. That consultation took the form of submitting a draft of this determination for the Secretary's advice.

3.3.2 The Secretary concurred with the draft.

3.4 Discussion

3.4.1 The Authority places great weight on the manufacturer's opinion that the fittings are not appropriate for use in areas having combustible dust. In the light of that opinion, and of the specific respects identified by the manufacturer where the fittings would need to be modified to comply with AS 2236, the Authority concludes that the fittings cannot be accepted as an alternative solution complying with clause G9.3.1(g) of the building code.

3.4.2 That is not to say that it would not be possible to modify the fittings so that they complied with AS 2236 or BS 6476, in which case they would comply with the relevant documents for establishing compliance with ECP 24, and therefore with the building code, and would be entitled to building consent as of right.

3.4.3 Alternatively, it might be possible to modify the fittings so that, while not complying with ECP 24 they nevertheless complied with the building code. In that case, the specific modifications would need to be submitted for a further determination before a building consent could be issued.

4. THE AUTHORITY'S DECISION

4.1 In accordance with section 20(a) of the Building Act the Authority hereby determines that:

(a) The store is a zone 12 hazardous area as specified in NZS 6101 Part 2; and

(b) The specified fittings cannot be accepted as an alternative solution to clause G9.3.1(g) of the building code.

Signed for and on behalf of the Building Industry Authority on this 8th day of July 1997

J H Hunt
Chief Executive