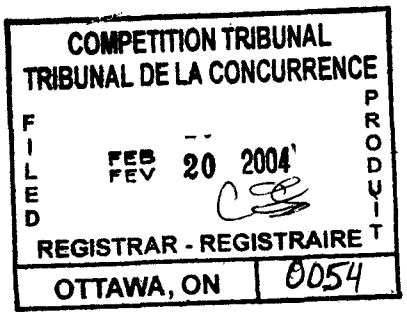
CT-2002-006

THE COMPETITION TRIBUNAL



IN THE MATTER OF *THE COMPETITION ACT,* R.S. 1985, c. C-34, as amended;

IN THE MATTER OF an application by the Commissioner of Competition pursuant to sections 79 and 77 of the *Competition Act*;

AND IN THE MATTER OF certain practices by Bibby Ste-Croix, a Division of Canada Pipe Company Ltd.

BETWEEN:

THE COMMISSIONER OF COMPETITION

Applicant

AND

CANADA PIPE COMPANY LTD./TUYAUTERIES CANADA LTÉE

Respondent

EXPERT REPORT OF JOZEF ZORKO

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AFFIDAVIT OF JOZEF ZORKO

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AFFIDAVIT OF JOZEF ZORKO

I, **JOZEF ZORKO**, Architect, of the City of Montréal in the Province of Québec, 001
MAKE OATH AND SAY AS FOLLOWS:

1 Qualifications

Resulting from my over 20 years of practice with the firm of Desnoyers Mercure & associates as an architect involved in a number of highly complex institutional, commercial and industrial projects both for new construction and for the refurbishment and adaptive re-use of existing structures, I came to focus on and develop a particular expertise in the domain of building codes and regulations. This knowledge concerns not only the interpretation and application of codes but also the understanding of the regulatory process and framework as a whole and its impact on the design of buildings and their separate components and systems. 002

This accrued expertise is widely recognized and regularly sought on a consultancy basis by peers as well as building owners and developers. This level of competency is further acknowledged by my appointment as professor in the field of building codes and regulations to undergraduate students at the McGill University School of Architecture as well as to interns and trainee architects for the Quebec Order of Architects continuing education program. Of special interest with regards to the application of building codes and regulations, I was also appointed to train the City of Montreal Permits and Inspections Services building Inspectors upon the adoption of the *National Building Code of Canada (NBC)* by the City of Montreal in 1995. 003

Attached as Exhibit "A" to my affidavit is a copy of my current Curriculum Vitae. 004

The firm of Desnoyers Mercure & associés has been active in the domain of professional architectural services since its creation in 1957. The firm's involvement since in a wide spectrum of projects, in terms of building types and in terms of scope, has resulted in both the accumulation of knowledge and experience of key issues governing the design and use of buildings in Canada and the development of the highest standards of technical competency in all of the relevant domains. 005

DMA actively renders consulting services in the domain of building codes and regulations application, within the work performed as general architectural services as well as stand-alone services for owners and other professionals, including code conformity assessments and conformity and fire & life safety upgrade programs. 006

For the purposes of this study and report, I also relied on the collaboration of my colleagues at Desnoyers Mercure, Mr. François Hogue, architect and associate of the firm as well as Ms. Christianne Rail, staff architect, who contributed to the research on which this report is based as well as to the writing of this report. 007

I attach as Exhibits "B" and "C" respectively, copies of their respective Curriculum Vitae. 008

2 Report Summary

In Canada, the physical characteristics as well as the use of construction materials are governed by various construction codes and regulations enacted by authorities having jurisdiction at various levels. 009

The recent years have seen a progressive convergence of regulations across the various levels of jurisdiction, federal, territorial, provincial and municipal, within their respective authority as defined by law, towards the adoption of similar, if not identical, requirements, following the National Model Codes developed by the National Research Council of Canada. 010

Acting as a whole, the various terms of the pertinent codes, namely the *NBC* and the *National Plumbing Code*, by way of direct prohibition or indirectly through restrictions aimed at certain applications and building designs, create a situation where the use of non-metallic drain/waste/vent piping materials is heavily curtailed for a large measure of the construction industry. 011

Moreover, the wide differences in costs strongly affect the possibility of choice among various materials that would conform in all regulated cases to the applicable Codes. These constraints combine to create the current conditions in Canada where drain/waste/vent piping materials made from cast iron are clearly favoured as a material of choice. 012

The recent emergence of products that can be substituted in some cases for cast iron piping is not likely, in the short term, to substantially mitigate the prevalence of cast iron in drain/waste/vent applications. For the long term, the viability of such substitutes remains speculative, owing to the legitimate reservations affecting these newly introduced materials as well as the limits imposed on their use by Code requirements. 011

Finally, tendencies observed in the evolution of drain/waste/vent piping elsewhere in the world and more particularly in the United States suggest that important revisions to the requirements of the Canadian model codes may be forthcoming. However, this revision process generally takes place over a number of years and it would not be reasonable to expect that the regulatory constraints favouring the use of cast iron piping are likely to disappear in the short or even the medium term. 012

3 Introduction

.1 Description of the Mandate

The mandate assigned to Desnoyers Mercure & associés by the Commissioner of Competition, Industry Canada consists in providing an analysis and an expert opinion to verify whether there exist, in the construction industry, conditions such that the use of cast iron piping materials for drain/waste/vent applications could be considered for all practical purposes as essentially unavoidable. 013

The scope of the study required to make this determination is defined as covering the two following aspects: 014
a) the conditions defined by the legal or regulatory framework or by otherwise normative requirements, and
b) the viability of using alternate materials under such conditions.

.2 Methodology

The present study proceeded in two stages: first research and, second, analysis and conclusions. 015

Where normative and regulatory issues are concerned, the approach was to follow the framework of the regulatory system regarding construction materials and products in Canada at the national, provincial and municipal levels. 016

Organisations representing various industry stakeholders were also contacted to obtain information regarding the possible existence of "para-normative" requirements, that is, requirements not emanating from regulations but rather from corporate or institutional performance or quality specifications. 017

Regarding materials for drain/waste/vent piping that could serve as substitutes for cast iron products, the spectrum of products available on the market were investigated along with their use, with particular attention given to fire-retardant coated polyvinyl chloride piping, an innovative product manufactured by IPEX Inc. 018

.3 Limitations

The present study is limited to the description of the regulatory environment and its effects on the qualification of materials with regards to their use. 019

It is beyond the scope of this report to address the relative size or value of markets or market segments related to such qualifications. 020

4 Research: conditions/constraints-use of piping materials

.1 Regulatory Environment

Under the *British North America Act* and its successor, the *Constitution Act*, responsibility for building regulations in Canada rests with the provinces and territories. This responsibility was generally delegated to municipalities, which, not surprisingly, resulted in a multiplicity of regulations being developed over time as each municipality tried to deal with its own needs. These variations from one municipality to the next made it very difficult for designers, product manufacturers and contractors to conduct business in more than one region. 021

Thus, in 1937, the federal Department of Finance asked the National Research Council (NRC) to develop a model building regulation that could be adopted by all provinces and/or municipalities in Canada. The result of that initiative was the publication of the first edition of the *NBC* in 1941. 022

The post-war construction boom fuelled the demand for a revised *NBC*. Thus in 1948, NRC created the Associate Committee on the National Building Code whose mandate was to update and maintain the *NBC* on an ongoing basis and to provide for broad input. The Associate Committee revised the *NBC* in 1953 and has subsequently published new versions approximately every five years. The 1995 version of the *NBC* 1995 is the 11th edition. 023

After having remained extremely fragmented and disconnected over the various levels of government and the various authorities having jurisdiction, the regulatory environment in Canada has been considerably simplified over the recent years, eventually crystallizing around the set of Codes published by the NRC in 1995. 024

These codes are introduced as model documents; they must be enacted by an authority having jurisdiction to have force of Law. The national model codes are therefore either adopted without modification as provincial, territorial or municipal building regulations or are modified to suit local conditions. 025

The framework of Codes takes the form of a hierarchy dominated by the *NBC* which states the minimal requirements to be met in new construction regarding the health and safety of occupants and structural resistance. Where plumbing installations are concerned, part 7 of the *NBC* refers directly to the *National Plumbing Code*, which governs the design and installation of plumbing systems in buildings. 026

.2 Legal Framework

In most provinces, laws regarding municipal affairs provide for the adoption of regulations establishing standards for building construction, use and occupancy. The purpose of these laws is to regulate the building of structures so as to foster the health and safety of their occupants. In several provinces, municipalities are given the authority to adopt the *NBC* or the *National Fire Code*, in whole or in part. For the purposes of formulating provincial laws, the code can be adopted by simple reference in a municipal by-law. 027

In order to achieve a modicum of uniformity among their municipalities, the provinces of Québec, Ontario, Alberta, Prince-Edward Island, Manitoba and Saskatchewan enacted provincial laws regarding a provincial building code addressing the issues of fire/life prevention and safety. 028

More particularly, the dispositions specific to the provinces are as follows, referring to the national model code, being the *NBC*: 029

.1 Nova-Scotia, Manitoba, Saskatchewan, Yukon, North-West Territories and Nunavut: the *NBC* is generally applied everywhere; 030

.2 Prince-Edward Island, New-Brunswick: most municipalities have adopted the *NBC*; 031

.3 Québec refers to its *Building Act* which provides for the adoption of the *Building Code, Chapter 1 - Buildings* of the *Construction Code* and which has been in force since November 7, 2000. This document reproduces for the most part the 1995 edition of the *NBC* published by the NRC with some additions and alterations; 032

.4 In Ontario, the *Building Code Act* has replaced the building construction standards formerly enforced by municipal by-laws by enacting the *Ontario Building Code (OBC)*. However, as a result of the *Act*, City Councils act solely as enforcers of the *Code* established by provincial legislation and can not impose more stringent requirements than are set forth in the *OBC*. As in Québec, the *OBC* closely matches the *NBC*; 033

The *Ontario Building Code* furthers includes a section 7 bearing specifically on plumbing; 034

.5 In Alberta, the *Safety Codes Act* enables the lieutenant-governor to enact regulations; the *Municipal Government Act* enables city councils to edict regulations to assure the fire and life safety for buildings. These regulations essentially correspond to the *NBC*; 035

.6 In British Columbia, city councils have the absolute authority to adopt by-laws addressing the health, security and safety of persons and property; councils may adopt the *Canadian Electrical Code*, the *National Fire Code* or the standards of the Canadian Gas Association; sections of the *NBC* have been adopted to form a provincial code. 036

.7 Newfoundland and Labrador: the *NBC* is applied on an individual basis by municipalities and no provincial codes exist to govern either buildings or plumbing installations. 037

In some instances, provincial laws prescribe specific requirements applying to some aspects of building construction. It appears that nothing prevents municipalities from adding construction requirement by-laws provided that this is done within the boundaries of their authority in the matter, as delegated by provincial governments. 038

It is worth noting that should the case arise of a conflict between municipal and provincial regulations, the latter would take precedence. 039

.3 The National Plumbing Code

Where plumbing installations are more specifically concerned, Part 7 of the *NBC* refers to the *National Plumbing Code*, also introduced as model document, and whose purpose and scope is to address the requirements for the design and installation of plumbing systems. The Code is drafted in such a way that it may be adopted or enacted for legal use by any jurisdictional authority in Canada jointly with or separately from the *NBC*. 040

Various jurisdictions, in accordance with their respective governing laws, have integrated the *National Plumbing Code* as follows: 041

.1 The following provinces and territories have adopted the *National Plumbing Code* with some modifications and additions: Yukon, Nunavut, New-Brunswick, Prince-Edward Island (without any changes), North-West Territories, Saskatchewan, Manitoba and Nova-Scotia. 042

.2 The following provinces have created their own Plumbing Codes, adapted from the *National Plumbing Code* with some modifications and additions: British Columbia (mainly additions), Ontario (with significant changes in scope and contents), Québec (with additions); 043

.3 The Province of Newfoundland and Labrador does not have provincial regulations regarding plumbing installations. 044

It is therefore safe to conclude that for all intents and purposes, jurisdictions generally follow national model codes with some modifications and additions. 045

It is worth noting however that although municipal governments do not have the authority to reduce by way of by-laws or otherwise the requirements of provincial building codes and regulations, they do have the authority to impose more restrictive requirements, including for example piping materials in drain/waste/vent plumbing installations, for any type of building erected within their jurisdiction and subject to their building permits. 046

This in no way contradicts the aim of model codes which is to foster fire and life safety in the use and occupancy of buildings. It must also be pointed out that modifications or additions by various jurisdictions to the national model codes, if any, are usually made to create more restrictive provisions or stringent requirements to address special or unique local conditions, constraints or levels of quality. 047

.4 Standards

Hundreds of standards are used in the construction industry and act in support of Code requirements. More particularly, by application of article 2.7, the NBC directly and specifically includes by reference some 260 documents, codes and standards, which in turn also refer to a number of others. As a general rule, these are documents prepared by organisations accredited within their respective fields of interest by the Canadian Standards Council: 048

- The Canadian General Standards Board (CGSB)
- The Canadian Standards Association (CSA)
- The Underwriter's Laboratories of Canada (ULC)
- The Canadian Gas Association
- The "Bureau de normalisation du Québec" (BNQ).

These standards, as well as parts and sections of the NBC also refer to standards from organisations in the United States such as the American Society for Testing and Materials (ASTM) and the National Fire Protection Association (NFPA).

A number of these standards are directly concerned with the physical characteristics and properties of materials and products that are relative to the performance and functional requirements specifically prescribed by the Codes. These standards also refer to other CSA, ULC or ASTM standards governing the testing methods by which the numerical values are established for the performance and physical characteristics that are the object of precise Code specifications. 049

It is thus through this standardisation system that products offered on the market are evaluated and qualified relative to their suitability to Code requirements with regards to their use in construction. 050

.5 Requirements flowing from applicable codes

Our survey of currently applied regulations has led us to conclude that various adaptations of either the NBC or the *National Plumbing Code* do not affect the Code provisions that directly concern the issues and requirements at hand in the particular case of drain/waste/vent piping. 051

The provisions of the *NBC*, either in its original format or in its various jurisdictional incarnations, that are relevant to this report are contained more specifically in Part 3: "Fire Protection, Occupant Safety and Accessibility". Requirements for the features of fire protection are specified therein, as applicable relative to building size and occupancy. Not covered by Part 3 are commercial buildings, low or medium hazard industrial buildings and residential buildings having a building area less than 600m² or having three storeys or less in building height which are the object of Part 9 of the *NBC*. The article numbers indicated hereunder in reference to the discussion, indicate by the first digit that they are extracted from Part 3 of the *NBC*. 052

The requirements relevant to drain/waste/vent piping materials are covered first and foremost by article **3.1.5.15.** of the 1995 edition of the NBC, hereunder quoted in full: 053

3.1.5.15. Combustible Piping Materials

(1) Except as permitted by Clause 3.1.5.2.(1)(e) and Sentences (2) and (3), combustible piping and tubing and associated adhesives are permitted to be used in a building required to be of noncombustible construction provided that, except when concealed in a wall or concrete floor slab, they

a) have a flame-spread rating not more than 25, and

b) if used in a building described in Sub-section 3.2.6, have a smoke developed classification not more than 50.

(2) Combustible sprinkler piping is permitted to be used within a sprinklered floor area in a building required to be of noncombustible construction. (See alsoArticle 3.2.5.14.)

(3) Polypropylene pipes and fittings are permitted to be used fro drain, waste and vent piping for the conveyance of highlky corrosive materials and for piping used to distribute distilled or dialyzed water in laboratory and hospital facilities in a building required to be of noncombustible construction, provided

a) the building is sprinklered throughout;

b) the piping is not located in a vertical shaft, and

c) piping that penetrates a fire separation is sealed at the penetration by a fire stop system that, when subjected to the fire test method CAN4-S115-M, "Standard Methods of Fire Test of Firestop Systems," has an FT rating not less than the fire-resistance rating of the fire separation.

There are further indirect requirements relating to flame-spread and smoke developed characteristics restrictions in sentence (1) of article 3.6.4.3. - Plenum Requirements of the *NBC*, copy of which is provided within Exhibit D, for piping in horizontal service spaces (between floor and ceiling, or ceiling and roof) used as a plenum. The restrictions regarding materials used inside such plenums are the same as those specified in sentence 3.1.5.15. (1) quoted above. 054

Finally, sentence (3), hereunder quoted in full, of article 3.1.9.4, imposes an indirect constraint resulting from the design of plumbing installations: 055

3.1.9.4. Combustible Piping Penetrations

3) Except as permitted by Sentences (4) to (6), combustible piping shall not be used in a drain, waste and vent piping system if any part of that system penetrates

a) a fire separation required to have a fire-resistance rating, or

b) a membrane that forms part of an assembly required to have a fire-resistance rating.

Clause a) of Sentence (4) of article 3.1.9.4. nevertheless allows the use of combustible piping for drain/waste/vent systems that penetrate fire-rated separations or assemblies provided that the piping is sealed at the penetration using prescribed fire-stopping materials. However, Clause b) of the same Sentence (4) of article 3.1.9.4. indicates that this allowance does not exist in the case of pipes installed in a vertical shaft. Note that in this last case, the prohibition of combustible piping materials in vertical shafts is made regardless of flame-spread rating or smoke contributed classification. Since plastic piping materials are combustible materials, the Code prohibits their use in vertical shafts. 056

The impact of the application of these provisions are discussed in section .6 hereunder. 057

.6 Scope and Meaning

The significance of 3.1.5.15 1) can be understood in terms of the scope that the expression "*...a building required to be of noncombustible construction...*" represents. Section 3.2 - Building Fire Safety of the *NBC* establishes the parameters along which is determined where a noncombustible construction is required. Articles 3.2.2.20 to 3.2.2.83 specifically indicate in which cases, depending on use and occupancy, building area, building height, accessibility from public roads and the presence of automatic fire extinguishing systems, a requirement for noncombustible construction will exist. 058

Table 1 hereunder, entitled *List of building types and configurations where non-combustible construction is required and where 3.1.5.15(1)a) is applicable* summarizes the building types and configurations that the requirement for noncombustible construction can encompass. This list includes buildings classified as high-rise and for which the provisions of 3.1.5.15 1)b) are added. These buildings, defined in Sub-section 3.2.6 of the NBC, copy of which is included in the appendix, are described more specifically in Table 2 hereunder. 059

The restrictions prescribed in 3.6.4.3(1)a) relative to piping installed in horizontal service spaces used as plenums will apply wherever the construction of horizontal service spaces or ducts used as plenums using combustible materials is permitted. In this case, the requirements regarding smoke developed classification in 3.1.5.15(1)b) are added to the flame-spread ratings requirement in 3.1.5.15(1)a) for all building types listed in Table 1. 060

This regulatory constraint is indirect in nature in that it is contingent upon technical decisions in the design of buildings. As it were, the application of the other requirements indicated in article 3.6.4.3(1) generally make it preferable for economic as well as for technical reasons to avoid building plenums and service spaces using non-combustible materials. 061

Table 1

List of building types and configurations where non-combustible construction is required and where 3.1.5.15(1)a) is applicable

Classification	*i.e.*	*having*
A-1	*Assembly occupancies intended for the production and viewing of the performing arts*	*more than one storey above grade*
A-2	*Assembly occupancies not elsewhere classified in Group A (restaurants, schools, auditoria, libraries, churches, etc.)*	*more than two storeys above grade*
A-3	*Assembly occupancies of the arena type*	*more than one storey above grade or a total building area greater than 1800m²*
A-4	*Assembly occupancies in which occupants are gathered in the open air (stadia);*	*a number of occupants greater than 1500*
B-1	*Care or detention occupancies in which persons are under restraint or are incapable of self preservation because of security measures not under their control*	*- no exception*
B-2	*Care or detention occupancies in which persons having cognitive or physical limitations require special care or treatment*	*more than two storeys above grade or a building area of 2 400m²*
C	*Residential occupancies*	*more than four storeys above grade, or more than three storeys above grade when not prinklered*
D	*Business and personal services occupancies*	*more than four storeys above grade, or more than three storeys above grade when not prinklered*
E	*Mercantile occupancies*	*more than four storeys above grade, or more than three storeys above grade when not prinklered*
F-1	*High hazard industrial occupancies*	*more than three storeys above grade*
F-2	*Medium hazard industrial occupancies*	*more than three storeys above grade*
F-3	*Low hazard industrial occupancies*	*more than four storeys above grade*

Table 2

List of building types and configurations where non-combustible construction is required and 3.1.5.15(1)a) is not applicable

Classification	*i.e.*	*and*
A/D/E/F	*all buildings used for assembly, business and personal services, mercantile or industrial occupancies*	*where the uppermost floor is located higher than 36m (±12 storeys) above grade*
A/D/E/F	*all buildings used for assembly, business and personal services, mercantile or industrial occupancies*	*where the uppermost floor is located higher than 18m (±6 storeys) above grade for an occupant load to be established in accordance with the prescribed method*
B	*all buildings used for care or detention occupancies*	*where the uppermost floor is located higher than 18m (±6 storeys) above grade*
B-2	*all buildings used for care or detention occupancies in which persons require special care or treatment (hospitals, sanitariums, etc.)*	*occupying a floor area located above the third storey of any building*
C	*Residential Occupancies*	*where one floor is located higher than 18m (±6 storeys) above grade*

Finally, the application of article 3.1.9.4. emphasizes the impact of the design of an entire plumbing system and its configuration within the building space. The cases in which the requirements of this article permit the use of combustible piping materials are those of isolated pipes or small groups of pipes where the act of cutting holes for each individual pipe does not involve significant difficulties with regards to either the integrity of the load-bearing capacity of structural elements in floors or walls, or to the additional costs in labour incurred the application of fire-stopping materials at each opening, as required under 3.1.9.4.(4)a). 062

It is however generally significantly more cost-effective during construction and for the purposes of building operation in many types of occupancies and uses to regroup pipes and ducts in strategically located vertical shafts so as to facilitate installation, maintenance and replacement. From the point of view of the use of the building space, this design principle allows for much greater flexibility in the planning of floor areas as well as for the eventual remodelling of spaces, since it is much easier to alter horizontal runs of pipes and ducts than to displace vertical risers. As a result of this, it is a widespread standard design strategy to concentrate a variety of building services ducts, conduits and pipes within vertical shafts, where the use of combustible piping materials in prohibited in all buildings, as specified in 3.1.9.4(4) b). 063

.7 Extra-regulatory Constraints

Among buildings where combustible construction would be allowed and where neither Sub-section 3.2.6 nor articles 3.1.5.15 and 3.6.4.3 would thus be applicable, there could exist, over and above those prescribed by the Codes in effect, even more restrictive requirements. Such could be the case, for example, with major builders, property developers or owners as a result of internal policies, design standards or other proprietary issues. It could also be the result, in the case of, for example, industrial or commercial buildings where combustible construction is permitted by Codes, of additional requirements imposed by property insurers or mortgage holders. 064

5 Piping Materials Readily Available

Table 3 hereunder lists the inventory of products commonly used in construction and which can be used in drain/waste/vent piping applications as a substitute for cast iron pipes, as governed by the requirements of the *National Plumbing Code*: 065

Table 3 -Materials commonly available for drain/waste/vent installations

Materials	Applicable Standards	As per the National Plumbing Code 1995 Application		Ratings (1)	
		Drain	Vent	Flame Spread	Smoke Developed
Metallic					
Aluminium pipes	*CAN/CSA-B281-M*	*Allowed*	*Allowed*	-	-
Cast iron drain pipes	*CSA-B70*	*Allowed*	*Allowed*	-	-
Galvanised steel pipes	*ASTM-A 53*	*Allowed*	*Allowed*	-	-
Copper or brass pipes	*ASTM-B 42, 43*	*Allowed*	*Allowed*	-	-
Rigid copper tubing	*ASTM-B 88*	*Allowed*	*Allowed*	-	-
Copper DWV tubing	*ASTM-B 306*	*Allowed*	*Allowed*	-	-
Lead drain pipes	*CSA-B67*	*Allowed*	*Allowed*	-	-
Polymers					
Polyvinyl Chloride (PVC) DWV pipes	*CSA-B181.2*	*Allowed*	*Allowed*	*10*	*250*
Polyvinyl Chloride (PVC) DWV XFR pipes	*CSA B181.2*	*Allowed*	*Allowed*	*0*	*35*
Acrylonitrine-Butadiene Styrene (ABS) plastic DWV pipes	*CSA-B181.1*	*Allowed*	*Allowed*	*200*	*500*
ABS plastic DWV pipes, honeycomb core, schedule 40	*ASTM-F 628*	*Allowed*	*Allowed*	*200*	*500*
Polyolefin for laboratories (PO)	*CAN/CSA-B181.3-M*	*Allowed*	*Allowed*	*n.a.*	*n.a.*
Polyethylene (PE)	*CSA-B137.1*	*Prohibited*	*Prohibited*	*n.a.*	*n.a.*
Polyvinyldiene Fluoride (PVDF)	*ASTM F1673-02*	*Prohibited*	*Prohibited*	*0*	*45*
Polypropylene (PP)		*Prohibited*	*Prohibited*	*n.a.*	*n.a.*
Polybutylene (PB)	*CAN/CSA-B137.8-M*	*Prohibited*	*Prohibited*	*n.a.*	*n.a.*
Chlorinated Polyvinyl Chloride (CPVC)	*CSA-B137.6*	*Prohibited*	*Prohibited*	*5*	*40*
Other materials					
Cement-asbestos DWV	*CAN/CGSB-34.22*	*Allowed*	*Allowed*	-	-
Cement-asbestos not under pressure	*CAN/CGSB-34.23*	*Prohibited*	*Prohibited*	-	-
Stainless Steel	*n/a*	*Allowed*	*Allowed*	-	-
Concrete	*CAN/CSA-A257.1-M*	*Prohibited*	*Prohibited*	-	-
Glazed ceramic pipes	*CSA-A60.1-M*	*Prohibited*	*Prohibited*	-	-
Borosilicate Glass DWV pipes	*ASTM C1053-00*	*Allowed*	*Allowed*	-	-

(1) The numerical values indicated for Ratings are absolute numbers used as indices where the lower the value of the number, the safer the product;
n.a.: not-available

.1 Metallic Products

The *National Plumbing Code* permits the use of a variety different metals such as aluminium, cast iron, copper and steel. These materials are noncombustible and have a flame spread rating and a smoke developed classification of zero, allowing them to be used in virtually all buildings and occupancies. As far as the above-ground drain/waste/vent piping market is concerned, only cast iron and copper are available. The other materials are not generally available, requiring special orders and implying long delivery delays as well as high costs. 066

As far as total material and installation costs are concerned, copper piping is less expensive to use for diameters up to 75mm and cast iron is more economical for diameters above 75mm. Therefore, as a general rule, copper pipes and fittings commonly used are 75mm diameters and less and cast iron pipes and fittings are usual for larger diameters. 067

.2 Plastic and Polymer Resin-Based Products

Synthetic resins used in the fabrication of plastic pipes are either of the thermosetting or thermoplastic type. Where the application of model Codes is concerned, these materials are considered as combustible materials, defined in the CNB as materials not conforming to the criteria of non-combustibility set out by the CAN4-S114 standard *"Standard Method of Test for Determination of Non-Combustibility in Building Materials"*. Moreover, in both types, the characteristic performance under exposure to fire, expressed in terms of flame spread rating and smoke developed classification, as determined by the CAN/ULC S102.2 standard, are the limiting factors in the cases where combustible piping is permitted by the Code in buildings otherwise required to be of noncombustible construction. 068

Plastic-based piping system components are assembled and joined using solvents which eases and reduces the cost of installation compared to copper and cast iron pipes. ABS plastic installations are less expensive than PVC installations since the latter is denser. 069

Table 3 shows that on the basis of flame spread rating and smoke developed classifications, only PVC piping materials would be permitted for use in drain/waste/vent systems in the building types listed in Table 1, and this under the constraints relative to plenums and those penetrations through fire-rated separations which then need to be sealed with rated fire-stopping materials. These materials would still however be prohibited for use in vertical shafts. 070

.3 Other Products

Other materials are also available for above-ground drain/waste/vent plumbing but their use is limited to very specific instances such as: 071

.1 borosilicate glass, used mainly in laboratories where corrosive chemicals such as concentrated acids or alkalis could damage drainage pipes; 071

.2 asbestos-cement composites, used mainly for very large diameter pipes such as collectors at building connections to public utilities; 072

.3 stainless steel, used for drainage in industrial process installations; 073

.4 "XFR" PVC piping by IPEX Inc..

The following discussion of IPEX Inc. piping products is based on information garnered from standard product brochures and technical literature published by IPEX Inc., as well as data available form the company's web site. 074

IPEX Inc. manufactures in Canada a wide range of plastic piping materials both for the domestic and export markets. It produces pipes made of ABS, PVC, CPVC, PVDF and PE for various applications. 075

Resins used in the fabrication of pipes are procured from the main chemical product manufacturers (Dupont, Goodyear, etc.) Pipes used in buildings for above-ground applications are made of Polyvinyl Chloride (PVC) and Acrylonitrile Butadiene (ABS). PVC drain/waste/vent piping products are produced by IPEX Inc. under the designation "system 15". 076

IPEX Inc. has recently developed a new line of products under the designation "XFR", based on its "system 15" range and whose flame spread rating is 0 and smoke contributed classification is 35. These pipes are also made of PVC but with the addition of an acrylic-based coating especially formulated to enhance its performance characteristics under exposure to flames. While the base materials thus conform to the requirements of Clauses 3.1.5.15 1)a) and b) of the NBC, their approved use is also subject to very specific methods of field assembly and rules of workmanship. In actual applications, the protective coating has to be stripped and the base plastic materials exposed at connection points to allow for the assembly by bonding. Touch-ups of the protective coating therefore have to be field-applied to restore the integrity of the product's fire-resistance characteristics. The approved use of these products is also contingent on the use of special, purpose-made proprietary products and devices to seal and fire-stop penetrations through fire-rated separations and assemblies (walls, shafts, floors or roofs), as per article 3.1.9.1 of the NBC. IPEX Inc. manufactures and distributes these accessory products. 077

These attributes and procedures form the product's main drawback in their use for conformity with code requirements as it is heavily contingent on actual workmanship and the field conditions of installation. The conformity of finished work is thus at the mercy of contractors' and labourers' knowledge and experience in the use of these products as well as their understanding of the criticality of the prescribed assembly procedures and quality of workmanship. Similarly, there needs to be an understanding and recognition of the importance of the integrity of the fire-resistance characteristics in the finished work and which is far from a trivial matter in the culture of the construction trades. 078

The procedure that requires altering the materials' integrity at every connection point appears as a serious flaw since the ultimate ability to fulfill its purpose with regards to Code requirements appears as entirely dependent on a quality of workmanship difficult to assure a priori and likely unverifiable a posteriori because works may have become inaccessible for inspection or without extensive testing procedures. 079

For these reasons it is reasonable to expect that plumbing system designers and specifiers would have some reticence towards the use of such a product to substitute for cast iron pipe products which are well established in standard trade practices and for which related works are also familiar. In all likelihood, it will take some time for contractors and tradesmen to become familiar with IPEX Inc.'s new XFR line of products (or other similar materials) and for the procedures for their use to become well understood before the product becomes well integrated in standard construction practice. 080

The durability of these materials is also a key issue, one that has become pivotal in the development of construction codes and standards. The durability of materials and assemblies, in terms of the longevity of their base physical properties and characteristics, resistance over time to exposure to various normal building operations, as well as the ability to conserve these characteristics after exposure to fire are core issues in the current development of objective-based codes expected to eventually replace and supersede current model Codes. Although quantitative and qualitative performance standards in this domain have to be developed, it is clear that because of their nature, polymer-based materials will be directly affected by these considerations. 090

Finally, the currently emerging trend towards the environmentally sustainable design of buildings and their component systems brings to the forefront further disadvantages of synthetic polymer-based materials compared to cast iron piping which lends itself far more easily to recycling and reuse. 091

All of the above observations outline the significant inconveniences and the risks that can be associated with IPEX Inc.'S XFR products that create a situation where they can only be perceived and selected as a viable alternative to cast iron piping materials if an important advantage is to be gained, either in terms of shortened delivery and/or installation schedules, work site procedures efficiency or, most importantly, in terms of economic benefits. 092

The viability of IPEX Inc.'s product in these terms remains to be established, as it has been on the market for too short a time to make this determination. Although this situation may change over time, it therefore does not appear reasonable for anyone to assume that these products constitute an obvious substitute for cast iron. 093

Such products are still considered combustible materials and as a result would still be prohibited in drain/waste/vent plumbing systems in all buildings listed in Tables 1 and 2 above when installed in vertical shafts and in all other cases where a non-combustible construction is required. Standard design practices for building mechanical systems therefore create a situation where the "XFR" type piping materials remain a marginal alternative to cast iron in drain/waste/vent piping systems in all buildings listed in tables 1 and 2. 094

.5 Other Considerations

Whether in terms of technology or of design practices related to any building elements, the construction industry is in constant evolution. Historically, building codes and regulations have relied on empirically acquired knowledge on performance in actual conditions and have consequently evolved continuously in kind. The restrictions and requirements stated in building Codes are the reflection of the consensus achieved among the main stakeholders of the construction industry to establish reference standards. In Canada, this proceeds by the conciliation of ideas and convictions prevailing in any given specialty or trade. Traditionally, the building products' manufacturing industry greatly contributes to the development of new reference standards and design practices as well as, directly or indirectly, to the elaboration not only of national model codes but also to provincial or municipal codes and regulations. 095

It has long been argued that the use of plastic or polymer based piping systems in buildings, especially in the case of drain/waste/vent applications has little if any bearing on the behaviour of structures in the event of a fire. Reservations have also been expressed concerning the risks associated with smoke emitted by plastic pipes exposed to flame. The current literature in the domain of fire and life safety often cites the arguments put forward by researchers in various institutions that the demonstration has never been conclusively made of the risks and dangers from which the regulations aimed at plastic piping materials are purported to protect the public. 096

For example, in its 2000 version, the *Uniform Plumbing Code*, the equivalent in the United States as a model code to Canada's National Plumbing Code, all previous restrictions regarding plastic piping materials have been removed. In parallel, the 2000 edition of the *International Plumbing Code* imposes no restrictions on the use of plastic piping materials while the *International Building Code* 2000 does include a number of restrictions on these uses, in particular in the case of high rise buildings. 097

Since these model codes undergo a number of modifications or amendments in the process of their adoption by State and/or Municipal governments, there potentially exists a wide diversity in the restrictions eventually imposed on plastic piping materials, ranging from complete elimination to the integral conservation of the anterior model code provisions. The literature published on this subject notes further that where it results in maintaining restrictions as they are, the legislatures' resistance to change is frequently attributed to the influence exerted by economic interests, unions or other lobby groups. It should also be emphasized that in the American experience, it is only at the end of a revision process lasting up to twenty years that some jurisdictions have finally lifted restrictions on the use of plastic piping materials. 098

We can only conclude from the preceding that even assuming that the current code requirements are likely to be sooner or later revised in depth, such revisions could not be expected to be put into effect in the near future except in jurisdictions where authorities can be persuaded to amend their respective regulations to depart from national model codes. The current regulatory restrictions on the use of plastic piping materials in drain/waste/vent plumbing systems which clearly, although indirectly, favour the use of cast iron pipes can therefore not be expected to be eliminated in the near future. 099

6 Conclusions

Building codes and regulations prohibit the use of plastic piping materials listed in Table 3 in drain/waste/vent plumbing systems as follows: 100

i) in all buildings listed in Table 2;
ii) in all buildings listed in Table 1, where the design is such that piping systems are installed in horizontal service spaces used as plenums or in vertical shafts.

The case evoked in ii) above is certainly the most frequent occurrence in buildings listed in Table 1. This building design principle can easily be considered as most widespread among standard design practices for the planning of plumbing systems as much for the purposes of cost-efficiency as for its economic and functional advantages relative to planning and building operations.

In the cases described in i) and ii) above, the additional restrictions imposed by the Plumbing Code on the selection of piping materials relative to use create a situation where, for all practical purposes, the choice of metal piping products generally becomes self-evident. Then must be factored in the economic considerations, where the materials least expensive at purchase and in which labour costs at installation will take precedence. Based on experience and set practice, the standard approach to the design of drain/waste/vent plumbing networks using metal piping materials is to choose copper for all elements having a diameter of 75mm or less and cast iron for all greater dimensions. As it were, most of the drain/waste/vent system elements in buildings listed in Tables 1 and 2, for reasons of the load inherent to the uses and scales listed, will be required to have diameters greater than 75mm and therefore cast iron piping will be selected except in the rare occurrences where economic considerations would yield to technical requirements exceeding those of the applicable codes. 101

The combination of regulatory and economic constraints as well as the most current standard design practice distinctly favour the selection of iron piping materials for use in drain/waste/vent applications, covering the majority of buildings governed by Part 3 of the *NBC*. We are not in a position to ascertain how much of the total real property is affected by the above-mentioned restrictions regarding non-combustibility, flame spread ratings and smoke developed classification for DWV piping materials, in terms of, for example, building area or economic value. It appears however obvious, as we have demonstrated, that it represents a very large share of the total, in particular in urban settings. It is also worth mentioning the ubiquity of cast iron piping in older buildings undergoing renovations and rehabilitations and where the conservation and repair of existing large diameter pipes is usually preferred over replacement, owing to the durability of cast iron systems. 102

In the absence of the immediate or short term availability of materials that can be substituted for cast iron pipe materials, in compliance with building codes and regulations in effect currently and in the foreseeable future and at a cost comparable to cast iron systems for materials and labour, we can conclude that there exists a clear advantage in the market for cast iron products in the current and foreseeable market for drain/waste/vent piping materials destined for a very large segment of the entire building construction industry. 103

See Illustration 1, attached herewith as Exhibit E, summarily illustrating the importance of cast iron piping in the distribution of building types for new construction.

Sworn before me at
the City of Montréal in
the Province of Québec
on February 20, 2004.

Danielle Bujold

Danielle Bujold, Commissaire à l'assermentation N° 144 455

JOZEF ZORKO

7 References

.1 Codes et Regulations

National Building Code of Canada - 1995, Canadian Commission on Building and Fire Prevention Codes, National Research Council, 1995.

National Plumbing Code - - 1995, Canadian Commission on Building and Fire Prevention Codes, National Research Council, 1995.

Quebec Construction Code - Chapter 1, Buildings, National Research Council, 1995.

Ontario Building Code 1997, Ministry of Municipal Affairs and Housing, 2000

Alberta Regulation 219/97 - Plumbing Code

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.2 Reference Literature

A. Blaga, *Use of Plastics as Piping Materials*, Canadian Building Digests CBD-219, National Research Council, 1983

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Technical Literature from IPEX Inc.
- IPEX XFR Pipe system,
- IPEX System 15 DWV,
- IPEX System ABS (DWV),
- *Use of combustible pipes in noncombustible construction,* Information Bulletin

R. George, CIPE, CPD, SmithGroup Inc., *Designer's Guide - Piping Materials*, in Plumbing Engineer, July 2001, TMB Publishing Inc.

J.B. Zicherman, Ph.D., Fire Cause Analysis, *Plastic Pipe and Fire Safety (draft)*, NFPA Journal, National Fire Protection Association, September 2000.

Fire Protection Handbook, 16th edition, National Fire Protection Association, Quincy, Massachuset, 1986

EXHIBITS

A - Curriculum Vitae of Mr. Jozef Zorko

B - Curriculum Vitae of Mr. François Hogue

C - Curriculum Vitae of Ms. Christianne Rail

D - Excerpts from the Pertinent Codes

National Building Code 1995
- Article 3.1.5.15
- Sub-section 3.2.6
- Article 3.6.4.3
- Article 3.1.9.4
- Annex A, article 3.1.2.1 1)

National Plumbing Code 1995
- Article 2.5.12 2)

D - Illustration 1

DMA

EXHIBIT A

Jozef Zorko, B.Arch, B.Sc. (architecture), OAQ, OAA, VBA, NFPA, principal, senior architect.

Acting as partner with DESNOYERS MERCURE & ASSOCIÉS, Mr. Zorko has developed a unique expertise in the domain of technical and functional programming for architectural projects, with particular emphasis on the interpretation and integration building codes and regulations. The resulting ability to assure the comprehensiveness of initial studies and address highly complex projects for both new construction and the rehabilitation of existing structures has been a key factor in the achievements of the firm on major institutional projects. This expertise has also been transferred into the production of detailed and sophisticated studies and reviews of buildings for the purposes of fire & life safety assessments and code conformity upgrade programming for a host of private and public structures. Mr. Zorko's competence in these matters have made his expertise highly sought by peers and other professionals in their own pursuits as well as in the context of litigation to address problematic and complex issues to which he is able to bring a comprehensive and enlightening contribution.

Education

Bachelor in Architecture, with honors, McGill University School of Architecture,
Bachelor in Science, with honors, McGill University School of Architecture,
D.E.C. Pure & Applied Sciences, Marianopolis College, Montreal

Distinctions

Recipient of the Hugh McLennan Memorial Award, McGill University School of Architecture,
Recipient of the RAIC Gold Medal for academic merit;
Recipient of the Wilfred Truman ShaverAward, McGill University School of Architecture,
Recipient of the McConnell Award of Excellence for academic merit, McGill University School of Architecture,

Professionnal Affiliations

Member of the Quebec Order of Architects
Member of the Ontarion Association of Architects
Member of the Vermont Board of Architects
Member of the National Fire Protection Agency
Member of the Royal Architectural Institute of Canada

Professional Experience

Since 1985, Architect with the firm of Desnoyers Mercure & Associés, acting as project architect of which the following projects, particularly affected by regulatory constraints:

Rehabilitation of the Library of Parliament, Ottawa
Renovation and fit-up of the Justice Building, Ottawa
Renovation of the McGill University Engineering Complex
Paramount Complex, Montreal
Renovation and fit-up of the Supreme Court building, Ottawa
Faubourg Ste-Catherine, Montreal

Mr. Zorko also acted as the firm's internal consultant in the domain of building codes and regulations, most prominently for the following projects:

The New Canadian War Museum, Technical and Functional Program, Ottawa;
The new J.-Armand-Bombardier building, University of Montreal, Montreal
Victoria Memorial building Technical and Functional program, Canadian Museum of Nature, Ottawa
Master Plan for space use, University of Montreal campus, Montreal
Montreal Museum of Fine Arts south extension, J.-N.-Desmarais building, Montreal

Mr. Zorko also acted as chief analyst in the following studies relative to building regulations (short list):

Montreal World Trade Centre (litigation)
Code conformity upgrades, Place du Parc Complex, Montreal
Code conformity upgrades, Haddon Hall housing complex, Montreal,
Code conformity upgrades, Molson Stadium, Montreal
Renovation of Windsor Station, Montreal,

Teaching

Since 1987, guest lecturer at the McGill University School of Architecture,
Since 1988, teacher at the Quebec Order of Architects continuing education program
Since 1993, training of building inspectors at the City of Montreal Permits and Inspection Services

This is Exhibit "A" to the Affidavit of Jozef Zorko sworn before me at Montréal, Québec this 20th day of February, 2004

Danielle Bujold

Danielle Bujold, Commissaire à l'assermentation N° 144 455

DMA

François Hogue, B. Arch., M.Sc. , OAQ, PMI, principal, senior architect.

Acting as project architect and project manager for Desnoyers Mercure & associés. Mr. Hogue is responsible for the firm for the preparation of technical specifications and construction contract documents. In this capacity, he directs and oversees technical research into building technology and materials and quality control procedures.

Mr. Hogue also acts as senior analyst in the various expert-studies undertaken by the firm.

Education

Master's in Sciences (M.Sc.) Université du Québec
Bachelor's in Architecture (B.Arch.), School of Architecture, Laval University,
D.E.C. Pure & Applied Sciences, Bourgchemin College, St-Hyacinthe

Professional

Member of the Quebec Order of Architects (OAQ)
Member of the Royal Architectural Institute of Canada (RAIC)
Memeber of the Project Management Institute (PMI)
Memeber of Construction Specifications Canada (CSC)

Professional Activities

Contributing writer to Canadian Architectural Practice Manual, Royal Architectural Institute of Canada (RAIC)
Memebr of the Canadian Commission on Construction Materials Evaluation (CCCME), National Research Council (NRC)
Memeber of the Canadian Construction Documents Committee (CCDC)

Professionnal Experience

Since 1985, Architect with the firm of **Desnoyers Mercure & Associés** (from Junior to Senior), acting as project architect for the main following projects:

New Student Residences, Hotel du Parc, McGill University
McGill University Engineering Complex Space Audit
Functional Programming, J.-Armand-Bombardier building, University of Montreal
Renovation of the Claire-McNicoll building, University of Montreal
Refurbishment of the Biosphere, Île Sainte-Hélène, Montreal
Rivière-des-Prairies recreational pool complex, Montreal
National Bank of Canada regional banking centre, St-Hyacinthe
Le Groupe Commerce central data processing centre, St-Hyacinthe
Renovation and fit-up of the Centre Administratif Ernest-Cormier, Montreal (Québec);
Services building, Aluminerie de Bécancour, Bécancour

Mr. Hogue also acted as internal consultant in the domain of preliminary studies, project planning and construction contract strategies for the following main projects:

New Canadian Chancery, Cairo, Égypt
Collège Gérald-Godin, Ste-Geneviève, Québec
Building Envelope Remedial Work, Montreal World Trade Centre,
Montreal Museum of Fine Arts south extension, J.-N.-Desmarais building, Montreal
Jean-Grou High School, Rivière-des-Prairies

Mr. Hogue has also acted as senior analyst in de following expert-studies:

C.I.L. Building due diligence, Montreal
Liquid Air industrial Complex due diligence studies, City of Montreal
Code conformity due diligence studies, Nun's Island, Montreal
Hôtel Château Royal, Montreal,
Le 1212 avenue Des Pins, Montréal,
Zellers store collapse, Place Bourassa, Montréal-Nord,
Windsor Building, Montréal,
Inter-Continental Hôtel, Montreal,
Museum of Contemporary Art, Montreal,

This is Exhibit "B" to the Affidavit of Jozef Zorko sworn before me at Montréal, Québec this 20th day of February, 2004

Danielle Bujold, Commissaire à l'assermentation N° 144 455

DMA

EXHIBIT C

Christianne Rail, B.Arch.

Attributions

Intermediate Architect, building codes and regulations specialist, charged with preliminary project studies in the domain of building codes as well as with code conformity assessment and upgrades programming.

Education

Master's in Urban Planning (in progress) McGill University
Bacchelor in Architecture, Laval University, Québec
D.E.C. Pure and and Applied Sciences, Collège de la Gaspésie et des Îles, Gaspé, Québec

Professionnal Experience

Since September 2000, with the firm of Desnoyers Mercure et associés as internal consultant in building codes and regulations, assigned to studies on the folowing projects:

C.I.L. Building Code Conformity Upgrades
C.I.L. Building due diligence, Montreal
J.-Armand-Bombardier building, University of Montreal
Extension of the UPA head offices, Longueil, Québec
Renovation of the Claire-McNicoll building, University of Montreal
Code conformity due diligence studies, Nun's Island, Montreal
Hôtel Château Royal, Montreal,
Le 1212 avenue Des Pins, Montréal,
Windsor Building, Montréal,
Code conformity upgrades, Place du Parc Complex, Montreal
Code conformity upgrades, Haddon Hall housing complex, Montreal,
Code conformity upgrades, Molson Stadium, Montreal
Renovation of Windsor Station, Montreal,
Inter-Continental Hôtel, Montreal,

2000 With the Permits and Inspections Services of the City of Montreal as building inspector, assigned to the Notre-Dame-de-Grâce sector.

1995 With the City of Gaspé as architectural advisor for the rehabilitation of heritage structures having provincial designations.

This is Exhibit "C" to the Affidavit of Jozef Zorko sworn before me at Montréal, Québec this 20th day of February, 2004

Danielle Bujold, Commissaire à l'assermentation N° 144 455

Tests of Building Construction and Materials,"
- i) will not develop an average temperature rise more than 140°C or a maximum temperature rise more than 180°C at any point on its unexposed face within 20 min, and
- ii) will remain in place for not less than 40 min.

5) *Combustible* insulation, including foamed plastics, installed above roof decks, outside of *foundation* walls below ground level and beneath concrete slabs-on-ground is permitted to be used in a *building* required to be of *noncombustible construction.*

6) Thermosetting foamed plastic insulation having a *flame-spread rating* not more than 500 which forms part of a factory-assembled exterior wall panel that does not incorporate an air space is permitted to be used in a *building* required to be of *noncombustible construction* provided
- a) the foamed plastic is protected on both sides by sheet steel not less than 0.38 mm thick which will remain in place for not less than 10 min when the wall panel is tested in conformance with CAN/ULC-S101-M, "Standard Methods of Fire Endurance Tests of Building Construction and Materials,"
- b) the *flame-spread rating* of the wall panel, determined by subjecting a sample including an assembled joint to the appropriate test described in Subsection 3.1.12., is not more than the *flame-spread rating* permitted for the room or space which it bounds,
- c) the *building* does not contain a Group B or Group C *major occupancy*, and
- d) the *building* is not more than 18 m high, measured between *grade* and the floor level of the top *storey.*

3.1.5.12. Combustible Elements in Partitions

1) Except as permitted by Sentence (2), solid lumber *partitions* not less than 38 mm thick and wood framing in *partitions* located in a *fire compartment* not more than 600 m² in area are permitted to be used in a *building* required to be of *noncombustible construction* in a *floor area* that is not *sprinklered* throughout provided the *partitions*
- a) are not required *fire separations*, and
- b) are not located in a *care or detention occupancy.*

2) *Partitions* installed in a *building* of *noncombustible construction* are permitted to contain wood framing provided
- a) the *building* is not more than 3 *storeys* in *building height*,
- b) the *partitions* are not located in a *care or detention occupancy*, and
- c) the *partitions* are not installed as enclosures for *exits* or *vertical service spaces.*

3) Solid lumber *partitions* not less than 38 mm thick and *partitions* that contain wood framing are permitted to be used in a *building* required to be of *noncombustible construction* provided
- a) the *building* is *sprinklered* throughout, and
- b) the *partitions* are not
  - i) located in a *care or detention occupancy*,
  - ii) installed as enclosures for *exits* or *vertical service spaces*, or
  - iii) used to satisfy the requirements of Clause 3.2.8.1.(1)(a).

3.1.5.13. Storage Lockers in Residential Buildings

1) Storage lockers in storage rooms are permitted to be constructed of wood in a *building* of *residential occupancy* required to be of *noncombustible construction.*

3.1.5.14. Combustible Ducts

1) Except as required by Sentence 3.6.4.3.(1), *combustible* ducts, including *plenums* and duct connectors, are permitted to be used in a *building* required to be of *noncombustible construction* provided these ducts and duct connectors are used only in horizontal runs.

2) *Combustible* duct linings, duct coverings, duct insulation, vibration isolation connectors, duct tape, pipe insulation and pipe coverings are permitted to be used in a *building* required to be of *noncombustible construction* provided they conform to the appropriate requirements of Subsection 3.6.5.

3) In a *building* required to be of *noncombustible construction*, *combustible* ducts need not comply with the requirements of Sentences 3.6.5.1.(1) and (2) provided the ducts are
- a) part of a duct system conveying only ventilation air, and
- b) contained entirely within a *dwelling unit.*

3.1.5.15. Combustible Piping Materials

1) Except as permitted by Clause 3.1.5.2.(1)(e) and Sentences (2) and (3), *combustible* piping and tubing and associated adhesives are permitted to be used in a *building* required to be of *noncombustible construction* provided that, except when concealed in a wall or concrete floor slab, they
- a) have a *flame-spread rating* not more than 25, and
- b) if used in a *building* described in Subsection 3.2.6., have a smoke developed classification not more than 50.

2) *Combustible* sprinkler piping is permitted to be used within a *sprinklered floor area* in a *building* required to be of *noncombustible construction.* (See also Article 3.2.5.14.)

3) Polypropylene pipes and fittings are permitted to be used for drain, waste and vent piping for the conveyance of highly corrosive materials and for piping used to distribute distilled or dialyzed water in laboratory and hospital facilities in a *building* required to be of *noncombustible construction*, provided
- a) the *building* is *sprinklered* throughout,
- b) the piping is not located in a vertical shaft, and
- c) piping that penetrates a *fire separation* is sealed at the penetration by a fire stop system that, when subjected to the fire test method in CAN4-S115-M, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* of the *fire separation.*

3.1.5.16. Combustible Plumbing Fixtures

1) *Combustible* plumbing fixtures, including wall and ceiling enclosures that form part of the plumbing fixture, are permitted in a *building* required to be of *noncombustible construction* provided they are constructed of material having a *flame-spread rating* and smoke developed classification not more than that permitted for the wall surface of the room or space in which they are installed.

3.1.5.17. Wires and Cables

1) Except as permitted by Article 3.1.5.18., optical fibre cables and electrical wires and cables with *combustible* insulation, jackets or sheathes are permitted in a *building* required to be of *noncombustible construction*, provided
- a) the wires and cables exhibit a vertical char of not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cabletrough in Clause 4.11.4. of CAN/CSA-C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables,"
- b) the wires and cables are located in
  - i) totally enclosed *noncombustible* raceways (see A-3.1.4.3.(1)(b)(i) in Appendix A),
  - ii) masonry walls,
  - iii) concrete slabs,
  - iv) a *service room* separated from the remainder of the *building* by a *fire separation* having a *fire-resistance rating* not less than 1 h, or
  - v) totally enclosed nonmetallic raceways conforming to Article 3.1.5.19.,
- c) the wires and cables are communication cables used at the service entry to a *building* and are not more than 3 m long.

(See Appendix A.)

3.1.5.18. Combustible Travelling Cables for Elevators

1) *Combustible* travelling cables are permitted on elevating devices in a *building* required to be of *noncombustible construction.*

3.1.5.19. Nonmetallic Raceways

1) Totally enclosed nonmetallic raceways not more than 625 mm² in cross-sectional area are permitted to be used in a *building* required to be of *noncombustible construction* to enclose optical fibre cables and electrical wires and cables, provided the raceways exhibit a vertical char not more than 1.5 m when tested in conformance with the Vertical Flame Test (FT - 4) – Conduit or Tubing on Cable Tray in Clause 6.16 of CSA C22.2 No. 211.0-M, "General Requirements and Methods of Testing for Nonmetallic Conduit."

3.1.6. Tents and Air-Supported Structures

(See Appendix A.)

3.1.6.1. Means of Egress

1) Tents and *air-supported structures* shall conform to Sections 3.3. and 3.4.

3.1.6.2. Restrictions

1) An *air-supported structure* shall not be located above the *first storey* on any *building.*

2) An *air-supported structure* shall not be used for Groups B, C, or Group F, Division 1 *major occupancies* or for classrooms.

3) An *air-supported structure* shall be designed as open floor space without interior walls, *mezzanines*, intermediate floors or similar construction.

3.1.6.3. Clearance to Other Structures

1) Except as permitted by Sentences (2), (3) and (4), every tent and *air-supported structure* shall conform to Subsection 3.2.3.

2) Tents and *air-supported structures*
- a) shall not be erected closer than 3 m to other structures on the same property except as permitted by Sentences (3) and (4), and
- b) shall be sufficiently distant from one another to provide an area to be used as a

4) If *combustible* sprinkler piping is located above a ceiling, an opening through the ceiling that is not protected in conformance with Sentence (3) shall be located so that the distance between the edge of the opening and the nearest sprinkler is not more than 300 mm.

3.2.5.15. Sprinklered Service Space

1) An automatic sprinkler system shall be installed in a *service space* referred to in Sentence 3.2.1.1.(7) if flooring for access within the *service space* is other than catwalks.

2) The sprinkler system required by Sentence (1) shall be equipped with waterflow detecting devices, with each device serving not more than one *storey*.

3) The waterflow detecting devices required by Sentence (2) shall be connected to the fire alarm system, to

a) initiate an *alert signal* in a 2 stage system or an *alarm signal* in a single stage system, and
b) indicate separately on the fire alarm system annunciator the actuation of each device.

3.2.5.16. Fire Department Connections

1) The fire department connection for a standpipe system shall be located so that the distance from the fire department connection to a hydrant is not more than 45 m and is unobstructed.

2) The fire department connection for an automatic sprinkler system shall be located so that the distance from the fire department connection to a hydrant is not more than 45 m and is unobstructed.

3.2.5.17. Portable Fire Extinguishers

1) Portable extinguishers shall be provided and installed in accordance with

a) provincial, territorial or municipal regulations, or
b) the National Fire Code of Canada 1995, in the absence of regulations referred to in Clause (a).

2) In a Group B, Division 1 *major occupancy*, portable fire extinguishers are permitted to be located in secure areas, or in lockable cabinets provided

a) identical keys for all cabinets are located at all supervisory or security stations, or
b) electrical remote release devices are provided and are connected to an emergency power supply.

3.2.5.18. Protection from Freezing

1) Equipment forming part of a fire protection system shall be protected from freezing if

a) it could be adversely affected by freezing temperatures, and
b) it is located in an unheated area.

3.2.5.19. Fire Pumps

1) If a fire pump is installed, it shall be installed in accordance with the requirements of NFPA 20, "Standard for the Installation of Centrifugal Fire Pumps." (See Appendix A.)

3.2.6. Additional Requirements for High Buildings

(See Appendix B.)

3.2.6.1. Application

1) This Subsection applies to a *building*

a) of Group A, D, E or F *major occupancy* classification that is more than
   i) 36 m high, measured between *grade* and the floor level of the top *storey*, or
   ii) 18 m high, measured between *grade* and the floor level of the top *storey*, and in which the cumulative or total *occupant load* on or above any *storey* above *grade*, other than the *first storey*, divided by 1.8 times the width in metres of all *exit* stairs at that *storey*, exceeds 300,
b) containing a Group B *major occupancy* in which the floor level of the highest *storey* of that *major occupancy* is more than 18 m above *grade*,
c) containing a *floor area* or part of a *floor area* located above the third *storey* designed or intended as a Group B, Division 2 *occupancy*, and
d) containing a Group C *major occupancy* whose floor level is more than 18 m above *grade*.

3.2.6.2. Limits to Smoke Movement

1) A *building* to which this Subsection applies shall be designed in accordance with Sentences (2) to (5) and Article 3.2.6.3. to limit the danger to occupants and fire fighters from exposure to smoke in a *building* fire.

2) A *building* referred to in Sentence (1) shall be designed so that, during a period of 2 h after the start of a fire, each *exit* stair serving *storeys* below the lowest *exit level* will not contain more than 1% by volume of contaminated air from the fire floor, assuming an outdoor temperature equal

3.6.3.3. Linen and Refuse Chutes

1) A linen chute or refuse chute shall

a) be impervious to moisture,
b) have a smooth internal surface,
c) be corrosion-resistant,
d) be constructed of *noncombustible* material, and
e) be located in a shaft in which there are no services other than *noncombustible* drain, waste and vent piping or *noncombustible* water piping.

2) A shaft containing a linen chute or refuse chute shall have a *fire-resistance rating* conforming to Sentence 3.6.3.1.(1), but not less than

a) 1 h if the chute outlet for the discharge room is protected by an automatic, self-latching *closure* held open by a fusible link, or
b) 2 h if no *closure* is provided at the chute outlet into the discharge room.

3) An interior linen chute or refuse chute shall extend not less than 1 m above the roof and shall be vented above the roof with a vent which

a) has an unobstructed area not less than the cross-sectional area of the chute, and
b) is equipped with a cover that will open automatically, or that can be opened manually, in the event of a fire in the chute.

4) Intake openings for a linen chute or a refuse chute shall

a) have an area not more than 60% of the cross-sectional area of the chute, and
b) be fitted with *closures* designed to close automatically and latch after use.

5) Intake openings for a linen chute or a refuse chute shall be located in rooms or compartments that

a) have no dimension less than 750 mm,
b) are separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 45 min,
c) are designed for no other purpose, and
d) do not open directly into an *exit*.

6) Sprinklers shall be installed at the top of each linen chute or refuse chute, at alternate floor levels and in the room or bin into which the chute discharges.

7) The room into which a linen chute discharges shall be separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 1 h.

8) A refuse chute shall be equipped at the top with spray equipment for washing-down purposes.

9) A refuse chute shall discharge only into a room or bin separated from the remainder of the *building* by a *fire separation* with a *fire-resistance rating* not less than 2 h.

10) The room or bin into which a refuse chute discharges shall be of sufficient size to contain the refuse between normal intervals of emptying, be impervious to moisture and be equipped with a water connection and floor drain for washing-down purposes.

11) A room into which a refuse chute discharges shall contain no service equipment that is not related to refuse handling and disposal.

3.6.3.4. Exhaust Duct Negative Pressure

1) If a *vertical service space* contains an exhaust duct that serves more than one *fire compartment*,

a) the duct shall have a fan located at or near the exhaust outlet to ensure that the duct is under negative pressure, and
b) the individual *fire compartments* shall not have individual fans that exhaust directly into the duct in the *vertical service space*.

3.6.4. Horizontal Service Spaces and Service Facilities

3.6.4.1. Scope

1) This Subsection applies to *horizontal service spaces* and service facilities, including ceiling spaces, duct spaces, crawl spaces and *attic or roof spaces*.

3.6.4.2. Fire Separations for Horizontal Service Spaces

1) A *horizontal service space* that penetrates a required vertical *fire separation* shall be separated from the remainder of the *building* it serves in conformance with Sentence (2).

2) If a *horizontal service space* or other concealed space is located above a required vertical *fire separation* other than a vertical shaft, this space need not be divided at the *fire separation* as required by Article 3.1.8.3. provided the construction between this space and the space below is a *fire separation* with a *fire-resistance rating* equivalent to that required for the vertical *fire separation*, except that the *fire-resistance rating* is permitted to be not less than 30 min if the vertical *fire separation* is not required to have a *fire-resistance rating* more than 45 min. (See Appendix A.)

3.6.4.3. Plenum Requirements

1) A concealed space used as a *plenum* within a floor assembly or within a roof assembly

need not conform to Sentence 3.1.5.14.(1) and Article 3.6.5.1. provided

a) all materials within the concealed space have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50, except for
   i) tubing for pneumatic controls,
   ii) optical fibre cables and electrical wires and cables that exhibit a vertical char not more than 1.5 m when tested in conformance with the Vertical Flame Test – Cables in Cabletrough in Clause 4.11.4. of CAN/CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables,"
   iii) optical fibre cables and electrical wires and cables that are located in totally enclosed *noncombustible* raceways (see A-3.1.4.3.(1)(b)(i) in Appendix A), and
   iv) totally enclosed nonmetallic raceways conforming to Article 3.1.5.19., and
b) the supports for the ceiling membrane are of *noncombustible* material having a melting point not below 760°C.

2) If a concealed space referred to in Sentence (1) is used as a return-air *plenum* and incorporates a ceiling membrane that forms part of the required *fire-resistance rating* of the assembly, every opening through the membrane shall be protected by a *fire stop flap* which shall

a) stop the flow of air into the concealed space in the event of a fire,
b) be supported in a manner that will maintain the integrity of the ceiling membrane for the duration of time required to provide the required *fire-resistance rating*, and
c) conform to the appropriate requirements of Appendix D.

3.6.4.4. Attic or Roof Space Access

1) An *attic or roof space* more than 600 mm high shall be provided with access from the floor immediately below by a hatchway not less than 550 mm by 900 mm or by a stairway.

3.6.4.5. Horizontal Service Space Access

1) A *horizontal service space*, consisting of ceiling and duct spaces, which is more than 1 200 mm high and 600 mm wide shall have inspection doors not less than 300 mm in both horizontal and vertical dimensions placed so that the entire interior of the duct or space can be viewed.

3.6.4.6. Crawl Space Access

1) A crawl space shall have at least one access opening not less than 550 mm by 900 mm.

3.6.5. Air Duct and Plenum Systems

3.6.5.1. Duct Materials

1) Except as permitted by Sentences (2) to (5) and Article 3.6.4.3., all ducts, duct connectors, associated fittings and *plenums* used in air duct systems shall be constructed of steel, aluminum alloy, copper, clay, asbestos-cement or other *noncombustible* material.

2) Except as permitted by Sentence (3), ducts, associated fittings and *plenums* are permitted to contain *combustible* material provided they

a) conform to the appropriate requirements for Class 1 duct materials in CAN/ULC-S110-M, "Standard Methods of Test for Air Ducts,"
b) conform to Article 3.1.5.14. in a *building* required to be of *noncombustible construction*,
c) conform to Subsection 3.1.9.,
d) are used only in horizontal runs in a *building* required to be of *noncombustible construction*,
e) are not used in vertical runs serving more than 2 *storeys* in a *building* permitted to be of *combustible construction*, and
f) are not used in air duct systems in which the air temperature could be more than 120°C.

3) *Combustible* ducts which are part of a duct system conveying only ventilation air and are contained entirely within a *dwelling unit* need not comply with the requirements of Sentences (1) and (2).

4) Duct sealants shall have a *flame-spread rating* not more than 25 and a smoke developed classification not more than 50.

5) Duct connectors that contain *combustible* materials and that are used between ducts and air outlet units shall

a) conform to the appropriate requirements for Class 1 air duct materials in CAN/ULC-S110-M, "Standard Methods of Test for Air Ducts,"
b) be not more than 4 m long,
c) be used only in horizontal runs, and
d) not penetrate a required *fire separation*.

3.6.5.2. Vibration Isolation Connectors

1) Except as permitted by Sentence (2), vibration isolation connectors in air duct systems shall be *noncombustible*.

b) sealed by a fire stop system that, when subjected to the fire test method in CAN4-S115-M, "Standard Method of Fire Tests of Firestop Systems," has an F rating not less than the *fire-protection rating* required for *closures* in the *fire separation*.

(See A-9.10.9.6.(1) in Appendix A.) (See also Article 3.1.9.4. for penetrations involving *combustible* drain, waste and vent piping.)

2) Piping, tubing, ducts, *chimneys*, optical fibre cables, electrical wires and cables, totally enclosed *noncombustible* raceways, electrical outlet boxes and other similar *building* services that penetrate a *firewall* or a horizontal *fire separation* that is required to have a *fire-resistance rating* in conformance with Article 3.2.1.2., shall be sealed at the penetration by a fire stop system that, when subjected to the fire test method in CAN4-S115-M, "Standard Method of Fire Tests of Firestop Systems," has an FT rating not less than the *fire-resistance rating* for the *fire separation*.

3.1.9.2. Combustibility of Service Penetrations

1) Except as permitted by Articles 3.1.9.3. and 3.1.9.4., pipes, ducts, electrical outlet boxes, totally enclosed raceways or other similar service equipment that penetrate an assembly required to have a *fire-resistance rating* shall be *noncombustible* unless the assembly has been tested incorporating that service equipment.

3.1.9.3. Penetration by Wires, Cables and Outlet Boxes

1) Optical fibre cables and electrical wires and cables in totally enclosed *noncombustible* raceways are permitted to penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2.

2) Except as permitted by Sentence (3), totally enclosed nonmetallic raceways conforming to Article 3.1.5.19., optical fibre cables, and electrical wires and cables, single or grouped, with *combustible* insulation, jackets or sheathes that conform to the requirements of Clause 3.1.5.17.(1)(a) and that are not installed in totally enclosed *noncombustible* raceways are permitted to penetrate an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the overall diameter of the single or grouped wires or cables, or the raceways is not more than 25 mm.

3) Single conductor metal sheathed cables with *combustible* jacketting that are more than 25 mm in overall diameter are permitted to penetrate a *fire separation* required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the cables are not grouped.

4) *Combustible* totally enclosed raceways which are embedded in a concrete floor slab are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the concrete cover between the raceway and the bottom of the slab is not less than 50 mm.

5) *Combustible* outlet boxes are permitted in an assembly required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the opening through the membrane into the box is not more than 0.016 m^2.

6) Outlet boxes that penetrate opposite sides of a wall assembly shall be offset where necessary to maintain the integrity of the *fire separation*.

3.1.9.4. Combustible Piping Penetrations

1) *Combustible* sprinkler piping is permitted to penetrate a *fire separation* provided the *fire compartments* on each side of the *fire separation* are *sprinklered*.

2) *Combustible* water distribution piping that has an outside diameter not more than 30 mm is permitted to penetrate a vertical *fire separation* that is required to have a *fire-resistance rating* without being incorporated in the assembly at the time of testing as required by Article 3.1.9.2., provided the piping is sealed in conformance with Clause 3.1.9.1.(1)(b).

3) Except as permitted by Sentences (4) to (6), *combustible* piping shall not be used in a drain, waste and vent piping system if any part of that system penetrates

a) a *fire separation* required to have a *fire-resistance rating*, or
b) a membrane that forms part of an assembly required to have a *fire-resistance rating*.

4) *Combustible* drain, waste and vent piping is permitted to penetrate a *fire separation* required to have a *fire-resistance rating* or a membrane that forms part of an assembly required to have a *fire-resistance rating*, provided

a) the piping is sealed at the penetration by a fire stop system that has an F rating not less than the *fire-resistance rating* required for the *fire separation* when subjected to the fire test method in CAN4-S115-M, "Standard Method of Fire Tests of Firestop Systems," with a pressure differential of 50 Pa between the exposed and unexposed sides, with the higher pressure on the exposed side, and

b) the piping is not located in a vertical shaft.

5) *Combustible* drain piping is permitted to penetrate a horizontal *fire separation* provided it leads directly from a *noncombustible* water closet through a concrete floor slab.

6) *Combustible* drain, waste and vent piping is permitted on one side of a vertical *fire separation* provided it is not located in a vertical shaft.

3.1.9.5. Openings through a Membrane Ceiling

1) A membrane ceiling forming part of an assembly assigned a *fire-resistance rating* on the basis of Appendix D is permitted to be penetrated by openings leading into ducts within the ceiling space provided

a) the ducts are sheet steel, and
b) the amount of openings and their protection conform to the requirements of Appendix D.

3.1.9.6. Plenums

1) A ceiling assembly used as a *plenum* shall conform to Article 3.6.4.3.

3.1.10. Firewalls

3.1.10.1. Prevention of Firewall Collapse

1) Except as permitted by Sentence (2), the connections and supports for structural framing members that are connected to or supported on a *firewall* and have a *fire-resistance rating* less than that required for the *firewall*, shall be designed so that the collapse of the framing members during a fire will not cause the collapse of the *firewall*.

2) Sentence (1) does not apply to a *firewall* consisting of two separate wall assemblies each tied to its respective *building* frame but not to each other, provided each wall assembly is

a) a *fire separation* having one half of the *fire-resistance rating* required for the *firewall* by Sentences 3.1.10.2.(1) and (2), and
b) designed so that the collapse of one wall assembly will not cause collapse of the other.

3) A *firewall* is permitted to be supported on the structural frame of a *building* of *noncombustible construction* provided the supporting frame has a *fire-resistance rating* not less than that required for the *firewall*.

4) Piping, ducts and totally enclosed *noncombustible* raceways shall be installed so that their collapse will not cause collapse of the *firewall*.

3.1.10.2. Rating of Firewalls

1) A *firewall* which separates a *building* or *buildings* with *floor areas* containing a Group E or a Group F, Division 1 or 2 *major occupancy* shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 4 h, except that where the upper portion of a *firewall* separates *floor areas* containing other than Group E or Group F, Division 1 or 2 *major occupancies*, the *fire-resistance rating* of the upper portion of the *firewall* is permitted to be not less than 2 h.

2) A *firewall* which separates a *building* or *buildings* with *floor areas* containing *major occupancies* other than Group E or Group F, Division 1 or 2 shall be constructed as a *fire separation* of *noncombustible construction* having a *fire-resistance rating* not less than 2 h.

3) Except for *closures*, the required *fire-resistance rating* of a *firewall* shall be provided by masonry or concrete.

3.1.10.3. Continuity of Firewalls

1) A *firewall* shall extend from the ground continuously through, or adjacent to, all *storeys* of a *building* or *buildings* so separated, except that a *firewall* located above a *basement storage garage* conforming to Article 3.2.1.2. is permitted to commence at the floor assembly immediately above the *storage garage*. (See also Sentence 3.1.10.1.(3).)

2) A *firewall* is permitted to terminate on the underside of a reinforced concrete roof slab provided

a) the roof slab on both sides of the *firewall* has a *fire-resistance rating* not less than
   i) 1 h if the *firewall* is required to have a *fire-resistance rating* not less than 2 h, or
   ii) 2 h if the *firewall* is required to have a *fire-resistance rating* not less than 4 h, and
b) there are no concealed spaces within the roof slab in that portion immediately above the *firewall*.

3.1.10.4. Parapets

1) Except as permitted by Sentences (2) and 3.1.10.3.(2), a *firewall* shall extend above the roof surface to form a parapet not less than

a) 150 mm high for a *firewall* required to have a *fire-resistance rating* not less than 2 h, and
b) 900 mm high for a *firewall* required to have a *fire-resistance rating* not less than 4 h.

2) A *firewall* that separates 2 *buildings* with roofs at different elevations need not extend above

practice and will meet the appropriate installation requirements in relevant standards. Good design is necessary to ensure that the level of public safety established by the Code requirements will not be reduced by a voluntary installation.

Fire Fighting Assumptions

The requirements of this Part are based on the assumption that fire fighting capabilities are available in the event of a fire emergency. These fire fighting capabilities may take the form of a paid or volunteer public fire department or in some cases a private fire brigade. If these fire fighting capabilities are not available, additional fire safety measures may be required.

Fire fighting capability can vary from municipality to municipality. Generally, larger municipalities have greater fire fighting capability than smaller ones. Similarly, older, well established municipalities may have better fire fighting facilities than newly formed or rapidly growing ones. The level of municipal fire protection considered to be adequate will normally depend on both the size of the municipality (i.e., the number of buildings to be protected) and the size of buildings within that municipality. Since larger buildings tend to be located in larger municipalities, they are generally, but not always, favoured with a higher level of municipal protection.

Although it is reasonable to consider that some level of municipal fire fighting capability was assumed in developing the fire safety provisions in Part 3, this was not done on a consistent or defined basis. The requirements in the Code, while developed in the light of commonly prevailing municipal fire protection levels, do not attempt to relate the size of building to the level of municipal protection. The responsibility for controlling the maximum size of building to be permitted in a municipality in relation to local fire fighting capability rests with the municipality. If a proposed building is too large, either in terms of floor area or building height, to receive reasonable protection from the municipal fire department, fire protection requirements in addition to those prescribed in this Code, may be necessary to compensate for this deficiency. Automatic sprinkler protection may be one option to be considered.

Alternatively, the municipality may, in light of its fire fighting capability, elect to introduce zoning restrictions to ensure that the maximum building size is related to available municipal fire protection facilities. This is, by necessity, a somewhat arbitrary decision and should be made in consultation with the local fire fighting service, who should have an appreciation of their capability to fight fires.

The requirements of Subsection 3.2.3. are intended to prevent fire spread from thermal radiation assuming there is adequate fire fighting available. It has been found that periods of from 10 to 30 minutes usually elapse between the outbreak of fire in a building that is not protected with an automatic sprinkler system and the attainment of high radiation levels. During this period, the specified spatial separations should prove adequate to inhibit ignition of an exposed building face or the interior of an adjacent building by radiation. Subsequently, however, reduction of the fire intensity by fire fighting and the protective wetting of the exposed building face will often be necessary as supplementary measures to inhibit fire spread.

In the case of a building that is sprinklered throughout, the automatic sprinkler system should control the fire to an extent that radiation to neighbouring buildings should be minimal. Although there will be some radiation effect on a sprinklered building from a fire in a neighbouring building, the internal sprinkler system should control any fires that might be ignited in the building and thereby minimize the possibility of the fire spreading into the exposed building. NFPA 80A, "Recommended Practice for Protection of Buildings from Exterior Fire Exposures," provides additional information on the possibility of fire spread at building exteriors.

The water supply requirements for fire protection installations depend on the requirements of any automatic sprinkler installations and also on the number of fire streams that may be needed at any fire, having regard to the length of time the streams will have to be used. Both these factors are largely influenced by the conditions at the building to be equipped, and the quantity and pressure of water needed for the protection of both the interior and exterior of the building must be ascertained before the water supply is decided upon. Acceptable water supplies may be a public waterworks system that has adequate pressure and discharge capacity, automatic fire pumps, pressure tanks, manually controlled fire pumps in combination with pressure tanks, gravity tanks, and manually controlled fire pumps operated by remote control devices at each hose station.

A-3.1.2. Use Classification. The purpose of classification is to determine which requirements apply. This Code requires classification in accordance with every major occupancy for which the building is used or intended to be used. Where necessary, an application clause has been inserted in this Part to explain how to choose between the alternative requirements which multiple occupancy classification may present.

A-3.1.2.1.(1) Major Occupancy Classification. The following are examples of the

major occupancy classifications described in Table 3.1.2.1.:

Group A, Division 1
- Motion picture theatres
- Opera houses
- Television studios admitting a viewing audience
- Theatres, including experimental theatres

Group A, Division 2
- Art galleries
- Auditoria
- Bowling alleys
- Churches and similar places of worship
- Clubs, nonresidential
- Community halls
- Courtrooms
- Dance halls
- Exhibition halls (other than classified in Group E)
- Gymnasia
- Lecture halls
- Libraries
- Licensed beverage establishments
- Museums
- Passenger stations and depots
- Recreational piers
- Restaurants
- Schools and colleges, nonresidential
- Undertaking premises

Group A, Division 3
- Arenas
- Indoor swimming pools, with or without spectator seating
- Rinks

Group A, Division 4
- Amusement park structures (not elsewhere classified)
- Bleachers
- Grandstands
- Reviewing stands
- Stadia

Group B, Division 1
- Jails
- Penitentiaries
- Police stations with detention quarters
- Prisons
- Psychiatric hospitals with detention quarters
- Reformatories with detention quarters

Group B, Division 2
- Children's custodial homes
- Convalescent homes
- Hospitals
- Infirmaries
- Nursing homes
- Orphanages
- Psychiatric hospitals without detention quarters
- Reformatories without detention quarters
- Sanitoria without detention quarters

Group C
- Apartments
- Boarding houses
- Clubs, residential
- Colleges, residential
- Convents
- Dormitories
- Hotels
- Houses
- Lodging houses
- Monasteries
- Motels
- Schools, residential

Group D
- Banks
- Barber and hairdressing shops
- Beauty parlours
- Dental offices
- Dry cleaning establishments, self-service, not using flammable or explosive solvents or cleaners
- Laundries, self-service
- Medical offices
- Offices
- Police stations without detention quarters
- Radio stations
- Small tool and appliance rental and service establishments

Group E
- Department stores
- Exhibition halls
- Markets
- Shops
- Stores
- Supermarkets

Group F, Division 1
- Bulk plants for flammable liquids
- Bulk storage warehouses for hazardous substances
- Cereal mills
- Chemical manufacturing or processing plants
- Distilleries
- Dry cleaning plants
- Feed mills
- Flour mills
- Grain elevators
- Lacquer factories
- Mattress factories
- Paint, varnish and pyroxylin product factories
- Rubber processing plants
- Spray painting operations
- Waste paper processing plants

Group F, Division 2
- Aircraft hangars
- Box factories
- Candy plants
- Cold storage plants
- Dry cleaning establishments not using flammable or explosive solvents or cleaners
- Electrical substations
- Factories
- Freight depots
- Helicopter landing areas on roofs
- Laboratories
- Laundries, except self-service
- Mattress factories
- Planing mills
- Printing plants
- Repair garages
- Salesrooms
- Service stations
- Storage rooms
- Television studios not admitting a viewing audience
- Warehouses
- Wholesale rooms
- Woodworking factories
- Workshops

Group F, Division 3
- Creameries
- Factories
- Laboratories
- Power plants
- Salesrooms
- Sample display rooms
- Storage garages, including open air parking garages
- Storage rooms
- Warehouses
- Workshops

A-3.1.2.3.(1) Arena Regulation. The use of an arena is regulated in the National Fire Code of Canada 1995.

A-3.1.4.2.(1)(c) Thermal Barrier in Combustible Construction. Any thermal barrier that is accepted under the requirements of Sentence 3.1.5.11.(2) for noncombustible construction is also acceptable for combustible construction.

A-3.1.4.3.(1) Wire and Cable Equivalence. Electrical wires and cables that conform to the requirements of Sentence 3.1.5.17.(1) are deemed to satisfy the requirements of Sentence 3.1.4.3.(1).

A-3.1.4.3.(1)(b)(i) Raceway Definition. The term raceway is defined in CSA C22.1, "Canadian Electrical Code, Part 1" and includes both rigid and flexible conduit.

A-3.1.5.2.(1)(b) Gypsum Board. Gypsum board of the typical thickness used in building construction and that is paper faced will not generally comply with the criteria in CAN4-S114-M, "Standard Method of Test for Determination of Non-Combustibility in Building Materials," for noncombustible materials even though there are no combustible components in the core. Gypsum board has satisfactory properties for resisting the spread of fire and Clause 3.1.5.2.(1)(b) has been included to specifically permit the use of paper faced gypsum board in a building of noncombustible construction.

A-3.1.5.4.(1) Skylight Spacing. The minimum spacing dimensions for skylight assemblies are based on the distance that flame must travel along a flat ceiling surface. If ceilings have projecting beams or other features that would increase the distance the flame would have to travel along the surface, the distances specified may be measured accordingly.

A-3.1.5.5.(1) Combustible Cladding. These requirements allow for exterior wall assemblies incorporating combustible cladding elements on buildings of noncombustible construction. Since the tested assemblies must be representative of actual construction, the performance of the entire assembly is assessed with regard to its ability to resist flame propagation up the outside of a building. The thermal barrier protection limits the impact of an interior fire on the wall assembly.

These requirements, in combination, thus allow for wall assemblies containing both combustible cladding elements and non-loadbearing combustible framing members. These wall assemblies can be used as infill or panel type walls between structural elements, or attached directly to a loadbearing noncombustible structural system. These requirements, however, do not waive others specifically intended for the protection of combustible insulation in buildings of noncombustible construction.

These requirements are predicated upon the assumption that the manufacturing process and field installation procedure are both carried out under an independent quality assurance program designed to confirm that the product and its application are consistent with the system as tested.

A-3.1.5.5.(2) Flame Spread Distance. The maximum flame spread distance refers to the distance between the top of the opening and the highest observable instance of flaming along the wall assembly and thus allows intermittent flaming to a height of 5 m above the opening.

A-3.1.5.5.(3) Heat Flux Measurement. The heat flux to the assembly referred to in Sentence 3.1.5.5.(3) is the maximum one-minute averaged heat flux measured by transducers located 3.5 m above the top of the opening. The intent of this criterion is to limit the spread of fire on the wall

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4) PVC water pipe and fittings referred to in Sentences (1), (2) and (3) shall not be used in a hot *water system*.

2.5.8. CPVC Pipe, Fittings and Solvent Cements

1) CPVC hot and cold water pipe, fittings and solvent cements shall conform to CSA B137.6-M, "CPVC Pipe, Tubing and Fittings for Hot and Cold Water Distribution Systems."

2) The design temperature and design pressure of a CPVC piping system shall conform to Table 2.5.8.

Table 2.5.8.
Maximum Permitted Pressure for CPVC Piping at Various Temperatures
Forming Part of Sentence 2.5.8.(2)

Maximum Temperature of Water, °C	Maximum Permitted Pressures, kPa
10	3 150
20	2 900
30	2 500
40	2 100
50	1 700
60	1 300
70	1 000
80	700
90	500
100	400

2.5.9. Polybutylene Pipe and Fittings

1) Polybutylene pipe and its associated fittings shall conform to CAN/CSA-B137.8-M, "Polybutylene (PB) Piping for Pressure Applications."

2) Joints in polybutylene tubing shall not be embedded in or installed under a concrete grade slab.

3) Polybutylene pipe and fittings shall not be used for a continuously circulating hot water line or the first metre of any branch off of the continuously circulating hot water line.

2.5.10. Plastic Pipe, Fittings and Solvent Cement Used Underground

1) Plastic pipe, fittings and solvent cement used underground outside a *building* or under a *building* in a *drainage system* shall conform to

a) CAN/CSA-B181.1-M, "ABS Drain, Waste and Vent Pipe and Pipe Fittings,"
b) CAN/CSA-B181.2-M, "PVC Drain, Waste and Vent Pipe and Pipe Fittings,"
c) CAN/CSA-B182.1-M, "Plastic Drain and Sewer Pipe and Pipe Fittings," with a pipe stiffness not less than 320 kPa,
d) CAN/CSA-B182.2-M, "PVC Sewer Pipe and Fittings (PSM Type)," with a pipe stiffness not less than 320 kPa,
e) CAN/CSA-B182.4, "Profile PVC Sewer Pipe and Fittings," with a pipe stiffness not less than 320 kPa, or
f) CAN/CSA-B182.6-M, "Profile Polyethylene Sewer Pipe and Fittings," with a pipe stiffness of not less than 320 kPa.

(See Appendix A.)

2.5.11. Transition Solvent Cement

(See Appendix A.)

1) Solvent cement for transition joints shall conform to

a) CAN/CSA-B181.1-M, "ABS Drain, Waste and Vent Pipe and Pipe Fittings," or
b) CAN/CSA-B181.2-M, "PVC Drain, Waste and Vent Pipe and Pipe Fittings."

2) Transition solvent cement shall only be used for joining an ABS drainage system to a PVC drainage system.

2.5.12. Plastic Pipe, Fittings and Solvent Cement Used Above Ground

1) Plastic pipe, fittings and solvent cement used inside or under a *building* in a *drainage* or *venting system* shall conform to

a) CAN/CSA-B181.1-M, "ABS Drain, Waste and Vent Pipe and Pipe Fittings," or
b) CAN/CSA-B181.2-M, "PVC Drain, Waste and Vent Pipe and Pipe Fittings."

(See Appendix A.)

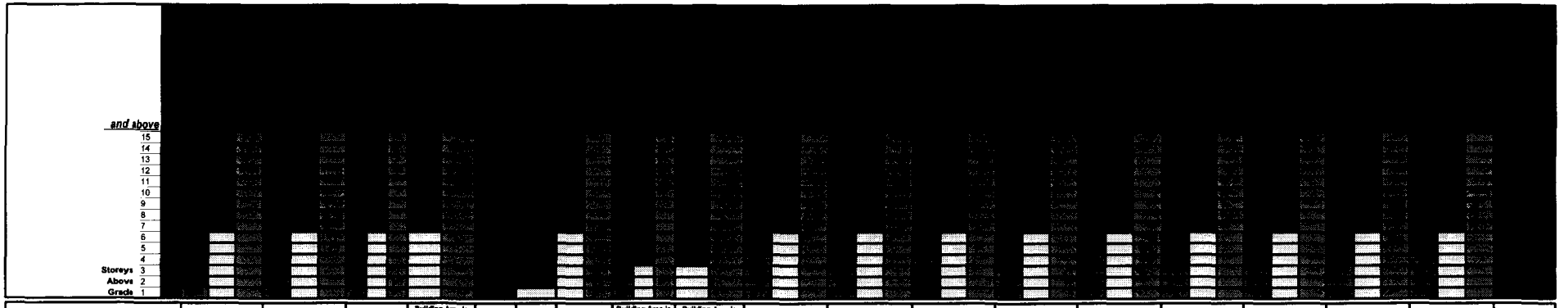
2) Requirements for *combustible* piping in relation to fire safety shall conform to Sentence 3.1.5.15.(1) and Article 3.1.9.4. of Part 3 and Sentences 9.10.9.6.(2) to (8) and Article 9.10.9.7. of Part 9 of the National Building Code of Canada 1995.

3) Where *noncombustible* piping pierces a *fire separation* or a *fire stop*, the requirements of fire stopping of Subsection 3.1.11. of Part 3 and Sentence 9.10.9.6.(1) and Article 9.10.15.4. of Part 9 of the National Building Code of Canada 1995 shall apply.

2.5.13. Polyethylene/Aluminum/Polyethylene Composite Pipe and Fittings

1) PE/AL/PE composite pipe and fittings shall conform to CAN/CSA-B137.9-M, " Polyethylene/Aluminum/Polyethylene Composite Pressure Pipe Systems." (See Appendix A.)

Exhibit E
Illustration 1
Distribution of building types where cast iron drain/waste/vent piping materials are required and/or normally preferred



This is Exhibit "E" to the Affidavit of Jozef Zorko sworn before me at Montréal, Québec this 20th day of February, 2004

Danielle Bujold, Commissaire à l'assermentation N° 144 455