

Compliance Document for New Zealand Building Code Clause F1 Hazardous Agents on Site

Prepared by the Department of Building and Housing

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Defined words (italicised in the text) and classified uses are explained in Clauses A1 of the Building Code and in the Definitions at the start of this Compliance Document.

F1: Document History		
	Date	Alterations
First published	July 1992	
Amendment 1	July 2001	p. 2, Document History, Status p. 9, Definitions
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.		

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Chief Executive of the Department of Building and Housing. It is effective from 1 July 2001 and supersedes all previous versions of this document.

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New Zealand Building Code

Clause F1 Hazardous Agents on Site

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

<p>1992/150</p>	<p><i>Building Regulations 1992</i></p>	<p>41</p>
<p>FIRST SCHEDULE—continued</p>		
<p>Clause F1—HAZARDOUS AGENTS ON SITE</p>		
<p>Provisions</p>	<p>Limits on application</p>	
<p>OBJECTIVE</p>		
<p>F1.1 The objective of this provision is to safeguard people from injury or illness caused by <i>hazardous agents</i> or <i>contaminants</i> on a site.</p>		
<p>FUNCTIONAL REQUIREMENT</p>		
<p>F1.2 <i>Buildings</i> shall be constructed to avoid the likelihood of people within the <i>building</i> being adversely affected by <i>hazardous agents</i> or <i>contaminants</i> on the site.</p>		
<p>PERFORMANCE</p>		
<p>F1.3.1 Sites shall be assessed to determine the presence and potential threat of any <i>hazardous agents</i> or <i>contaminants</i>.</p>		
<p>F1.3.2 The likely effect of any <i>hazardous agent</i> or <i>contaminant</i> on people shall be determined taking account of:</p>		
<p>(a) The <i>intended use</i> of the <i>building</i>,</p>		
<p>(b) The nature, potency or toxicity of the <i>hazardous agent</i> or <i>contaminant</i>, and</p>		
<p>(c) The protection afforded by the <i>building envelope</i> and <i>building systems</i>.</p>		

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References

For the purposes of New Zealand Building Code Compliance, referenced documents shall be deemed to include any amendments issued prior to the date of the Approved Document as displayed at the foot of the page on which the references are listed.

	Where quoted
British Standards Institution	
BSDD 175: 1988 Code of practice for the identification of potentially contaminated land and its investigation	VM1 2.3.1, 2.3.2, 2.4.1
New Zealand Government Departments	
Department of Labour Workplace exposure standards and biological indices for NZ 1992	VM1 2.5.2
Australian and New Zealand Environment and Conservation Council	
Guidelines for assessment and management of contaminated sites 1992	VM1 1.0.1
United States Environmental Protection Agency	
USEPA SW 846: 1986 Test methods for evaluating solid waste	VM1 2.4.1
EPA/540/1 – 89/002: 1989 Risk assessment guidance for Superfund, Vol 1 Human health evaluation manual (Part A) Interim final. Prepared by USEPA Office of Emergency and Remedial Response	VM1 2.5.4
United States Public Health Service	
Toxicological profiles on individual chemicals. Prepared by the Agency for Toxicological Substances and Disease Registry, in collaboration with the US Environmental Protection Agency	VM1 2.5.2 a)
World Health Organisation/Food and Agriculture Organisation	
Environmental Health Criteria 70 Principles for the safety assessment of food additives and contaminants in food, Geneva: 1987	VM1 2.5.2
Evaluation of certain food additives and contaminants, Technical report series 776. Geneva: 1989	VM1 2.5.2
IARC Monographs on the evaluation of carcinogenic risks to humans for individual chemicals, groups of chemicals, or processes. Published by the International Agency for Research on Cancer "Environment health criteria" for various chemicals	VM1 2.5.2 c) VM1 2.5.2 b)

Miscellaneous Publication

Casarett and Doull's Toxicology. The basic science of poisons. 4th ed. Macmillan. New York 1991.
Klassen CD, Amdur MO, Doull J (Eds)

Where quoted

VM1 2.5.3

Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Approved Document. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Building has the meaning ascribed to it by the Building Act 1991.

Contaminant has the meaning ascribed to it by the Resource Management Act 1991.

Drain A pipe normally laid below ground level including fittings and equipment and intended to convey *foul water* or *surface water* to an outfall.

Hazardous Creating an unreasonable risk to people of bodily injury or deterioration of health.

Intended use of a *building* includes:

- a) Any reasonably foreseeable occasional other use that is not incompatible with the *intended use*; and
- b) Normal maintenance; and
- c) Activities taken in response to *fire* or any other reasonably foreseeable emergency – but does not include any other maintenance and repairs or rebuilding.

Network utility operator means a person who:

- a) Undertakes the distribution or transmission by pipeline of natural or manufactured gas, petroleum, or geothermal energy; or
- b) Is an electricity operator or electrical distributor as defined by section 2(1) of the Electricity Act 1992 for the purposes of any works defined by that Act; or
- c) Undertakes the piped distribution of *potable* water for supply; or
- d) Is the operator of a sewerage system or a stormwater drainage system.

Territorial authority has the meaning ascribed to it by section 2 of the Local Government Act 1974; and includes any organisation which is authorised to permit structures pursuant to section 12(1)(b) of the Resource Management Act 1991.

Amend 1
Jul 2001

Verification Method F1/VM1

1.0 Introduction

1.0.1 This Verification Method is based on information derived from the Australian and New Zealand Environmental and Conservation Council "Guidelines for assessment and management of contaminated sites".

1.0.2 The presence of *hazardous* agents or *contaminants* on a *building* site shall be evaluated by:

- a) Studying the site history,
- b) Visually surveying the site, and
- c) Where necessary, undertaking further investigation to:
 - i) identify any *hazardous* agents or *hazardous contaminants*, and
 - ii) evaluate the risk in relation to the proposed *building*.

1.0.3 Figures 1 and 2 outline the procedure to be followed in investigating and assessing a site.

2.0 Site Investigation

2.1 History and records

2.1.1 A study of the history including any previous use of the site shall be made. This study shall include information obtained from sources such as:

- a) Aerial photographs,
- b) The land title (which may indicate past uses of the land),
- c) *Territorial authority* records (the *territorial authority* will supply information it holds, when an application is made for a project information memorandum),

- d) Geological records,
- e) Local landowners and adjacent occupiers, and
- f) *Network utility operators* for sewers, gas, water, and electricity reticulation. (The information should include the presence of any abandoned pipes or lines.)

2.1.2 Table 1 shows the *contaminants* likely to result from some previous industrial uses of a site.

2.2 Preliminary investigation

2.2.1 The preliminary visual inspection shall include the observation of flora and fauna as well as a critical appraisal of the physical land features. Anything unusual, or any non-conformity in the features of the site should be accounted for, as it may indicate past uses or the presence of *hazardous* agents or *contaminants*. A *hazardous* agent could also be a naturally occurring feature of the land, for example geothermal activity. The inspection should include the identification of things such as:

- a) Past development and uses,
- b) Old rubbish tips, abandoned pits and quarries,
- c) Mine workings and backfilling,
- d) Polluted waterways, *drains*, ponds, or aquifers,
- e) Areas of stunted or blighted growth, or of discoloured soil,
- f) Unhealthy animal life and the presence of vermin, and
- g) Possible *surface water* transport of *contaminants* from adjoining sites.

Figure 1: Site Investigation
Paragraph 1.0.3

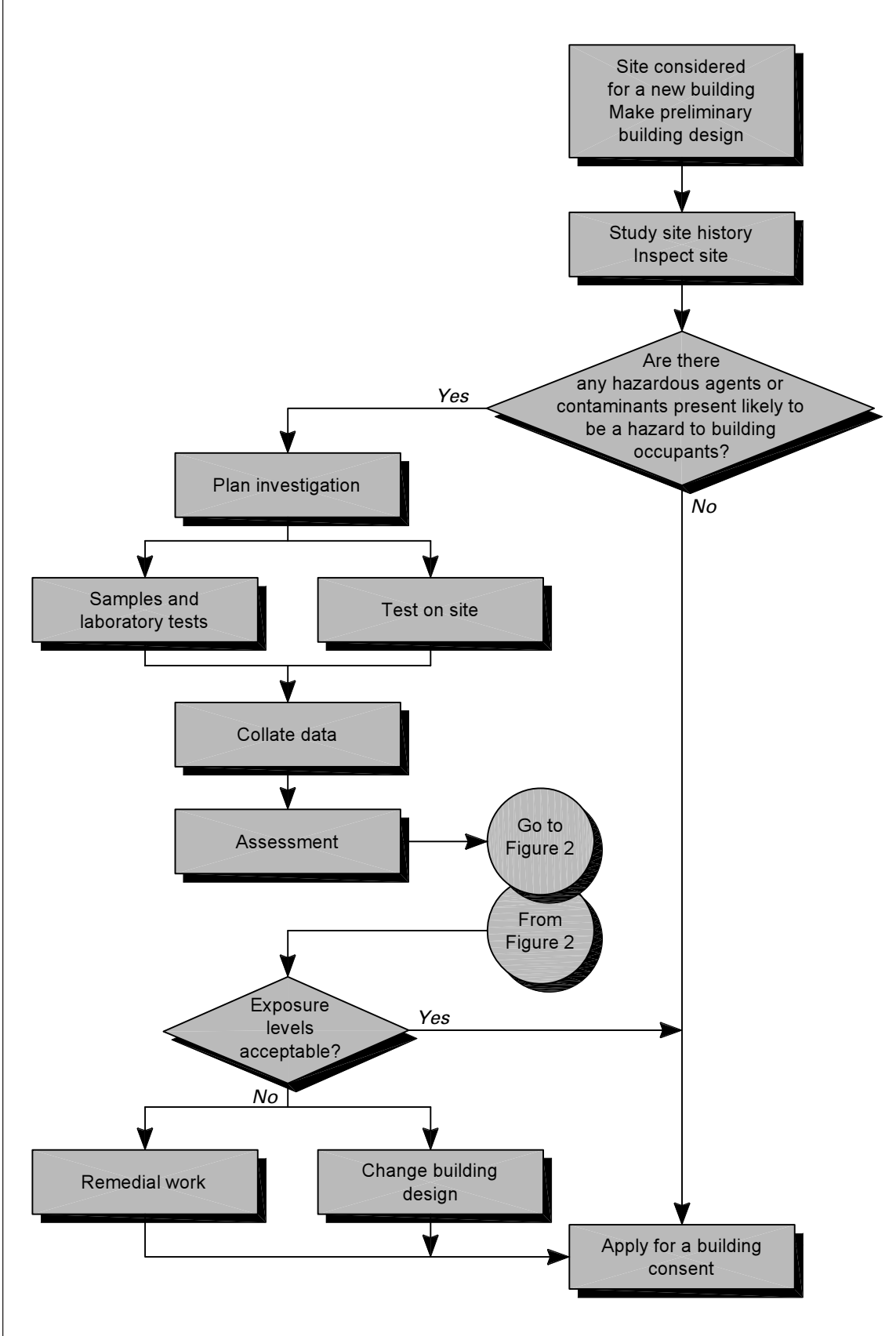


Figure 2: Assessment of Agents or Contaminants
Paragraph 1.0.3

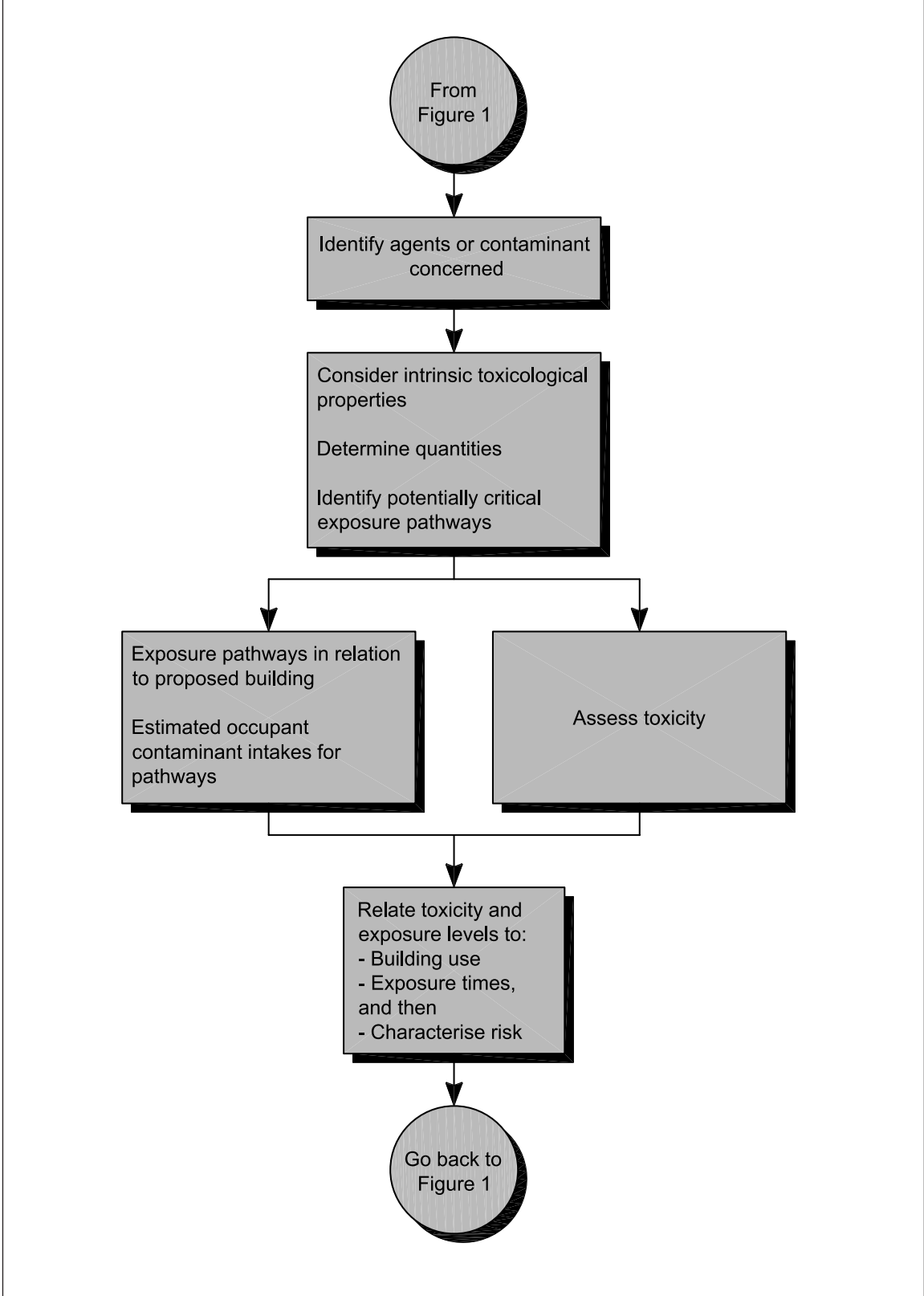


Table 1: Industries, Sites and Contaminants
Paragraph 2.1.2

IMPORTANT: This table should not be taken to mean that other types of site need not be investigated nor to mean that other *contaminants* are absent (see Note)

Industry	Examples of sites likely to contain hazardous contaminants	Likely contaminants
Chemicals	Acid/alkali works Dyeworks Fertilisers and pesticides Paint works Wood treatment plants	Acids; alkalis; asbestos; metals; solvents (e.g. toluene, benzene); phenols; specialised organic compounds
Petrochemicals	Oil refineries Tank farms Fuel storage depots Tar distilleries	Hydrocarbons; phenols; acids; alkalis and asbestos
Metals	Iron and steel works Foundries, smelters Electroplating, anodizing and galvanising works Engineering works Ship building/ship breaking Scrap reduction plants	Metals, especially iron, copper, nickel, chrome, zinc, cadmium and lead; asbestos
Energy	Gasworks Power stations Geothermal	Combustible substances (e.g. coal and coke dust); phenols; cyanides; sulphur compounds; asbestos
Transport	Garages, vehicle builders and maintenance workshops Railway depots	Combustible substances; hydrocarbons; asbestos
Mineral extraction Land restoration (including waste disposal sites)	Mines and spoil heaps Pits and quarries Filled sites	Metals (e.g. copper, zinc, lead); gases (e.g. methane); leachates
Water supply and treatment	Waterworks Sewage treatment plants	Metals (in sludges) Micro-organisms
Miscellaneous	Docks, wharfs and quays Tanneries Rubber works Military lands Paper and printing works	Acids; alkalis; metals; organic compounds; methane; toxic, flammable or explosive substances; micro-organisms

Note:

Common and widespread *contaminants* include hydrocarbons, polychlorinated biphenyls (PCBs), asbestos, sulphates and many metals used in paint pigments or coatings. These may be present on almost any site, and may range from barely detectable concentrations to relatively high levels.

2.2.2 Table 2 gives some site characteristics which may indicate the presence of *hazardous contaminants*.

2.2.3 Information derived from the study of the site history and the visual investigation shall be used to determine whether or not further detailed investigation is necessary. The *intended use* and method of *construction* of the proposed *building* shall be taken into account when this decision is made.

2.3 Detailed investigation

2.3.1 Sampling where contaminated soil is suspected shall generally be undertaken over the suspect area in a systematic manner, such as by using a uniform grid pattern. However judgemental sampling may be more appropriate where there is good reason to believe there is localised contamination. Samples shall also be taken from adjacent uncontaminated land of similar soil type to provide background reference levels. An acceptable procedure for carrying out sampling is given in BSDD 175 sections 5.4, 6.3, and 6.4.

2.3.2 Other *hazardous* agents or *contaminants*, such as liquids or gases, shall be sampled in a similar manner to contaminated soils or by

testing on-site. BSDD 175 sections 5.4, 6.3, and 6.4 provide acceptable means of obtaining samples or testing for *hazardous* agents not directly contained in the soil.

2.4 Analysis

2.4.1 Analysis may be completed on site or, particularly for soil samples, may be done in a laboratory. BSDD 175 sections 8 and 9 give acceptable procedures for analysis and for producing a report summarising the results. An alternative acceptable laboratory procedure is given by USEPA SW 846.

2.5 Assessment

2.5.1 *Hazardous* agents or *contaminants* are most likely to be a danger to *building* occupants by being transported in an airborne state into the *building* through open windows and doors or the ventilation system. Contaminated soil particles may also be carried into a *building* in this manner. Actual concentrations of *contaminants* that are *hazardous* to *building* occupants are likely to be different from concentrations that are *hazardous* to people in closer contact with the soil or with liquids at ground level on the site.

Table 2: Site Characteristics and Possible Hazardous Contaminants Paragraph 2.2.2	
Signs of possible contamination	Possible contaminant
a) Vegetation (absence, poor or unnatural growth)	Metals, metal compounds, organic compounds, gases
b) Surface material (unusual colours and contours may indicate wastes and residues)	Metals, metal compounds, oily and tarry wastes, asbestos (loose), other fibres, organic compounds, including phenols, potentially combustible material including coal and coke dust, refuse and waste
c) Fumes and odours (may indicate organic chemicals at very low concentrations)	Flammable, explosive and asphyxiating gases including methane and hydrogen sulphide, corrosive liquids, faecal, animal and vegetable matter (biologically active)
Note: Other signs of contamination may exist. Adjacent land should be used for comparison.	

2.5.2 The concentrations of substances from the site that reach people in the *building* shall be considered in terms of foreseeable ingress or exposure pathways. Provisional Tolerable Weekly Intakes (PTWI) or Acceptable Daily Intakes (ADI) shall be those determined by the World Health Organisation/Food and Agriculture Organisation (WHO 1987, WHO 1989). Workplace exposure standards shall be those adopted by the Occupational Safety and Health division of the New Zealand Department of Labour. Reference texts for toxicological data shall be:

- a) Toxicological profiles for individual chemicals prepared by the Agency for Toxicological Substances and Disease Registry (US Public Health Service) in collaboration with the US Environmental Protection Agency.
- b) 'Environmental Health Criteria' for individual chemicals published by the World Health Organisation.
- c) IARC Monographs on the evaluation of carcinogenic risks to humans for individual chemicals, groups of chemicals, or processes, published by the International Agency for Research on Cancer, World Health Organisation.

2.5.3 Where information is unavailable in these texts, secondary texts may be consulted including:

'Casarett and Doull's Toxicology. The basic science of poisons'.

2.5.4 The reference text for risk assessment shall be: USEPA, Office of Emergency and Remedial Response. Risk assessment guidance for Superfund, Vol 1. Human health evaluation manual (Part A) Interim final.

2.5.5 Some potentially *hazardous* agents such as asbestos fibres require action at very low concentration levels.

2.5.6 Some substances may not in themselves present a hazard but may be dangerous in combination with others, or may

produce an explosion or fire when ignited, (e.g. fine dusts, volatile oils, tar, sulphur, methane gas). These possible effects shall also be considered.

2.6 Remedial work

2.6.1 In some cases remedial work to reduce concentrations of harmful substances in a *building* may be a more practical solution, and additionally may make the site suitable for a wider range of *building* types.

2.6.2 Remedial action can involve one or more of the following activities:

- a) Excavation of contaminated soil for disposal to a place acceptable to the *territorial authority*.
- b) Isolation of the contaminated soil by covering it with a calculated thickness of clean inert fill or hard cover.
- c) Chemical, biological or physical treatment to destroy, remove, or immobilise the *contaminant* or agent.
- d) Mixing the contaminated soil with clean soil in order to reduce the maximum concentrations of *contaminants* to a level that is not *hazardous* to *building* occupants.

2.6.3 Some of the more commonly found *contaminants* and examples of remedial action are given in Table 3.

2.7 Hazards to building elements

2.7.1 Some substances occurring naturally in the soil may cause degradation of *building* materials. This could lead to structural failure or provide opportunities for contamination within the *building*. Sulphates, for example, are known to attack concrete and some other naturally occurring chemicals can attack buried water or gas pipes. Such hazards shall be assessed at each site and appropriate preventive measures taken.

Table 3: Examples of Remedial Action for Common Contaminants
Paragraph 2.6.3

Contaminant	Hazard	Remedial action
Gases, solids and liquids	<p>i) Gases which can affect the occupants of <i>buildings</i> include methane and carbon dioxide.</p> <p>ii) Solids and liquids such as hydrocarbons, solvents, phenols, inert refuse containing gypsum and domestic and industrial wastes may react to produce noxious fumes. Other chemicals may only react in the presence of acid or alkaline ground water, liquors or leachates. Acids may react with limestone, chalk and other carbonate rocks. Disturbance of the ground may activate these reactions or release the gases they produce.</p>	<p>i) Remove <i>contaminants</i> where practicable, and</p> <p>ii) Limited excavation, filling and sealing, and</p> <p>iii) Sealing service entries, and</p> <p>iv) Eliminating voids (including voids due to the settlement of any filling) where possible, and</p> <p>v) Sealing or effectively ventilating at high and low level voids which cannot be eliminated.</p>
Combustible materials	<p>Combustible materials may be already burning and smoulder or flame when broken into or may if they are not already burning, be ignited. They may produce gases which, if inhaled, could affect the occupants of the <i>building</i>. They may also produce gases which carry the risk of explosion and fire or direct damage to the building or loss of support to the foundations in the long term.</p>	<p>i) Where the material is known to have ignited, removal, partial excavation and filling. This action carries with it the risk of aggravating the severity of the <i>fire</i>, and</p> <p>ii) Where gases are being produced (whether or not the material has also ignited) remedial action similar to those described for Gases above.</p>
Radioactive materials	<p>Radioactive materials may be in enclosed containers or loose.</p>	<p>i) Where the container is intact, removal, and;</p> <p>ii) Where there is no container or it is not intact, excavation of all contaminated ground.</p>
Materials attacking the building fabric	<p>Materials, whether or not they are <i>contaminants</i> in their own right, may react with materials normally used for <i>buildings</i> and their services.</p>	<p>i) Removing the ground <i>contaminant</i> particularly where it is localised, and</p> <p>ii) Specifying <i>building</i> materials such as sulphate resisting cements which are sufficiently resistant to the ground <i>contaminant</i>, and</p> <p>iii) Protecting the <i>building</i> materials with, for example, bituminous or plastic membranes.</p>

Note:

This table is intended as a preliminary guide only. Actual solutions are likely to be more complex and specific to the site.

Acceptable Solution F1/AS1

1.0 No specific acceptable solution has been adopted for complying with the Performance of NZBC F1.

Index F1/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

Contaminants **VM1** 1.0.2 c) i), 2.1.2, 2.2.1 g), 2.2.2, 2.3.2, 2.5.1, 2.6.2 a) b) c) d), 2.6.3, Table 2

Hazards to building elements **VM1** 2.7

Hazardous agents . . . **VM1** 1.0.2 c) i), 2.2.1, 2.3.2, 2.5.1, 2.5.5, Table 2

Network utility operators **VM1** 2.2.1 f)

Remedial work **VM1** 2.6, Table 3

Risk assessment **VM1** 1.0.2 c) ii), 2.5, 2.5.4

Site investigations **VM1** 1.0.3, 2.0, Figure 1

 analysis **VM1** 2.4

 assessment **VM1** 1.0.3, 2.5, Figure 2

 detailed investigation **VM1** 1.0.2 c), 2.3

 history and records **VM1** 2.1

 preliminary investigations **VM1** 1.0.2 b), 2.2

 previous industrial use of site **VM1** 2.1.1, Table 1