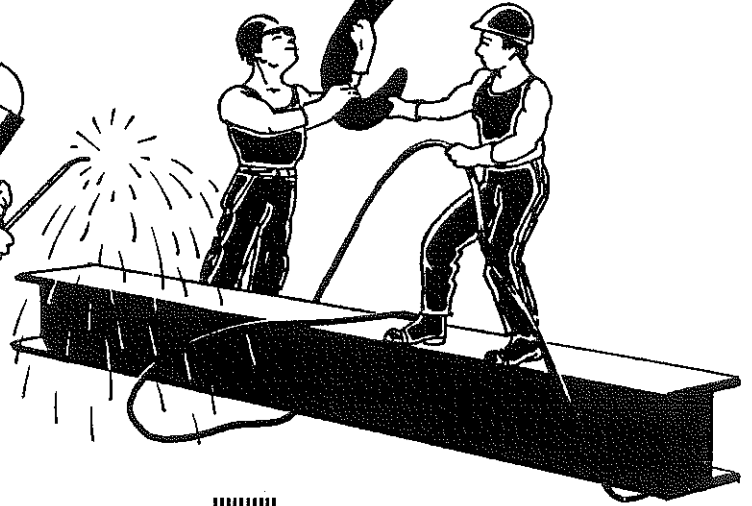
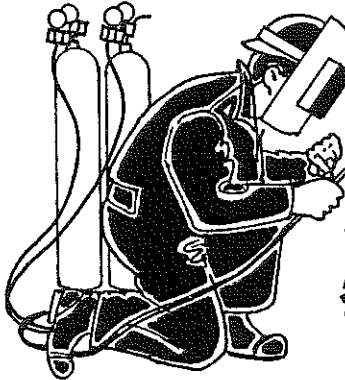
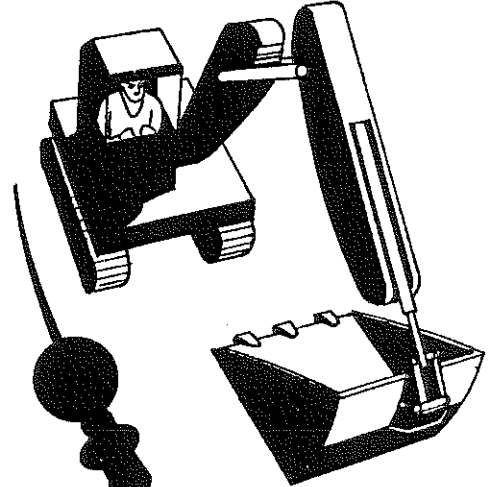
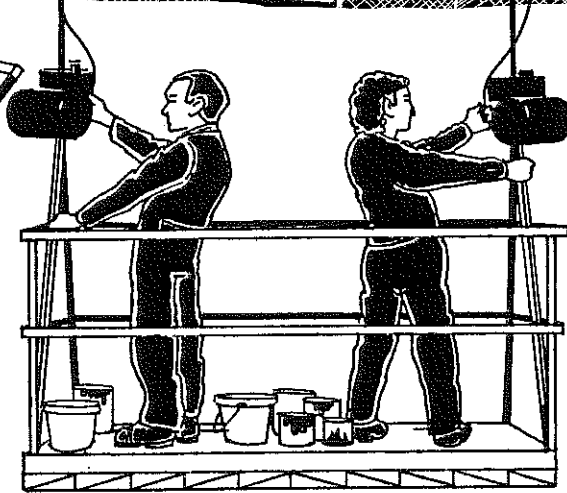
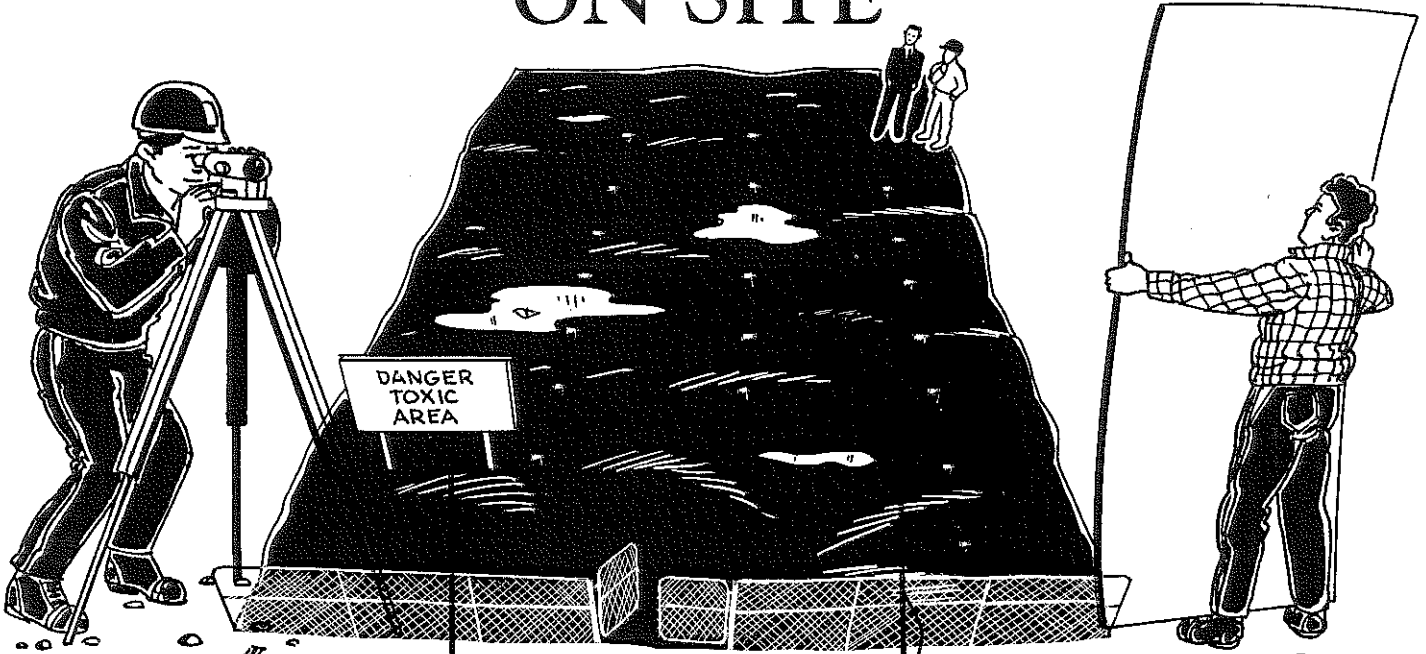


HAZARDOUS AGENTS ON SITE

(1)



BUILDING INDUSTRY AUTHORITY

The New Zealand Building Code Handbook and Approved Documents have been prepared and will be maintained by the Building Industry Authority which is a statutory body established by the Building Act 1991.

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APPROVED DOCUMENT

F1: HAZARDOUS AGENTS ON SITE

STATUS OF APPROVED DOCUMENTS

Approved Documents are prepared by the Building Industry Authority in accordance with section 49 of the Building Act 1991. They are non-mandatory guidance documents offering only one method of compliance with specific performance criteria of the New Zealand Building Code.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Approved Documents and explains alternative methods of achieving compliance.

Classified uses and defined words which are italicised in the text are explained in clauses A1 and A2 of the New Zealand Building Code.

NZBC 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.

Provisions

Limits on application

OBJECTIVE

F1.1 The objective of this provision is to safeguard people from injury or illness caused by *hazardous agents* or *contaminants* on a site.

FUNCTIONAL REQUIREMENT

F1.2 *Buildings* shall be constructed to avoid the likelihood of people within the *building* being adversely affected by *hazardous agents* or *contaminants* on the site.

PERFORMANCE

F1.3.1 Sites shall be assessed to determine the presence and potential threat of any *hazardous agents* or *contaminants*.

F1.3.2 The likely effect of any *hazardous agent* or *contaminant* on people shall be determined taking account of:

- (a) The *intended use* of the *building*,
- (b) The nature, potency or toxicity of the *hazardous agent* or *contaminant*, and
- (c) The protection afforded by the *building envelope* and *building systems*.

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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	
BSDD175:1988 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.

VM1 2.5.2(c)

"Environmental health criteria" for various chemicals.

VM1 2.5.2(b)

Miscellaneous Publications

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

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 other reasonably foreseeable emergency, but does not include any other maintenance works, 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 supply authority as defined by the Electricity Act 1968 for the purpose of an electric line as 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.

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

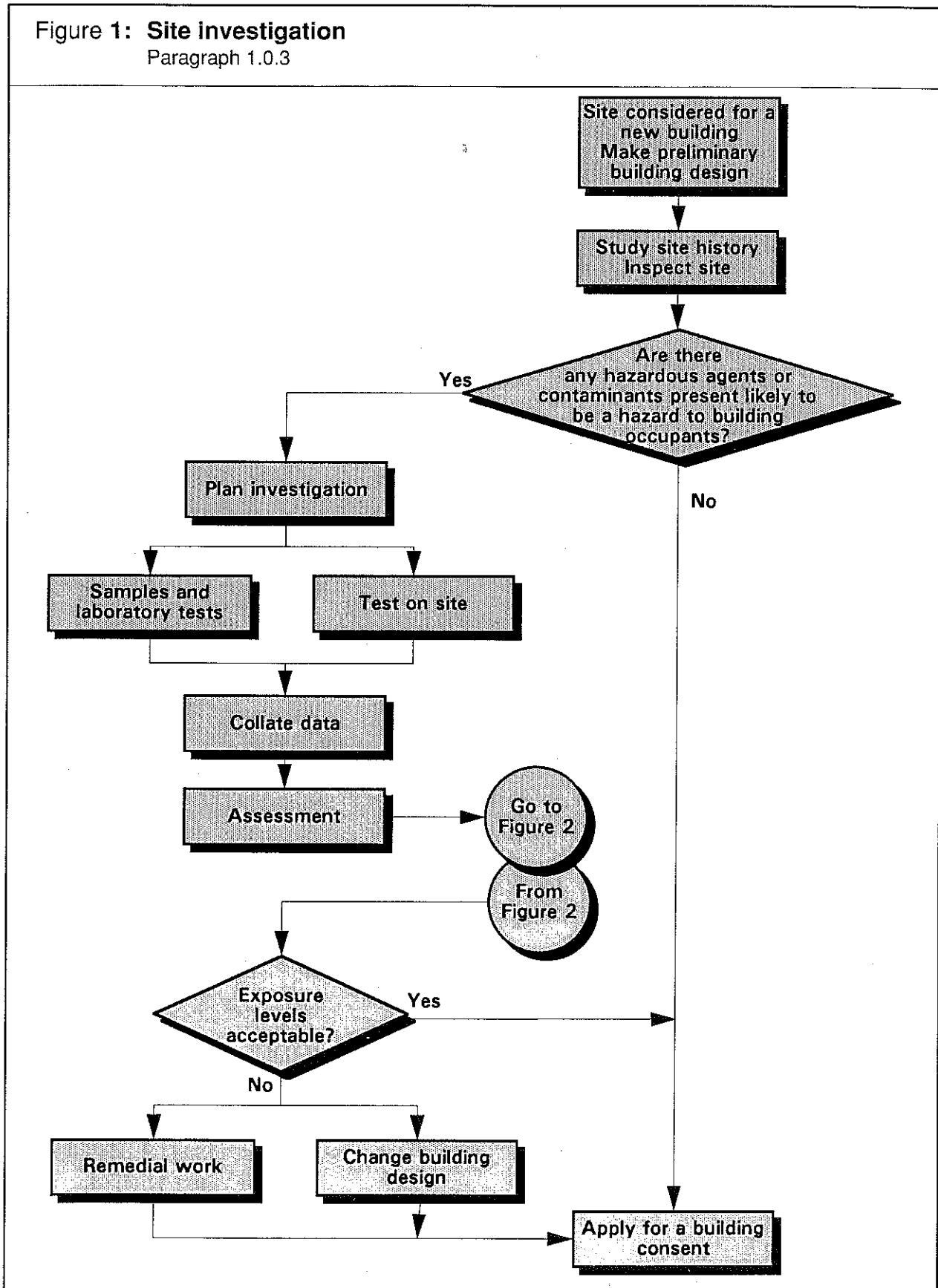


Figure 2: Assessment of agents or contaminants
Paragraph 1.0.3

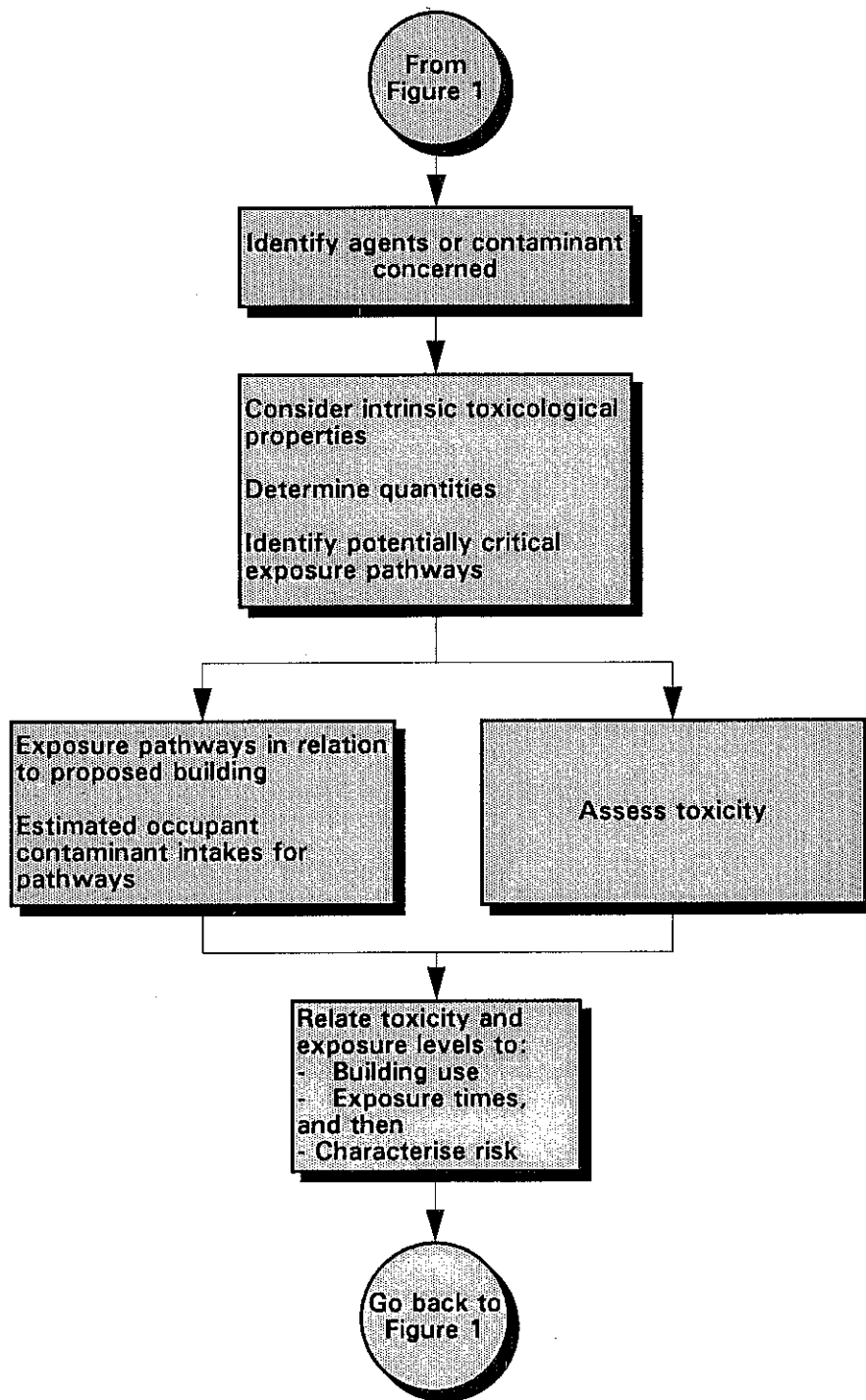


Table 1: Industries, sites and contaminants

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 BSDD175 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. BSDD175 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. BSDD175 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

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.	

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.

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 buildings 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 contaminants 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 building. 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 fire, 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 contaminants in their own right, may react with materials normally used for buildings and their services.</p>	<p>(i) Removing the ground contaminant particularly where it is localised, and</p> <p>(ii) Specifying building materials such as sulphate resisting cements which are sufficiently resistant to the ground contaminant, and;</p> <p>(iii) Protecting the building 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 2.1.1 (f)
Remedial work	VM1 2.6, Table 3
Risk assessment	VM1 1.0.2 (c) (ii), 2.5, 2.5.4
Site investigation	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 investigation	VM1 1.0.2 (b), 2.2
previous industrial use of site	VM1 2.1.1 Table 1

The New Zealand Building Code

Publications associated with the New Zealand Building Code consist of a Handbook and 35 Approved Documents. These documents identify requirements to ensure a building is safe, durable, healthy, accessible and energy efficient, and contain:

- **Acceptable solutions – approved ways of meeting the requirements of the Code.**
- **Verification methods – acceptable test and calculation methods to establish compliance with the Code.**

Developed by the Building Industry Authority and published by Standards New Zealand, the documents are available in both looseleaf and bound editions. Each document is available separately and the New Zealand Building Code Handbook and Approved Documents may also be purchased as a full set in two binders.

New Zealand Building Code Handbook and Approved Documents:

No.	Title	No.	Title
HB	New Zealand Building Code Handbook	F7	Warning systems
B1	Structure	F8	Signs
B2	Durability	G1	Personal hygiene
C1	Outbreak of fire	G2	Laundering
C2	Means of escape	G3	Food preparation and prevention of contamination
C3	Spread of fire	G4	Ventilation
C4	Structural stability during fire	G5	Interior environment
D1	Access routes	G6	Airborne and impact sound
D2	Mechanical installations for access	G7	Natural light
E1	Surface water	G8	Artificial light
E2	External moisture	G9	Electricity
E3	Internal moisture	G10	Piped services
F1	Hazardous agents on site	G11	Gas as an energy source
F2	Hazardous building materials	G12	Water supplies
F3	Hazardous substances and processes	G13	Foul water
F4	Safety from falling	G14	Industrial liquid waste
F5	Construction and demolition hazards	G15	Solid waste
F6	Lighting for emergency	H1	Energy efficiency

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