OFFICE OF THE
DEPUTY PRIME MINISTER

Housing Health and Safety Rating System

Guidance (Version 2)

Unfinalised Draft
December 2003

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Office of the Deputy Prime Minister: London

Contents

Arrangement of the Guidance

Chapter 1 outlines the background and theory behind the Housing Health and Safety Rating System.

Chapter 2 deals with the terminology used in the Guidance, giving definitions for particular words and phrases. It also discusses responsibility for housing conditions.

Chapter 3 gives an overview of the Hazard Rating procedure, explaining the stages involved.

The procedure for the assessment of conditions using the Rating System is dealt with in Chapter 4. This gives practical guidance on how to score hazards caused by deficiencies, which have been identified through a survey of a dwelling.

Supplemental Guidance on the assessment of conditions and the scoring of hazards in flats and other multi-occupied residential buildings is given in Chapter 5.

Annex A discusses the landlord's (owner's) responsibilities in relation to housing conditions which may contribute to hazards.

A suggested survey procedure is outlined in Annex B. This includes an example Hazard Scoring Form.

Annex C gives examples of health conditions for each of the four Classes of Harm used in the HHSRS.

Profiles for each of the HHSRS Hazards is given in Annex D. These Profiles provide for each a description of the hazard and its potential for harm, state whether a particular age group is more vulnerable to the hazard than others, and give the statistical averages for the likelihood and outcomes by age range of dwellings. Guidance is also given on the causes of the hazard and the preventative measures to avoid or minimise it.

Chapter 1

Introduction and Background

1.01 The Housing Health and Safety Rating System (HHSRS or the Rating System) is the Government's new approach to the evaluation of the potential risks to health and safety of any deficiencies identified in dwellings. It is a form of risk assessment, founded on the logical evaluation of both the likelihood of an occurrence that could cause harm, and the probable severity of the outcome of such an occurrence. The HHSRS uses judgments of both these to provide a means of evaluating and representing the severity of any dangers present in a dwelling.

1.02 The HHSRS, although not in itself a standard, is to be introduced as a replacement for the Housing Fitness Standard[1]. This document provides guidance of the technical aspects of the HHSRS assessment in this context. It does not deal with the enforcement options after the assessment, nor does it cover the use of the HHSRS in a stock condition survey.

1.03 The Rating System is evidence-based. It is supported by extensive reviews of the literature and by detailed analyses of statistical data on the impact of housing conditions on health. This evidence is summarised in the Hazard Profiles section of this Guidance[2] and is intended to inform professional judgment.

> Note –
> Research on the relationship between housing and health is a continuing process, and it is the responsibility of professionals using the HHSRS to keep up-to-date on current evidence.

1.04 The HHSRS assessment is an assessment of the condition of the whole dwelling. Therefore, before an assessment can be made, a thorough survey of the unit must be carried out. While this does not involve a new approach to inspecting or surveying dwellings, it does require an understanding and appreciation of the potential effects that could result from conditions and deficiencies which should have been identified during the survey.

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1 Housing Act 1985, s604, as amended by the Local Government and Housing Act 1989.

2 Fuller details of this evidence and the background to Version 2 can be found at http://www.odpm.gov.uk/stellent/groups/odpm_control/documents/contentservertemplate/odpm_index.hcst?n=1417&l=4

1.05 As it concentrates on threats to health and safety, the HHSRS is not concerned with matters of quality, comfort and convenience unless these could also have an impact on a person's physical or mental health or safety. Also, as the Rating System is about the assessment of hazards (the potential effect of conditions), the form of construction and the type and age of the dwelling do not directly affect an assessment. However, these matters will be relevant to determining the cause of any problem and so indicate the nature of any remedial action.

The Background to the Housing Health & Safety Rating System

The Theory Behind the HHSRS

1.06 The Rating System has been developed to allow assessment of all the main potential housing related hazards, and, by focusing on potential hazards, it places the emphasis directly on the risk to health and safety.

1.07 As the range of potential housing hazards have differing characteristics, the Rating System uses a Formula to generate a numerical score which allows the full range of hazards to be compared. This, together with the simple but logical twin approach of assessing both the likelihood and harm outcome allows the comparison of highly likely minor hazards and unlikely major ones. Whatever the hazard, the higher the score, the greater the risk.

The Principle underlying the HHSRS

1.08 The underlying principle of the HHSRS is that –
Any residential premises[3] should provide a safe and healthy environment for any potential occupier or visitor.

1.09 To satisfy this principle, a dwelling should be designed, constructed and maintained with non-hazardous materials and should be free from both unnecessary and avoidable hazards.

1.10 However, some hazards are necessary or unavoidable, and some are desirable or expected because the perceived benefits outweigh the risks. For example, electricity is hazardous but considered necessary; stairs (however well designed) are hazardous but necessary in any multi-storey dwelling. For such hazards, the design, construction and maintenance should be such as to reduce to a minimum the probability of a occurrence which could result in harm.

1.11 It is a general principle that any dwelling should provide adequate protection from all potential hazards prevailing in the local external environment. This includes the

[3] For the meaning of 'residential premises' and 'dwelling' see Chapter 2.

normal local weather conditions, ground conditions and pollution (including noise, air and radiation). It should also take account of whether the dwelling is in an urban or rural environment.

1.12 Where the dwelling is a part of a larger structure, the design, construction and maintenance of that larger structure and of the dwelling should provide adequate protection from all potential hazards prevailing in the internal environment outside the dwelling, including the normal noise pollution, as well as the external environment.

1.13 This approach acknowledges that all dwellings will contain some hazards, and that the degree to which the above principle can be satisfied in existing dwellings will vary. The HHSRS provides a means of assessing dwellings which reflects the risk from any hazard, and allow judgments to be made as to whether that risk, in the particular circumstances, is acceptable or not.

1.14 While the Rating System focuses on the existing potential effect of any deficiencies[4] on health and safety. Any inspection or survey should not overlook any other deficiencies which do not currently contribute to hazards. Such deficiencies may have other implications, such as an effect on the aesthetic quality, the convenience, the comfort of occupants and visitors, or, if left to deteriorate, could contribute to hazards in the future. Other powers or actions can often be used to deal with such deficiencies.

1.15 For the purposes of the HHSRS, the assessment is solely about the risks to health and safety. The feasibility, cost or extent of any remedial action is irrelevant to the assessment. Some deficiencies, such as a broken stair tread or a leaking pipe, may be quickly, easily and cheaply remedied, but while such deficiencies are present, the threat to health or safety can be considerable.

4 For the meaning of 'deficiencies' see Chapter 2.

Chapter 2

Terminology, and Extent and Purpose of the Guidance

2.01 The Housing Health and Safety Rating System has been developed to be used for a wide range of purposes. It can be used, for example, in stock condition surveys, to assess home safety issues, and as part of the assessment of health and safety issues in neighbourhoods.

2.02 This Guidance, however, deals only with the use and application of the HHSRS for the purposes of enforcement under the Housing Act 2004. For these purposes, the Rating System concentrates on the assessment of potential threats to health or safety arising from the condition of an individual dwelling.

Glossary

2.03 It is important to note that certain words and phrases have particular meanings when used in connection with the HHSRS. To assist in the correct understanding and application of the HHSRS the definitions of these words and phrases for the purposes of this Guidance are given below.[5]

Dwelling[6]

2.04 For the purposes of this Guidance, a **dwelling** is any form of accommodation which is used for human habitation, or intended or available for such use. It includes –

(a) what is commonly known as a "house", whether it is detached, semi-detached or terraced;

(b) what is commonly known as a "flat", "maisonette" or "apartment"; that is a self-contained dwelling on one or more floors in a building containing other dwellings or other types of accommodation (eg, shops or offices); and

(c) what may be known as a "bedsit", or "flat", and which is not self-contained, and where there is the shared use with other dwellings of some facilities such as a bath- or shower-room, sanitary accommodation, or kitchen.

5 For the statutory definitions of some of these terms, see Housing Act 2004, Part 1.

6 See s1, Housing Act 2004.

2.05 Included as part of the dwelling are –

(a) any paths, yards, gardens, and outbuildings etc that are associated or for use with, or give access to that dwelling, whether or not they are for the exclusive use of that dwelling, or are shared with other dwellings; and

(b) any rights of way, easements, and common or shared parts and services necessary for the occupation and use of the dwelling, for example non-adopted footpaths, drives, and drains or private sewers.

2.06 Where the dwelling is a flat, maisonette or bedsit, whether or not self-contained, as well as including those means of access, amenities and services mentioned in 2.05 above, the dwelling also includes any rooms, passageways, circulation areas, and facilities that are shared or used in common with others, and the common structural elements, such as the roof, walls and foundations.

Note –
The application of the HHSRS for assessing conditions in some forms of dwellings involves some changes from the standard approach described below.
Supplemental Guidance and advice is given for the assessment in such cases in Chapter 5.
This supplemental Guidance is particularly relevant for –

i dwellings which are part of a larger building (ie, flats etc – 2.04(b) above);
ii those which are not self-contained (ie, bedsits etc – 2.04(c) above); and
iii premises such as halls of residence, hostels and so-called "bed and breakfast" accommodation.

Element

2.07 Any component or constituent part, facility or amenity of a dwelling.

2.08 For example, a wall, a window, a staircase, a bath, means of lighting, and means of space heating are all 'elements' for the purposes of the HHSRS.

Deficiency[7]

2.09 This is a failure of an element to meet the Ideal, as defined at 2.19 below.

2.10 The failure could be inherent, such as a result of the original design, construction or manufacture, or it could be a result of deterioration, disrepair or a want of repair or maintenance.

Harm and Class of Harm

2.11 Harm is an adverse physical or mental effect on the health of a person[8].

2.12 It includes, for example, an illness, condition, symptom or injury. It includes both permanent and temporary harm.

2.13 For the purposes of the HHSRS, the possible Harms that may result from an occurrence are categorised according to their perceived severity into four Classes of

7 See s2, Housing Act 2004.
8 Ibid.

Harm. These are harms of sufficient severity that they will either prove fatal or require medical attention and, therefore, be recorded in hospital admissions or GP records. (Examples for each Class of Harm are given in Annex C)

Hazard[9]

2.14 Any risk of harm to the health or safety of an actual or potential occupier that arises from a deficiency.

2.15 A Primary Hazard is a hazard arising directly from a deficiency. A Secondary Hazard is one that increases the likelihood of an occurrence of, or the severity of harm likely to result from, a primary hazard. A Secondary Hazard may be a Hazard in its own right as well as contributing to the likelihood and/or severity of a Primary Hazard.

Hazard Score and Rating

2.16 The Hazard Score is a numerical representation of the overall risk from a hazard. It is based on the evaluation of the likelihood of an occurrence and the probable spread of harms that could result.

2.17 The Hazard Rating is the Band into which the Hazard Score falls[10].

Health

2.18 This is an individual's state of physical, mental and social well-being. It is not limited to the presence or absence of disease, infirmity or physical injury, and includes psychological injuries and distress.

Ideal

2.19 The currently perceived model for an element that defines the functions and safest performance criteria that can be reasonably expected of that element.

Likelihood

2.20 The probability of an occurrence that could cause harm.

2.21 For the purposes of the HHSRS, this is the probability of an occurrence during the twelve months following the assessment.

Location

2.22 This is one or more sites in or associated with a dwelling where the presence of a particular hazard could threaten the health or safety of a member of the most vulnerable age group to that hazard.

2.23 For the assessment following a survey, the same hazard may exist at more than one location. For example, there may be more than one set of stairs or steps at a dwelling, each set contributing to the hazard of Falls associated with Stairs and Steps[11].

Occurrence

2.24 This is an event or period of time exposing an individual to a hazard.

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9 Ibid.

10 The Hazard Bands are explained in Chapter ?

11 For a discussion on assessing hazards existing in more than one location, see paras 4.21 and 4.26.

Risk

2.25 The combination of the likelihood of an occurrence and the spread of harms resulting during the following twelve month period. For the purposes of the HHSRS this is expressed as the Hazard Score or Hazard Rating.

Spread of Harms

2.26 The range of possible harm outcomes (ie, Classes of Harm) which could result from an occurrence. For the HHSRS, this is expressed numerically as percentages indicating the relative possibility of each Class of Harm.

Vulnerable Age Group

2.27 An age range of people for whom the risk arising from a hazard is greater than for any other age group in the population. and who might typically be expected to occupy or visit the dwelling.

2.28 For the purposes of this Guidance, vulnerability to particular hazards is restricted to age groups. It does not extend to vulnerability for other reasons and so does not include those who could be registered as chronically sick or disabled.

Responsibility for Deficiencies and Hazards

2.29 Hazards in dwellings can result from –

(a) deficiencies solely attributable to the design, construction and/or maintenance of the dwelling;
(b) deficiencies solely attributable to the behaviour of the occupants or neighbours; and
(c) deficiencies which are attributable to both the dwelling and the occupants or neighbours.

2.30 The HHSRS provides, for enforcement purposes, a means of assessing the dwelling. It is, therefore, concerned only with those deficiencies that can be attributable solely or partly to the design, construction and/or maintenance of the dwelling (ie, those falling within 2.29(a) or (c) above). This assessment is of the dwelling disregarding the current occupiers (if any)[12], and based on the potential effect of any hazards on a member of the relevant vulnerable age group[13]. This is important and means that the assessment will not be affected by a change of occupier, and that an unoccupied dwelling can be assessed.

Landlords' Responsibilities

2.31 Dwellings, as well as providing protection from the environment, should be capable of being occupied safely and healthily by a range of households with a spectrum of lifestyles, and should meet the needs of a wide range of households whose members may include the elderly or the very young. In some cases, occupiers, through their

[12] The current occupiers are taken into account after this initial assessment of the dwelling, as a factor in determining the best course of action – on this see the Enforcement Guidance.
[13] See Chapter 2.

activities and the furniture, furnishings, fixtures and fittings they may introduce, can increase or reduce the likelihood of a hazardous occurrence and the severity of harm from any such occurrence. In many cases it is not possible to apportion the contribution a deficiency makes to the likelihood of an occurrence and the contribution made by the behaviour of the occupants. For example, while variations in the size and shape of stairs and lack of a handrail will make a fall more likely; an elderly person who is distracted by other household members may also be more likely to fall than a person in the vulnerable age group.

2.32 Thus, for enforcement purposes, the Rating System is primarily concerned with those matters which can properly be considered the responsibility of the owner (or landlord) even where the dwelling is occupied by the owner. This means that it is necessary to distinguish between those elements of a dwelling for which responsibility lies with the dwelling owner (or landlord) and those for which responsibility lies with the user (the occupier).

2.33 The issue of the division of responsibility between landlord and occupier in unfurnished residential lettings has been subject to considerable Parliamentary and judicial scrutiny for well over a century. Guidance, which is not intended to be conclusive, based on the results of this scrutiny is given in Annex A[14].

[14] This advice is meant to assist in assessments using the HHSRS for enforcement purposes, and is not intended as an interpretation of the law.

CHAPTER 3

Overview of Rating Hazards

3.01 The HHSRS uses judgments made by the surveyor, based on an inspection of the dwelling, to generate a numerical score. This Hazard Score is important as it allows the comparison of very different hazards so that the most significant hazard is the one with the highest score. Thus, a score of 1,250 is more significant than one with a score of 800.

3.02 The Rating System assessment procedure requires, for each hazard, two judgments from the surveyor. These are an assessment of –

(a) the likelihood, over the next twelve months, of an occurrence that could result in harm to a member of the vulnerable age group; and
(b) the range of potential outcomes from such an occurrence, from the most damaging Class of Harm to the other possible Classes[15].

3.03 This twin approach is more logical than merely attempting to judge the severity of the hazard. It ensures that the severity of a threat which is very likely to occur but will result in a minor outcome can be compared with one which is highly unlikely to occur but if it did would have a major outcome. It also allows differentiation between similar hazards where the likelihood may be the same, but the outcome very different (see Box 1).

3.04 With these two surveyor judgments, the HHSRS Formula is used to generate the numerical Hazard Score for each of the hazards; the higher the score, the greater the severity of the risk from that hazard.

The HHSRS Formula

3.05 Three sets of figures are used to generate a Hazard Score, these are –

(a) a weighting for each Class of Harm reflecting the degree of incapacity to the victim resulting from the occurrence;
(b) the likelihood of an occurrence involving a member of a vulnerable age group, expressed as a ratio;
(c) the spread of possible harms resulting from an occurrence, expressed by percentage for each of the four Classes of Harm.

15 See paras 2.11-2.13 above, for the interpretation of these terms, and Annex C for Examples for each Class.

Box 1

Similar Hazards, with Differing Outcomes – Example

There is a window with a low internal sill (about 250mm above the floor) and with a loose, easy to open catch to the large side hung opening light. A small child could climb onto the sill and open the window relatively easily, and, once there could fall out through the open window. The likelihood of this occurring over the next twelve months is judged to be around 1 in 180.

If that window is in the bedroom of a flat on the ground floor, with grass immediately below, the outcome would be relatively minor – 99% Class IV (bruising) and perhaps 1% Class III (a strain or sprain). This would give a Hazard Score of 7 (Band J).

However, if that same window is in the bedroom of a flat on the 2nd floor, with a paved area immediately below, the outcome would be major – 10% Class I (paralysis or even death), 80% Class II (serious fractures)and 10% Class III (a strain or sprain). In this case, with the same likelihood of 1 in 180, the Hazard Score would be 1,016 (Band C).

Although in both cases the likelihood is the same, the Hazard Score reflects the dramatically different outcome.

3.05 The first of these, the weighting given to each Class of Harms, remains fixed and is shown in Table 1[16]. This built-in fixed weighting means that, given the same likelihood, those hazards which cannot result in death (eg, risks from poor ergonomics) will not produce a Score as high as those which may cause death (eg, risks from carbon monoxide).

Class of Harm		Weighting
I	Extreme	10,000
II	Severe	1,000
III	Serious	300
IV	Moderate	10

Table 1 – Weightings for the Classes of Harm

16 See *A Risk Assessment Procedure for Health and Safety in Buildings* (1999) BRE.

3.06 The other two sets of figures are assessed by the surveyor. Based on informed professional judgment, the surveyor judges both the likelihood and the spread of harms. (General advice and guidance on assessing the likelihood and outcomes is given in the following paragraphs[17].)

3.07 The Hazard Score is calculated as the sum of the products of the weightings for each Class of Harm which could result from the particular hazard, multiplied by the likelihood of an occurrence, and multiplied by the set of percentages showing the spread of Harms. (See Figure 1.)

	Class of Harm Weighting		Likelihood		Spread of Harm (%)		
I	10,000	x	1 L	X	O_1	=	S_1
II	1,000	x	1 L	X	O_2	=	S_2
III	300	x	1 L	X	O_3	=	S_3
IV	10	x	1 L	X	O_4	=	S_4
				Hazard Score		=	$(S_1 + S_2 + S_3 + S_4)$

Where –

L = the Likelihood of an occurrence
O = the Outcome expressed as a percentage for each Class of Harm
S = the product for each Class of Harm.

Figure 1 – The HHSRS Formula

Judging the Likelihood

3.08 The surveyor judges the likelihood of an occurrence which could result in harm to a member of a vulnerable age group over the next twelve months. For the HHSRS, the judgment is limited to the likelihood of an occurrence resulting in outcomes which would require medical attention – a visit to a doctor or a hospital. This is because the Rating System deals only with those hazards which could cause significant harm outcomes (and so carry a significant Class of Harm weighting)., It is only these outcomes for which there is recorded data to inform the judgment.

17 More specific guidance on assessments for each individual hazards is given in the Hazard Profiles.

3.09 The judgment of the likelihood made by the surveyor involves taking account of the conditions (deficiencies) identified during the survey, in particular whether those conditions will increase or reduce the average likelihood of an occurrence.

3.10 Thus, the surveyor should assess the likelihood having regard to –
(a) the average likelihood given for the particular type and age of dwelling;
(b) the dwelling characteristics and conditions identified during the survey, which are the responsibility of the landlord, and which –
i. may increase the likelihood of an occurrence; and
ii. those which may reduce the likelihood of such an occurrence.

(See Box 2.)

Box 2

Judging the Likelihood – Examples

For *falls on stairs*, the surveyor determines the likelihood of a fall occurring which could result in a Class I to IV Harm to a member of the vulnerable age group. This involves taking account of such matters as the going, the presence or absence of handrails, the state of repair of the treads and the available lighting.

For *dampness and mould growth etc*, the surveyor determines the likelihood of the dampness causing Class I to IV Harm to a member of the vulnerable age group over the next twelve month period, taking into account the extent and degree of the dampness and its location in the dwelling.

3.11 To inform the surveyor's judgment, average likelihoods of an occurrence involving a person in the vulnerable age group for different age groups of dwellings (and for multi-occupied dwellings and single household houses) are given for each category of hazard in the Hazard Profiles (see Annex D). These averages represent the likelihood for the typical condition that could be expected in a dwelling of that particular age and type. Also provided in the Hazard profiles is guidance on dwelling characteristics which may affect the likelihood of an occurrence[18].

3.12 Assessing likelihood is not determining or predicting that there definitely will be an occurrence. The likelihood of an occurrence over the next twelve months also means that it may not happen. Even where it is judged that there is a very high likelihood, such as a 1 in 10 probability, it is accepting that the likelihood of no occurrence is nine times greater than that of an occurrence.

3.13 The surveyor is not expected to give an exact likelihood ratio, but to select one of the standard HHSRS likelihood ranges – eg, the range of 1 in 24 to 1 in 42; or the range of 1 in 420 to 1 in 750. For each standard range there is a representative scale point which is used to calculate the Hazard Score. The representative scale point for the range 1 in 24 to 1 in 42 is 1 in 32. See Box 3 for the standard HHSRS ranges of likelihoods,

[18] Also available to inform the surveyor's judgment are the *Worked Examples* and *Statistical Evidence to Support the Housing Health and Safety Rating System: Volume II – Summary of Results.*

and the Representative Scale Points of those ranges that is used in the Hazard Rating Formula.

Box 3

HHSRS Standard Range of Likelihoods –

			Representative Scale Point
Less likely than		1 in 4,200	1 in 5,600
1 in 4,200	to	1 in 2,400	3,200
2,400	to	1,300	1,800
1,300	to	750	1,000
750	to	420	560
420	to	240	320
240	to	130	180
130	to	75	100
75	to	42	56
42	to	24	32
24	to	13	18
13	to	7.5	10
7.5	to	4	5.6
4	to	2.5	3.2
2.5	to	1.5	1.8
More likely than		1 in 1.5	1 in1.0

The surveyor judges the range for the likelihood. The HHSRS Hazard Formula uses scale points to represent that range.
The likelihood scale is based on the logarithmic scale of 10 to root 4. The standard ranges have been calculated by the logarithmic scale of 10 to root 8 (x 1.3335), the alternate rounded values of which give the 16 single Representative Scale Points used in the HHSRS calculation.

3.14 Some hazards may be present in several locations. Falls on the level, for example, will include reviewing the condition of all the floors and all the paths and yards associated with the dwelling. Damp, mould growth etc will involve reviewing the extent and severity of the dampness and any mould growth in all rooms within the dwelling. For these, the surveyor should assess the collective likelihood of an occurrence at the dwelling. This should take into account the expected frequency of use of each location and how that may affect the exposure to that particular hazard at the dwelling as a whole. (See Box 4.)

Box 4

Assessing the Likelihood for Falls associated with stairs – Example

There are three sets of steps and stairs to a house –

1. At the front gate there are two steps. These are of rough concrete and have high risers. There is a crude loose handrail to one side.
2. At the front door there are four steps of smooth concrete. The bottom step is higher than the others. There is a steel tube handrail to one side.
3. The internal stairs have two winders at the top. The stairs are fairly steep, but not more than the average for this type of dwelling (a 1930s, detached house) and there is a handrail to one side.

The main stairs are assessed as giving the same likelihood of a major fall as the average for inter-war houses, (ie, around 1 in 230). However, the state and condition of the steps at the gate and to the front door – particularly dangerous in icy weather and at night – is judged to substantially increase the overall probability that, in the next twelve months, an elderly person (60 years or more) will have a fall that could result in some injury. While the occupants may use the rear door (with only a single low step), they cannot avoid using the steps close to the front gate. In this case, the likelihood of a member of the vulnerable age group falling the next twelve months is judged to be in the range of 1 in 24 to 1 in 13 – a Representative Scale Point of 1 in 18.

Judging the Spread of Harm outcomes

3.15 After judging the likelihood of an occurrence, the surveyor makes the second judgment, that of the possible harm outcomes for the vulnerable age group, which could result from such an occurrence. This is done by assessing which is the most significant Class of Harm outcome, and then the next most significant and so on, the highest percentage being given to the most probable outcome.

3.16 Average spreads of harm outcomes for each hazard are given in the Hazard Profiles (see Annex D) for different age groups of dwellings (multi-occupied buildings/single household houses or houses/flats). As with the average likelihoods, these represent the harm outcomes for the typical condition that could be expected in a dwelling of that particular age and type. Also given in the Hazard Profiles is guidance on dwelling characteristics that may affect the outcomes.

3.17 The spread of outcomes should be assessed having regard to –

(a) the average spread of harm outcomes given for the particular type and age of dwelling;

(b) the dwelling characteristics and conditions identified during the survey which are the responsibility of the landlord, and which –

i may increase the severity of those outcomes; and

ii those which may mitigate the severity of those outcomes.

3.18 In a similar to manner to that adopted in judging the likelihood, the surveyor is not expected to give an exact spread of outcomes, but select one of the standard HHSRS outcome ranges. For each standard range there is a representative scale point which is used in the Hazard Rating Formula. See Box 5 for the standard HHSRS ranges of outcomes, and for the Representative Scale Points used in the Formula to generate the Hazard Score.

Box 5

HHSRS Standard Range of Class of Harm Outcomes –

			Representative Scale Point
Below		0.05%	0.00%
0.05%	to	0.15%	0.10%
0.15%	to	0.3%	0.22%
0.3%	to	0.7%	0.46%
0.7%	to	1.5%	1.00%
1.5%	to	3.0%	2.20%
3.0%	to	7.0%	4.60%
7.0%	to	15.0%	10.0%
15.0%	to	26.0%	21.5%
26.0%	to	38.0%	31.6%
Above		38.0%	46.4%

The lower points of the outcome scales are based on the logarithmic scale of 10 to root 3 and the upper points on the scale of 10 to root 6, and the Representative Range Points used in the HHSRS Hazard Formula are given by the logarithmic scales of 10 to root 6 (x 1.4678) and 10 to root 12 (x 1.2115) respectively, and the figures then rounded.

3.19 As the spread of outcomes is given as percentages, the total must equal 100. Therefore, the surveyor should select the representative scale points for three of the Classes of Harm, and the fourth Class should be 100 minus the sum of the other three Classes.

3.20 For those hazards which may be present in several locations, the surveyor should take account of the expected frequency of use of each location and how that might affect the likelihood of an occurrence and so increase or lessen the expected severity of the range of harm outcomes. (See Box 6.)

Box 6

Assessing the Outcomes for Falls associated with stairs – Example

Using the same example as above, a house with three sets of steps and stairs –

1. At the front gate there are two steps. These are of rough concrete and have high risers. There is a crude loose handrail to one side.
2. At the front door there are four steps of smooth concrete. The bottom step is higher than the others. There is a steel tube handrail to one side.
3. The internal stairs have two winders at the top. The stairs are fairly steep, but not more than the average for this type of dwelling (a 1930s, detached house) and there is a handrail to one side.

There is nothing to suggest that the outcomes from a fall on the internal stairs will be anything other than average (ie, 2.1%, 7.4%, 20.5% and 70.0% for Classes I, II, III, and IV respectively). However, the state and condition of the steps to the front door steps and those near the front gate, are such that it is judged that the Class I outcome to a person aged 60 years or more from a fall at either of these locations will be increased, particularly if that fall was in cold weather or at night. The Representative Scale Points of the outcomes are judged to be 4.6%, 10.00%, 21.5% and 63.8% respectively.

Generating a Hazard Score

3.21 Using the same Falls associated with stairs example as above, the Likelihood of 1 in 18 and the Outcomes of 4.5%, 10.0%, 21.5% and 63.8% for Classes of Harm I to IV respectively are used by the HHSRS Formula to generate a Hazard Score of 3,505 (See Box 7).

Box 7

Generating a Hazard Score

	Class of Harm Weighting		Likelihood (1 in)		Spread of Harm (%)		
I	10,000	÷	18	X	4.6	=	2,556
II	1,000	÷	18	X	10.0	=	556
III	300	÷	18	X	21.5	=	358
IV	10	÷	18	X	63.8	=	35
					Hazard Score	=	**3,505**

3.22 Average Hazard Scores for each hazard are given in the Hazard Profiles (see Annex D) for different age groups of dwellings (multi-occupied buildings and single household houses). These have been calculated using the average likelihoods and outcomes and the Hazard Rating Formula.

The Hazard Bands

3.23 For most purposes, and particularly for the purposes of enforcement, the numerical Hazard Score can appear too specific. It can also falsely imply that the score is a precise representation of the risk, rather than a representation of the surveyor's judgment.

3.24 Hazard Bands have been devised to avoid too much emphasis being placed on the precise numerical Hazard Score deriving from the surveyor's judgments. As well as avoiding too much emphasis being placed on the exact number, the Bands provide an simple means for handling the potentially wide range of Scores – from under 0.2 to 1,000,000[19].

3.25 Ten Hazard Bands have been devised (see Box 8), with Band J being the safest, and Band A being the most dangerous.

Box 8

HHSRS Bands –

Band	Hazard Score Range
A	5,000 or more
B	2,000 to 4,999
C	1,000 to 1,999
D	500 to 999
E	200 to 499
F	100 to 199
G	50 to 99
H	20 to 49
I	10 to 19
J	9 or less

3.26 The Hazard Band is one of the factors taken into account in determining the appropriate enforcement action – for guidance on which, see the Enforcement Guidance.

[19] A 1 in 5,600 likelihood with 100% Class VI outcome, and a 1 in 1 likelihood of 100% Class I outcome respectively.

CHAPTER 4

The Assessment of Conditions Using the HHSRS

4.01 The assessment of the risks to health and safety using the HHSRS requires an assessment of the whole dwelling for each hazard. Therefore, for enforcement purposes, the assessment must be based on the findings from a full survey of the whole of the dwelling[20]. The survey is a means of gathering information and will form a major part of the evidence to support the judgments on which the Hazard Rating is based.

4.02 Once the survey has been completed, the surveyor[21] makes the assessment. This involves –

(a) determining whether there are any deficiencies present by assessing whether each dwelling element and the dwelling as a whole meets the relevant Ideal;
(b) determining whether any deficiencies contribute to one or more hazards, and if so, which hazards; and
(c) for each hazard, the surveyor assesses –
  i) the likelihood of an occurrence over the next twelve months;
  ii) the probable spread of harms which could result from such an occurrence.

4.03 Each of these stages is discussed below.

The Survey Procedure

4.03 A survey is, of course, a means of gathering information on which to base decisions. As those decisions could result in enforcement action, the survey should be thorough and comprehensive. The survey notes and observations should be accurately recorded and stored for future reference, particularly as they may be needed to justify the basis for decisions which may affect someone's home and someone's property.

4.04 For the purposes of assessment using the Rating System, the survey should be comprehensive enough to gather details of the state and condition of a dwelling, and particularly any deficiencies. As with all surveys, a simple logical approach should be adopted to ensure all internal and external parts of the dwelling are inspected. For local authority officers, such surveys generally will be restricted to visual and surface

20 See paras 2.04-2.06 above for the definition of the dwelling.
21 The term "surveyor" used in this Guidance includes environmental health practitioner or other local authority officer.

inspection, without any destructive investigations and limited by furniture and furnishings. (A suggested survey procedure is described in Annex A.)

Assessing the Condition

LINKING DEFICIENCIES AND HAZARDS

4.05 The first stage in assessing the condition of a dwelling is a review of the deficiencies identified during the survey, including any whole dwelling deficiencies.

4.06 As defined above (paras 2.09-2.10) for the purposes of the HHSRS, a deficiency is a failure of an element to meet the Ideal, whether that failure is inherent, such as a result of the original construction or manufacture, or a result of deterioration or of disrepair and a want of maintenance. While a deficiency may have implications in building and aesthetic terms, its prime importance for the purposes of the HHSRS is when the effect from that deficiency has the potential to cause harm – ie, when the deficiency results in a hazard (see paras 2.14-2.15).

4.07 A single deficiency may contribute, to differing degrees, to more than one hazard. For example, the single deficiency of disrepair to a ceiling could lead to the following hazards –

- excessive cold (through increased heat loss),
- fire (by allowing fire and smoke to spread to other parts of the dwelling),
- lead (from old paint),
- infections from other sources (by providing means of access and harbourage for pests), and
- noise (because of an increase in noise penetration between rooms).

The contribution a single deficiency makes to each hazard will vary, perhaps from the relatively insignificant to the substantial.

4.08 Also, several deficiencies may contribute to the same hazard. For example, disrepair to a ceiling, an ill-fitting door, and the lack of a smoke detector may all contribute to the hazard of fire, with the potential for smoke and flames to spread to other parts of the dwelling without means of detection and warning.

4.09 Finally, there may be similar deficiencies in various locations throughout the dwelling which all contribute to the same hazard. There may be, for example, dampness affecting walls to several rooms within the dwelling. In this case, it is the cumulative contribution of those deficiencies to the hazard of damp and mould growth which should be assessed. Similarly, there may be deficiencies to steps to the entrance path to the dwelling, deficiencies to the main stairs within the dwelling and deficiencies to the rear door steps. Again, it is the cumulative contribution of these deficiencies to the hazard of falls associated with stairs/steps which is assessed.

4.10 Guidance on the matters to be taken into account in assessing the potential contribution to a hazard by a deficiency is given in the "causes and preventive measures"

sections of the Hazard Profiles in Annex D. However over time research may be published that will overtake the evidence used in the profiles.

NB – It is imperative that users of the Rating System keep up to date with published research and other relevant information which can be used to supplement that given in the Hazard Profiles (Annex D) and which may influence their judgment as to likelihood and/or spread of harms.

IDENTIFYING HAZARDS

4.11 Identifying and assessing hazards involves an understanding of the basic physiological and psychological requirements for human life, and of the functions of a dwelling as a whole and of each individual dwelling element.

4.12 As a minimum, a dwelling should be capable of satisfying the basic and fundamental needs for the everyday life of a household. It should provide shelter, space and facilities for the occupants. And, it should be suitable for the spectrum of households who could normally be expected to occupy a dwelling of that size and type.

4.13 As well as satisfying the general principle behind the Rating System (see paras 1.08-1.15), the dwelling should not contain any deficiency and consequential hazard which interferes with the household establishing a home or which might endanger the occupants and any visitors.

4.14 Determining whether a deficiency contributes to one or more hazards requires an understanding of the function(s) of each element and facility, and a competence to assess whether the deficiency interferes with a function so as to create a hazard. (See Box 9 for some examples of the functions of individual elements.)

Box 9

FUNCTIONS AND REQUIREMENTS OF ELEMENTS – SOME EXAMPLES[22]

Doors – External doors provide for access into and out of the dwelling or building, and also complete the weather protection, privacy and security provided by the external structure. They should be close-fitting when closed, provided with appropriate door furniture so as to be capable of being readily opened and closed and secured against unauthorised entry.
Internal doors allow for access between different parts of the dwelling. When closed, they complete the separation provided by the internal walls, and provide for privacy by separating a room (such as a bathroom, a wc compartment and a bedroom) from other parts of the dwelling. As well as being able to be readily opened and closed, internal doors should satisfy similar functions to the internal walls, such as sound insulation and limiting the spread of fire.
Walls – In traditionally built dwellings, the External walls will provide for support for floors and the roof. They also give weather protection, thermal and sound insulation and limit the spread of fire.
Internal walls divide the dwelling into separate rooms and areas, enabling different activities to be carried out. They also provide for privacy for individual members of a household allowing personal and domestic activities to be carried out in proper conditions and in private. Internal walls may provide support for other elements and should give thermal and sound insulation and should limit the spread of fire. The surfaces of internal walls should be capable of being decorated and easily maintained in a clean condition; this is especially so in such areas as kitchens and bathrooms where hygiene is of particular importance.
Paths, Yards etc – External paths, yards, and steps should be laid so as to be even and self-draining. This includes paths giving access from public or shared areas, and those giving access to amenity spaces.
Rainwater Goods – Eavesgutters are intended to collect rain water draining off roofs and carry it safely to rain water fall pipes which in turn should carry it safely to a drainage inlet or soakaway.
Kitchens – These are primarily food preparation areas. All surfaces and fittings and fixtures, such as sinks, worktops and food stores, should be designed, fitted and maintained so that they and the kitchen area can be readily cleansed and maintained in an hygienic condition. All surfaces and fittings in bathrooms and wc compartments should also be designed, fitted and maintained to facilitate cleaning and the maintenance of hygiene.
Thermal Efficiency – The dwelling should be provided with adequate thermal insulation and a suitable and effective means of space heating so that the dwelling space can be economically maintained at reasonable temperatures.

22 Additional information on features of elements contributing to, or mitigating against, each individual Hazard category is given in Annex D.

ASSESSING HAZARDS

4.15 Using details of the deficiencies identified which contribute to hazards, the surveyor should score each hazard. To assist in this process it may be useful to list each of the deficiencies contributing to a hazard, then review them during the rating process.

4.16 To fully assess some hazards, destructive investigations may be necessary, but the surveyor may not be in a position to carry these out. In other cases, such as for Excess Cold, Noise, and Radon, further investigations and measurements may be needed to verify the existence and seriousness of the hazard. For these, a preliminary assessment should be made, with the proviso that verification by measurement or further investigation will be necessary.

4.17 As stated above, the assessment procedure for the HHSRS requires, for each hazard, two judgments from the surveyor on –

(a) the likelihood, over the next twelve months, of an occurrence that could result in harm to a member of the vulnerable age group; and
(b) the possible range of outcomes from such an occurrence, from the most significant Class of Harm to the other possible Classes[23].

These stages are discussed below.

Judging the Likelihood

4.18 Having reviewed the deficiencies identified during the survey, which contribute to a hazard, the surveyor should assess the likelihood.

4.19 This assessment should have regard to –

(a) the average likelihood for that particular hazard given for the particular type and age of dwelling[24];
(b) the deficiencies (ie, dwelling characteristics and conditions) identified and recorded during the survey which may –
   i. increase the likelihood of an occurrence; and
   ii. reduce the likelihood of such an occurrence[25].

4.20 It is important to remember that the assessment is the likelihood of an occurrence involving a member of the relevant vulnerable age group. This means taking into account the expected behaviour of such an individual – eg, how an elderly person would use the stairs, or whether a young child could climb the guarding to a balcony and fall over.

4.21 For those hazards present in several locations, the surveyor should assess the collective likelihood of an occurrence at the dwelling. This should take into account the expected frequency of use of each location and how that may affect the exposure to that particular hazard at the dwelling as a whole.

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23 See Chapter 2 for the interpretation of these terms.

24 See Annex D for details of these averages. The averages are also given in the HHSRS program and on the paper based scoring pack.

25 See Annex D for guidance on the matters which can reduce or increase the likelihood of an occurrence.

4.22 The surveyor is not expected to give an exact likelihood ratio, but a range – eg, the range of 1 in 24 to 1 in 42; or the range of 1 in 420 to 1 in 750. However, the HHSRS Formula uses a representative scale point to signify the selected range[26].

Judging the Spread of Harm outcomes

4.23 The second stage of the assessment is to judge the possible harm outcomes that could result to a member of the relevant vulnerable age group from such an occurrence.

4.24 This stage of the assessment should involve taking account of –

(a) the average spread of harm outcomes for that particular hazard given for the particular type and age of dwelling;[27]

(b) the deficiencies (ie, dwelling characteristics and conditions) identified and recorded during the survey which may –

i increase the severity of those outcomes; and

ii mitigate the severity of those outcomes.

4.25 As for likelihood, it is important to remember that the assessment is the potential outcomes from an occurrence involving a member of the relevant vulnerable age group. This means assessing the outcomes on such an individual – eg, the effect of a fall on stairs to an elderly person, the effect of excess cold on an elderly person, the effect of damp and mould on a young child, or the effect of a fall from a balcony to a young child.

4.26 Again, for hazards which may be present in several locations, the surveyor should take account of the expected frequency of use of each location and how that might, through the expected frequency of use of each location, affect the likelihood of an occurrence and so increase or lessen the expected severity of the range of harm outcomes.

4.27 As with the likelihood, the surveyor is not expected to give an exact spread of outcomes, but judge the range – eg, for Class III Harm this may be the range of 0.3 % to 0.7%; or the range of 15% to 26% - although the HHSRS Formula uses a representative scale point to signify the selected range[28].

Generating the Hazard Scores

4.28 The Representative Scale Points for the assessed likelihood and spread of harms are used in the HHSRS Formula to generate a single numerical Hazard Score for the hazard. Figure 2 shows an example calculation using a likelihood of 1 in 56 and a spread of outcomes of 2.2%, 31.6%, 46.4% and 19.8%.

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26 See Chapter 3, para 3.13 for an explanation.

27 See Annex D for details of these averages. The averages are also given in the HHSRS program and on the paper based scoring pack.

28 See Chapter 3, para 3.18 for an explanation.

	Class of Harm Weighting		Likelihood (1 in)		Spread of Harm (%)		
I	10,000	÷	56	X	2.2	=	392.9
II	1,000	÷	56	X	31.6	=	564.3
III	300	÷	56	X	46.4	=	248.6
IV	10	÷	56	X	19.8	=	3.5
					Hazard Score	=	**1,209.3**

Figure 2 – Example Calculation to Generate a Hazard Score.

4.29 The scoring procedure should be repeated for all hazards that are considered to be worse than average, that is where the Hazard Scores will be significantly above the average for the housing stock.

4.30 The Hazard Band for all the significant hazards should be recorded. These form the first factor in the enforcement decision-making process. Guidance on that process is given in the Enforcement Guidance.

Options for Calculating the Hazard Scores

4.31 Three options for recording the Likelihood and Outcome judgments and for calculating the Hazard Score have been developed. These are –

- a paper scoring form;
- a scoring program for handheld computers (PDAs); and
- a scoring program for desk top PCs.

4.32 All three options have a similar appearance for recording Likelihood and Outcome judgments. However, both the scoring programs use the Hazard Formula and the prescribed calculation method to generate the Hazard Score and Band as the Likelihood and Outcomes are entered. The scoring program for handheld computers has the advantage that it can be used on site. Both programs save the data, which can be reviewed when printed from a desk top PC, or exported into other software[29].

4.32 Having assessed the likelihood, the surveyor should enter his or her decision into the Likelihood Scoring grid in the electronic program or the paper scoring form. (Figure 3 shows the grid layout for the paper scoring form. A similar grid is displayed on the scoring screens for the two survey programs.)

29 For getting started and using the HHSRS Scoring software see the Handbook.

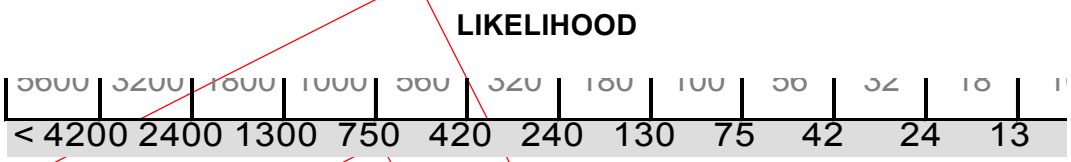

Figure 3 – Likelihood Scoring Grid

4.33 For the scoring programs, having chosen the hazard to be scored, a screen appears with the appropriate average likelihood for the particular age and type of property marked as a green line. Selecting the assessed likelihood range displays the Representative Scale Point which will be used in the HHSRS Formula.

4.34 For the paper scoring form, it is recommended that the average likelihood for the particular age and type of property is marked with a vertical line (as indicated in the relevant Hazard Profile) and then the assessed likelihood range for the surveyed dwelling circled. The given Representative Scale Point can be used in the HHSRS Formula when calculating the Hazard Score and Band.

4.35 Having assessed the spread of harm outcomes, the surveyor should enter his or her decision into the Outcomes Scoring grid in the electronic program or the paper scoring form. (Figure 4 shows the grid layout for the paper scoring form. A similar grid is displayed on the scoring screens for the two survey programs.).

Figure 4 – Classes of Harm Outcomes Grid

4.36 As for the Likelihood scale, having chosen the hazard to be scored, the scoring programs will display a screen with the appropriate average spread of outcomes for the particular age and type of property marked by a green line. For each Class of Harm, selecting the assessed percentage range displays the Representative Scale Point, which will be used in the HHSRS Formula. It is recommended that the outcomes are assessed in order of severity, starting with Class I, and, as the spread is a percentage, the outcome for Class IV will then be automatically adjusted to ensure the total remains at 100.

4.37 For the paper scoring form, the average spread of harms for the particular age and type of property can be marked for each of the Classes of Harm (obtained from the relevant Hazard Profile) and then the assessed percentage range for each Class for the surveyed dwelling circled. It is important to remember that the spread of outcomes is a percentage and that the total therefore must not exceed 100. The given Representative Scale Points can be used in the HHSRS Formula to calculate the Hazard Score and Band.

4.38 As the likelihood and outcomes are entered into the scoring programs (both that for hand-held computers and PCs), the hazard score is generated automatically. In each case, the program shows the Hazard Band for the score. Where the score generated is within the top or bottom 10th of the band, the programs will show a "+" or "–" sign, indicating whether the score is close to the Band above or below respectively (see Box 9). This indicator alerts the surveyor, enabling her or him to review their assessments so as to be confident of their and the resulting Score and Band.

Box 9

Hazard +/- Sub-Bands

Sub Band	Hazard Score
A-	5,000 – 5,400
B+	4,600 – 5,000
B-	2,000 – 2,200
C+	1,800 – 2,000
C-	1,000 – 1,070
D+	930 – 1,000
D-	500 - 540
E+	460 - 500
E-	200 - 220
F+	180 - 200
F-	100 - 107
G+	93 - 100
G-	50 - 54
H+	46 - 50
H-	20 - 22
I+	18 - 20
I-	10 - 11
J+	9 - 10

Supplemental Stage for Crowding

4.39 For all Hazards, the Hazard Score and Band are based on the assessment of the dwelling without taking account of the current occupants (if any). This means that the Score and Band relate to the dwelling and does not vary with a change of occupancy.

> **Note –**
> The current occupants are taken into account as one of the other factors in the enforcement decision-making process.

4.40 For the assessment of Crowding, which can only occur in an occupied dwelling, a supplemental stage may be necessary to determine whether the dwelling is crowded, and if so, the severity of the Hazard and whether enforcement action should be considered.

4.41 For example, disregarding the current occupants, a two storey pre-1920 house may be assessed as average, having adequate space for sleeping, living and recreation for four persons (irrespective of age). This would give a Hazard Score of 22 (Band H-). If this dwelling is currently occupied by five persons – two parents and their three children, then there is mis-match between the household and the dwelling. In this case the likelihood of a harmful occurrence should be re-assessed taking account of the current occupation. For Crowding only, it is this adjusted Hazard Score and Band which form the first factor in the enforcement decision-making process.

Scoring Hazards Schematic

Survey the dwelling

Carry out a full survey of the dwelling to identify all deficiencies, particularly those which could contribute to any of the 29 Hazards.

For each Hazard to be scored

Relevant Deficiencies

Review deficiencies identified which could contribute to Hazard.

Score the Hazard

Assess for this dwelling –
a) the likelihood range; and
b) the outcome range for each Class of Harm.
Taking into account national averages for particular type and age of dwelling.

Hazard Score and Band Generated

Determine Appropriate Enforcement Action

The Hazard Band is one of the factors to take into account in determining the appropriate enforcement action.
On this see the Enforcement Guidance.

CHAPTER 5

Flats and Other Dwellings in Multi-Occupied Buildings

Supplemental Guidance

5.01 This additional guidance is for the use and application of the HHSRS for enforcement purposes in the case of dwellings in multi-occupied buildings. These are dwellings within a larger building, whether purpose-built or created by conversion, which are –

(a) self-contained;
(b) non-self-contained, where not all rooms are behind one entrance door to the dwelling, but where no facilities or rooms are shared;
(c) non-self-contained, where some rooms are shared (for example dining or living rooms), but where no facilities are shared;
(b) non-self-contained, and where one or more of the following facilities are shared in common with other units within the building, that is –
  i sanitary accommodation;
  ii personal washing facilities;
  iii food storage facilities;
  iv food preparation facilities; and/or
  v food cooking facilities.

> Note –
> Separate additional guidance is given below for premises where sleeping accommodation is provided in dormitories.

5.02 The HHSRS has been devised and designed so that it can be applied to any form of dwelling (see paras 2.04-2.06). This means that any dwelling can be assessed, whether it is self-contained or not, and whether it is contained within a larger building or not. To achieve, this, it is only necessary to survey and assess the dwelling and those parts and areas (whether shared or not) which are associated with that unit.

5.03 Assessments using the Rating System, therefore, include –

(a) those rooms and areas of the dwelling which are in exclusive occupation (ie, not shared in common with others);
(b) any rooms or areas (whether internal or external) which are shared with others;
(c) the means of access to the dwelling; and
(d) the building associated with the dwelling.

The assessment does not include any public areas not associated with the building.

Judging Likelihood and Outcomes

5.04 For those rooms and areas which are not shared with others, the assessment is as described above (see paras 4.15-4.38).

5.05 For all rooms and areas shared with others, the assessment should take into account any increase in the likelihood and/or outcomes which could result from the sharing and the degree of that sharing (ie, the number of other dwellings sharing the rooms and areas). For example, does that sharing increase the risk of infection, or is it likely to cause stress to an occupant of the dwelling being rated? Guidance on the potential effect of sharing in the individual Hazard Profiles in Annex D. In addition, the statistical averages given in the Hazard Profiles for multi-occupied buildings should be used to inform the judgments.

5.06 For the means of access and the building containing the dwelling, the assessment should be related to the potential hazards in those parts and the effect they could have on a potential occupier from the relevant age group in the dwelling being rated.

5.07 Where more than one dwelling in a multi-occupied building is being surveyed and rated, then the assessment of the shared rooms and areas, means of access, and the building should be reviewed in relation to the subsequent dwelling(s). There should be no need to re-survey those parts.

Domitory Style Accommodation

5.08 For residential premises providing dormitory style sleeping accommodation, it is the whole of the premises which is assessed, taking account of the potential effect the sharing may have on the potential users from the vulnerable age groups. For such accommodation there is no national averages available for the individual hazards, and the assessment must rely on professional judgment.

Annexes

Contents

Annex A

LANDLORD'S RESPONSIBILITY

A1 For enforcement purposes, the Rating System is concerned with those matters which can be considered the responsibility of the owner or landlord (see paras 2.29-2.33 above). This applies even where the dwelling is occupied by the owner. It is necessary, therefore, to distinguish between those elements of a dwelling for which responsibility lies with the owner (or landlord) and those for which responsibility lies with the user (the occupier).

A2 The issue of the division of responsibility between landlord and occupier in unfurnished residential lettings has been subject to considerable Parliamentary and judicial scrutiny for well over a century. The following advice, which is not intended to be conclusive, is based on the results of this scrutiny[30].

A3 Generally, the landlord (or owner) is responsible for the provision and state of the following –

(a) the structural and external elements of the dwelling; and
(b) the installations within and associated with the dwelling for –
  - i the supply and use of water, gas and electricity;
  - ii personal hygiene, sanitation and drainage;
  - iii food safety;
  - iv ventilation;
  - v space heating; and
  - vi heating water.

A4 The landlord (or owner), however, is not responsible for the state of any fixtures or fittings provided by the occupier unless they have been adopted by the landlord (or owner) and are not removable. Adoption by the landlord (or owner) can occur on the change of tenancy where fixtures or fittings provided by the previous occupier remain at the commencement of the new tenancy.

A5 Although not intended to be an interpretation of the law, regard should be had to the following guidance for interpreting the landlord's (or owner's) responsibilities as given in paras A3 and A4.

Provision and State

A6 The term "provision and state" in para A3 covers –

(a) the provision of the materials and the proper construction of the element;
(b) the provision of the facilities and equipment and their proper installation and connection;
(c) the maintenance of the elements and installation, in a proper state of repair and in proper working order; and

30 This advice is meant to assist in assessments using the HHSRS for enforcement purposes, and is not intended as an interpretation of the law.

(d) where necessary, the replacement of obsolete, defective or ineffective elements or installations.

Structural and External Elements

A7 The term "structural and external elements of the dwelling" are not limited to the load-bearing elements, but include all those elements which give a dwelling its essential appearance, stability and shape, and those which provide protection from the climate. It includes, for example, means of access, amenity space, foundations, walls (including internal plasterwork), roof, windows, doors, and ceilings. While it includes protective finishes (including paintwork to timber), it does not normally include the internal surface decoration such as wallpaper and emulsion paint.

Water, Gas and Electricity

A8 The term "installations within or associated with the dwelling for the supply and use of water" includes the necessary pipework, tanks, cisterns, and taps. The similar term "…. for the supply and use of … gas" includes the necessary pipework, valves and taps; and the same term "… for the supply and use of … electricity" includes the necessary wiring, sockets, switches and fuses or other safety devices.

A9 These terms are not intended to include any removable equipment or appliances which use gas or electricity as a source of power, such as refrigerators, washing machines, audio and visual equipment, portable heaters and light bulbs, unless these are provided by the landlord.

Personal Hygiene, Sanitation and Drainage

A10 The term "installations within or associated with the dwelling for personal hygiene" includes the necessary wash hand basins, showers and/or baths. Such facilities should be properly installed and fitted, including being sealed to adjacent surfaces, provided with splash-backs and with appropriate supplies of hot and cold water. It also includes the rooms or compartments where these facilities are installed.

A11 The similar term "… for … sanitation and drainage" includes wc basins, drains, waste pipes, rainwater goods, inlet gulleys and inspection chambers.

Food Safety

A12 The term "installations within or associated with the dwelling for food safety" includes sinks, draining boards, work tops, cooking facilities (or cooker points and space for cooking facilities), cupboards and/or shelves for cooking and eating utensils and equipment, and food storage facilities (including socket outlets and space for a refrigerator).

A13 The sinks, draining boards, and work tops should be properly installed and fitted, including being sealed to adjacent surfaces, and provided with splash-backs. The sinks should also be provided with appropriate supplies of hot and cold water.

Ventilation

A14 The term "installations within or associated with the dwelling for ventilation" include air bricks, trickle vents, opening lights to windows, passive stack ventilation systems and mechanical ventilation equipment.

Space and Water Heating

A15 The term "installations within or associated with the dwelling for space heating" includes any form of fitted space heating appliance(s) or central heating system, such as open fireplaces, fixed solid fuel stoves, gas boilers, storage heaters, warm air heating systems and radiators. It does not include moveable heaters provided by the occupier.

A16 The similar term "… for heating water" includes any form of fitted water heating system whether instantaneous or storage. It does not include kettles or similar devices.

Annex B

Suggested Survey Procedure

Introduction

B1 The guidance given here is for the basic survey procedure where the purpose is to assess the condition of the dwelling using the HHSRS. Additional guidance for dwellings which are part of a larger building (ie, flats etc – 2.04(b) above), those which are not self-contained (ie, bedsits etc – 2.04(c) above) and premises such as halls of residence, hostels and so-called "bed and breakfast" accommodation is given in paras B34-B53 below.

B2 Survey details and information can be recorded either on paper (a notebook or inspection form) or in a proprietary software program for hand-held computers.

> Note –
> A Hazard Scoring Form which can be used for the HHHSRS assessment on completion of a survey is provided at the end of this Annex.
> There are also HHSRS Hazard Scoring programs available for use with handheld computers (running on either Palm OS or Pocket PC).

B3 The purpose for which any survey is carried out will have some influence on the detail and information collected, so it is important that the surveyor fully understands the HHSRS and the information required before undertaking a survey.

B4 It is recommended that the survey should ensure that all deficiencies are identified and recorded, whether or not those deficiencies could contribute to a hazard[31]. In addition, sufficient information on each deficiency and on the dwelling as a whole should be recorded to inform the hazard assessments.

B5 It should be remembered that decisions based on the findings from a survey may affect someone's home and may have financial implications for both the owner and the occupier. Such decisions may be challenged and could be the subject of scrutiny by the courts. Any survey should ensure that sufficient clear information is recorded to substantiate the findings, and that that information is in a form which is logical and readily understandable, in particular by occupiers and owners. In this way it will be possible to justify decisions and demonstrate how a deficiency or deficiencies contribute to a particular hazard.

[31] See paras B21-B22 on deficiencies which do not contribute to a hazard.

CONVENTIONS

B6 To promote consistency in the carrying out of surveys and in record keeping, it is recommended that the following conventions be adopted for the purposes of the HHSRS. It is suggested that any report or formal document (eg, Notice or Order served under the Housing Act 2004) should include a statement to the effect that "The conventions used to describe the aspects of the dwelling are those recommended in *Housing Health and Safety Rating System: Guidance (Version 2)* 2003 (ODPM)".

Front – The elevation of the dwelling, or the building in which the dwelling is contained, that faces the road or street which is in the address of the dwelling, or where this is inappropriate, define the "front" for the rest of the survey by its orientation (eg, make a note that the front elevation faces "south").

Back or **Rear** – The direction opposite to the front.

Left and **Right** – The left-hand side and the right-hand side when outside the dwelling, or the building in which the dwelling is contained, and facing the front elevation.

Floors – The dwelling floor levels are described using the appropriate descriptive term – eg, basement, ground, first, etc. Usually the ground floor is at or near pavement level on the elevation including the main entrance door to the dwelling, or the building in which the dwelling is contained. The basement is the level immediately beneath the ground floor level (the basement will often be at garden level at the rear of a building). Where there is more than one level below the ground floor, these are defined as level –1, level –2, etc. The level above the ground floor is the first floor, the level above that the second floor, etc. A mezzanine is indicated as half-way between two floor levels –eg, "first/second floor mezzanine".

Rooms – These should be identified by their position within the dwelling, together with their current use. For example, "second floor, rear right bathroom", "ground floor, rear middle living room" and "first floor, rear left store room".

Additions and Extensions – These should be clearly identified in relation to the main structure, particularly where there are, for example, rear extensions to back additions.

SUGGESTED PROCEDURE

B7 The following suggested survey procedure should ensure that all the necessary information is collected and enable any hazards to be scored and to justify decisions made.

Practical Considerations

B8 Where a survey is carried out on the instructions of the owner of the building, it may be possible to obtain background and historical information, plans and records.

Authority for destructive investigations where necessary should also be obtained, either as a part of the original instructions or if subsequently found necessary.

B9 Surveys carried out by local authority officers or on the instruction of tenants may not have such benefits. These surveys will usually be carried out without detailed information on materials used in construction, the original construction and in any subsequent alterations. Nor will there be any authority to carry out destructive investigations, which might be the only means of properly identifying the cause or source of a deficiency or hazard. In addition, it may not be possible to remove furniture, furnishings and fittings. Any report or record of surveys carried out under such restrictions should include a statement to that effect and should identify those matters which would require further investigation to determine the appropriate remedial action or confirm the hazard score.

B10 Any survey is a snap-shot of the dwelling and its condition at that particular time. Clearly the weather on the particular day and the days prior to the survey, and the time of year can have a dramatic effect on the conditions in the dwelling – even to the experienced eye, a dwelling may seem reasonably satisfactory on a warm summer day after a dry spell, but the conditions may be very different on a cold and wet day in winter. These factors should be taken into account during the inspection, and should be noted in any report and, if necessary, included as a qualification to the assessment of the condition.

General Information

B11 A survey should begin with the collection of basic information. This should include –

(a) the identification of the surveyor;
(b) the address or other means of identification of the dwelling;
(c) the date of the survey;
(d) a note of prevailing weather conditions; and
(e) an outline description of the structure and dwelling.

B12 Any description of the dwelling should be brief but clear. It should include the type of dwelling (eg, terraced house, two storey flat/maisonette in a purpose-built block), type of construction and an estimate of when it was originally built (and, if appropriate, when converted or rehabilitated). The lowest level and number of levels of the dwelling should be given. The orientation should be given, including the direction faced by the front of the dwelling and whether the site is exposed or sheltered.

B13 Where the dwelling is part of a larger structure (whether a purpose-built block or a converted building) details of the lowest level and number of levels in that structure should be given, together with details of the means of access to the individual dwelling and any shared parts or facilities.

B14 There should be a general description of the construction of the dwelling and/or building containing the dwelling. This should include whether the construction is traditional (eg, brick or blockwork) or of a system or industrialised technique. It should also note whether there have been any obvious alterations from the original. Where the method and materials used in construction are not obvious, this should be stated.

B15 It may not be appropriate or possible to obtain all the general information about the dwelling at the start of the survey – such as means of space and water heating, and number and type of rooms. These details can be obtained as the survey progresses and can be summarised at the end.

THE SURVEY

B16 Normally, after collection of the general information, the interior of the dwelling should be surveyed first. While the order in which rooms are surveyed is not important, it is useful to follow a routine as this helps prevent rooms or elements within rooms being missed.

Interior

B17 The floor area and ceiling height of the room and the glazed window area should be estimated, although, if the dwelling is to be assessed for energy efficiency, measurements may be necessary. Details should be given of the floor construction and finish; the main and any supplementary means of space heating; the number and type of windows, the material of the frame and whether double or single glazed; and the means of ventilation. Other information could also be recorded, such as the number of socket outlets and the number and type of doors.

B18 For kitchens, bathrooms and wc compartments, the number and type of facilities should be noted.

B19 The surveyor should check each element of the room for deficiencies. Doors should be included in the room or area into which they open. Sliding doors should be included in a room, rather than a circulation area. If there are no deficiencies, the surveyor moves on to the next room or area of the dwelling. Whether or not it is recorded on a paper survey that each element is satisfactory is a matter of preference, although such records can help ensure elements are not overlooked.

B20 Details of deficiencies should be recorded, including the particular element affected (eg, rear internal wall, ceiling, left window) the nature of the deficiency, and, where appropriate, the extent of the area of the element affected

B21 Although not necessarily relevant for the HHSRS, it is suggested that all deficiencies identified are recorded, including those that do not currently, or could not in the next 12 months, contribute to a hazard. Some deficiencies, such as open-jointed brickwork, if left unremedied, could deteriorate to an extent where in a subsequent year they would contribute to a hazard; other deficiencies are matters which may need attention in the interests of maintenance or improvement of the housing stock.

B22 Whether or not a deficiency contributes to a hazard, the surveyor should indicate whether remedial action, further investigation or no action is appropriate. The details on the extent of the deficiency and on the element itself should provide sufficient information to indicate what action is necessary.

B23 As noted above (paras B8-B9) restrictions on the surveyor may mean that it is not possible to verify the existence of a suspected deficiency. In such cases, the surveyor should record the circumstantial evidence on which the suspicion is based.

B24 Where the survey of a room or area is limited or access is not possible, this should be recorded.

B25 Having recorded all the deficiencies present in the room or area, the surveyor should move on to the next room or area.

Exterior

B26 The external survey should follow a similar approach to that for the interior. Each elevation should be identified by its position, eg, front, rear, left or right. Additions and extensions should be treated separately.

B27 For each elevation, extension and addition, details should be given of the type, construction and finish for each element; eg, the roof type and covering, the wall construction and finish, and the type of rain water goods.

B28 As for each internal room or area, the surveyor should then check for and record any deficiency to each element of each elevation, extension and addition.

B29 Where the dwelling is a part only of a building, the external survey should be in two parts; first, the exterior of the dwelling, and then the exterior of the building containing the dwelling.

Means of Access, Amenity Space, and Yards or Gardens

B30 The means of access to the dwelling, amenity spaces, and other facilities associated with the dwelling should also be surveyed. This should include shared means of access etc (whether inside or outside the building), as well as those which are for the exclusive use of the occupants[32].

B31 Once the survey has been fully completed, the surveyor should note the number of rooms, areas and elevations (or parts), if any, where it was not possible to survey or check for deficiencies.

Whole Dwelling Deficiencies

B32 There are some deficiencies which can only be assessed once the whole of the dwelling has been surveyed. These are matters which relate to the overall size, design or layout of the dwelling. For example, the means of escape in case of fire can only be properly assessed considering the dwelling as a whole; similarly, the number and location of sanitary accommodation and personal hygiene facilities can only be assessed in relation to the whole dwelling[33].

B33 Any whole dwelling deficiencies should be recorded.

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32 See also paras B34-B53 below for additional guidance on surveys of dwellings in multi-occupied buildings.

33 In the case of dwellings in multi-occupied buildings, this will mean that the common/shared parts should be surveyed prior to assessing the whole dwelling deficiencies – see paras B38-B49 below.

SURVEYING A DWELLING IN A MULTI-OCCUPIED BUILDING

B34 The general guidance, advice and conventions given for surveying a dwelling, as given in paras B1-B15 apply equally to surveying a dwelling in a larger building.

B35 The number and relative position of other units within the building should be collected and recorded, including whether each is residential or non-residential (eg, whether the ground floor is commercial or residential). General details should also be collected and recorded on the rooms and areas (not yet surveyed) that are shared in common with other occupants and users of the building; these should include the passages, corridors, stairs, means of access, means of escape in case of fire, kitchens, bathrooms, shower rooms, wc compartments, living rooms, and dining rooms.

B36 After collecting the general information, the interior of the individual dwelling should be surveyed (ie, the rooms and areas in exclusive occupation).

Surveying the Dwelling

B37 The procedure for surveying the dwelling should follow the general guidance given above – see paras B16-B25.

Surveying the Internal Shared Rooms and Areas

B38 Once the survey of the dwelling itself has been completed, the surveyor should then survey the internal shared rooms and areas associated directly with that dwelling.

B39 Where the dwelling is not self-contained (ie, some facilities such as kitchen, sanitary accommodation or personal washing facilities, or living or dining rooms, are shared with others), it is suggested that these rooms and facilities are surveyed before other areas.

B40 The same procedure for the shared rooms should be followed as outlined above (paras B16-B25). In addition, details should be recorded of the number of other units the rooms or areas are shared with, and whether those units are residential or non-residential.

B41 The "landlord's" responsibility in rooms and areas which are shared extends further than it does in those areas which are in exclusive occupation. In these rooms and areas, as well as the responsibilities outlined in Annex A, the landlord is also responsible for the furnishing and appliances. This includes floor coverings, cookers, washing machines, refrigerators, moveable space heaters, light bulbs etc.

> Note –
> Commonly shared areas such as passages, halls, and staircases may be subject to controls under other legislation and may be considered non-residential premises or workplaces.

B42 The survey should include an assessment of all the furnishings and appliances in shared rooms and areas, noting details of any deficiencies, including the nature of the deficiency. Whether or not a deficiency contributes to a hazard, the surveyor should indicate whether remedial action, further investigation or no action is appropriate.

B43 Where there are shared rooms which are not directly associated with the dwelling, it may not be necessary to fully survey them. However, it may be useful to record general details of the position, use and facilities.

B44 Once the survey of all the shared rooms associated with the dwelling has been completed, the internal shared areas should be surveyed. This should include the following –

(a) all those passages, corridors, access balconies, landings and stairs that the occupants (if any) of the dwelling would normally use, in particular those giving access to the dwelling, and those giving access to any shared rooms and facilities associated with that unit;
(b) any lifts giving access to the dwelling and to any shared rooms and facilities associated with that dwelling;
(c) any means of escape in case of fire which could be used by occupants of the dwelling, including any fire detection and alarm systems and any fire fighting equipment; and
(d) .any refuse storage or disposal system, such as refuse chutes.

It may also include other areas which, although not commonly used by the occupants of the dwelling, are accessible and could be used.

B45 Where meals are provided – eg, in accommodation such as Bed and Breakfast, Hotels and Guest Houses – then the food storage and preparation areas will be outside the scope of assessment under the Rating System because they are not areas to which the occupant of the dwelling in question has access. However, such areas may be assessed for other purposes and are subject to other requirements (eg, Food Safety or Health and Safety at Work legislation).

Surveying the Exterior, Means of Access, Amenity Space etc

B46 It is suggested that the survey of the exterior should be in two parts. First, those parts of the exterior directly associated with the dwelling, including the walls, windows, and where appropriate roof. For this part, external elements such as the type and condition of the windows are often best assessed during the internal inspection, particularly in the case of upper floor flats. This stage should also include the external means of access, refuse storage and amenity space associated with the dwelling. The second stage should be a survey of the exterior of the building containing the dwelling.

B47 For each elevation, extension and addition, details should be given of the type, construction and finish for each element; eg, the roof type and covering, the wall construction and finish, and the type of rain water goods.

B48 As for each internal room or area, the surveyor should then check for and record any deficiency to each element of each elevation, extension and addition.

Note –
As with commonly shared areas, external areas may be subject to other requirements (such as Health and Safety at Work legislation).

B49 Once the survey has been completed, the surveyor should note the number of rooms, areas and elevations (or parts), if any, which it was not possible to survey or check for deficiencies.

Whole Dwelling and Building Deficiencies

B50 There are some deficiencies which can only be assessed once the whole of the dwelling and the building containing the dwelling have been surveyed. These are matters which relate to the overall size, design or layout of the dwelling and of the building. For example, the means of escape in case of fire can only be properly assessed considering the dwelling and building as a whole and the location of the dwelling within the building. Similarly, in multi-occupied buildings, the number and location of sanitary accommodation and personal hygiene facilities can only be assessed in relation to the number of units within the building and the location of those facilities in relation to the dwelling.

B51 Any whole dwelling and building deficiencies should be recorded.

Note –
Where more than one dwelling in the building is to be surveyed, it may be unnecessary to duplicate the survey of the shared rooms and areas, and the exterior etc. However, the survey of the exterior and the consideration of whole dwelling and building deficiencies will need to reflect the location of each dwelling within the building.

SURVEYING PREMISES WITH DORMITORY ACCOMMODATION

B52 For residential premises where accommodation is of a non-exclusive basis – ie, occupiers are not granted exclusive occupation of a room or rooms, and sleeping accommodation is provided in dormitories – the whole of the premises should be surveyed as for a single household occupied house (see paras B16-B33).

B53 In such cases the consideration of facilities and whole building deficiencies should take account of the number of persons the premises is capable of accommodating.

Example Paper Scoring Form (Page 1)

HAZARD & No. **Item/s**

LIKELIHOOD	5600	3200	1800	1000	560	320	180	100	56	32	18	10	6
	< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4

Justification

OUTCOMES		< 0.05	0.15	0.3	0.7	1.5	3	7	15	26	38 >
	Class I	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class II	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class III	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4

Justification

RATING	A	B	C	D	E	F	G	H	I	J
	<5000	2000	1000	500	200	100	50	20	10 >	

S

HAZARD & No. **Item/s**

LIKELIHOOD	5600	3200	1800	1000	560	320	180	100	56	32	18	10	6
	< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4

Justification

OUTCOMES		< 0.05	0.15	0.3	0.7	1.5	3	7	15	26	38 >
	Class I	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class II	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class III	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4

Justification

RATING	A	B	C	D	E	F	G	H	I	J
	<5000	2000	1000	500	200	100	50	20	10 >	

S

Example Paper Scoring Form (Page 2)

RATING	A	B	C	D	E	F	G	H	I	J	S
	<5000	2000	1000	500	200	100	50	20	10 >		

HAZARD & No. **Item/s**

LIKELIHOOD	5600	3200	1800	1000	560	320	180	100	56	32	18	10	6
	< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4

Justification

OUTCOMES		< 0.05	0.15	0.3	0.7	1.5	3	7	15	26	38 >
	Class I	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class II	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class III	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4

Justification

RATING	A	B	C	D	E	F	G	H	I	J	S
	<5000	2000	1000	500	200	100	50	20	10 >		

HAZARD & No. **Item/s**

LIKELIHOOD	5600	3200	1800	1000	560	320	180	100	56	32	18	10	6
	< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4

Justification

OUTCOMES		< 0.05	0.15	0.3	0.7	1.5	3	7	15	26	38 >
	Class I	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class II	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4
	Class III	0	0.1	0.2	0.5	1.0	2.2	4.6	10.0	21.5	31.6	46.4

Justification

RATING	A	B	C	D	E	F	G	H	I	J	S
	<5000	2000	1000	500	200	100	50	20	10 >		

Annex C

Examples for the Four HHSRS Classes of Harm

C1 The Classes of Harm used for the HHSRS are based on the top four Classes of Harm as identified in *A Risk Assessment Procedure for Health and Safety in Buildings* (1999) BRE. While this work identified seven Classes of Harm, only the top four are used for the purposes of the HHSRS as these are harms of sufficient severity that they will either prove fatal or require medical attention and, therefore, are likely to be recorded in hospital admissions or GP records.

C2 Work on developing and refining the Statistical Evidence supporting the Rating System involved classifying a more comprehensive list of harm outcomes[34].

C3 The examples given below are intended for guidance only. It should be noted that some of the harm outcomes may appear in more than one Class depending on the severity of the condition. For example, respiratory disease will be in Class II or III depending on the severity and duration.

Class I

This covers the most extreme harm outcomes. It includes –

Death from any cause; Lung cancer; Mesothelioma and other malignant lung tumours; Permanent paralysis below the neck; Regular severe pneumonia; Permanent loss of consciousness; 80% burn injuries.

Class II

This Class includes severe conditions, including –

Cardio-respiratory disease; Asthma; Non-malignant respiratory diseases; Lead poisoning; Anaphylactic shock; Crytosporidiosis; Legionnaires disease; Myocardial infarction; Mild stroke; Chronic confusion; Regular severe fever; Loss of a hand or foot; Serious fractures; Serious burns; Loss of consciousness for days.

Class III

This Class includes serious conditions such as –

Eye disorders; Rhinitis; Hypertension; Sleep disturbance; Neuro-pyschological impairment; Sick building syndrome; Regular and persistent dermatitis, including contact dermatitis; Allergy; Gastro-enteritis; Diarrhoea; Vomiting; Chronic severe stress; Mild heart attack; Malignant but treatable skin cancer; Loss of a finger; Fractured skull and severe

[34] See *Statistical Evidence to Support the Housing Health and Safety Rating System Volume III – Technical Appendix* (2003) ODPM.

concussion; Serious puncture wounds to head or body; Severe burns to hands; Serious strain or sprain injuries; Regular and severe migraine.

Class IV

This Class includes moderate harm outcomes which are still significant enough to warrant medical attention. Examples are –

Pleural plaques; Occasional severe discomfort; Benign tumours; Occasional mild pneumonia; Broken finger; Slight concussion; Moderate cuts to face or body; Severe bruising to body; Regular serious coughs or colds.

Annex D

Profiles of potential health and safety hazards in dwellings

Introduction

In this Annex the hazards are arranged in four main groups, each group being dependent on the nature of the threat to health. The groups are sub-divided relating to the nature of the hazards, with a total of 29 hazards profiled within these sub-groups.

Hazard groups and sub-groups

A Physiological Requirements
including – Hygrothermal conditions and Pollutants (non-microbial)

B Psychological Requirements
including – Space, Security, Light, and Noise

C Protection against Infection
including – Hygiene, Sanitation, and Water supply

D Protection against Accidents
including – Falls, Electric shock, Burns and Scalds, and Building related Collisions

The profiles provide a summary of information to assist in the assessment of hazards. It is assumed that those using the HHSRS for enforcement purposes will have a broad understanding of the relationship between housing and health, and will have read widely around the relevant subject area. They are also expected to keep up to date with developments, including any changes to the standards relevant to the Ideal, and any new research findings.

Each profile consists of -

- *Description of the hazard* - this defines the hazard, describing what is included and what is excluded.
- *Potential for harm* – this sets out how the hazard can affect health, outlining typical illnesses and injuries which may result from exposure to the hazard. The prevalence

of the hazard, and typical numbers of people affected nationally each year, are identified.

The statistical averages[35] for the likelihood and spread of harms for the hazard are given, together with the resultant average hazard scores. For the majority of hazards these are the national averages, but where they are not the base used is specified. For each hazard these statistical averages have been calculated for the age range of the population most vulnerable to the hazard. This age group is identified, and it this vulnerable age group which is to be considered when assessing the hazard. For some hazards no age group of people is more vulnerable than others, and for these the statistics are based on the total population of England.

For most hazards the national statistics are provided for four age ranges of dwellings and for both houses and flats, or for both singly occupied and multi-occupied dwellings, so that there are eight sets of statistics for different ages and types of dwellings, plus an overall mean for all dwellings.

The strength of the evidence for the production of the statistical averages is indicated for each hazard, together with any note of where there might be over or under estimation in the national averages given.

- *The Ideal* – this gives an indication of the current optimum standard aimed at avoiding or minimising the hazard. The Ideal is usually based on the current UK British Standards or relevant Building Regulation Approved Documents. However, where there is no appropriate UK guidance, reference is made to standards set by the World Health Organization or the European Commission.

- *Causes and preventive measures* – consideration of this part of the profile will assist in the determination of the relevance of deficiencies identified as part of a survey to the hazard in question. It suggests potential causes of the hazard in dwellings, and (in a box) suggests what can help avoid or minimise the hazard. Where multi-occupation has an impact on the causes and possible severity of the hazard this is also identified.

  This section also differentiates between the dwelling features and human behaviour which can contribute to the hazard. It is intended to assist in assessing whether deficiencies at a dwelling can cause the likelihood of an occurrence, or the spread of harm outcomes, to deviate from the national average for the particular age and type of property. It should be remembered that the Rating assessment is based on the relevant vulnerable age group and their expected normal behaviour. (The behaviour of current occupiers, and how this may increase or decrease the average risk, is ignored for the purposes of the assessment.) Where appropriate, the range of 'normal' human, biological and domestic activities which can be expected in relation to the hazard are identified.

- *Relevant matters affecting likelihood and harm outcome* – dwelling features which may increase the likelihood and the severity of the outcome of a hazardous occurrence are presented in a check-list. In many cases the same dwelling characteristics can affect both the likelihood of an occurrence and the severity of the outcome, and they are presented in one list. However, where different dwelling features affect the likelihood and spread of harm outcomes the lists are given separately.

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35 For most hazards these are the averages for England in the years 1997 to 1999 given in *Statistical Evidence to Support the Housing Health and Safety Rating System – Volume II Summary of Results,* May 2003, ODPM, London

- *Hazard assessment* – gives advice on how to assess the severity of the hazard, which may, for example, include guidance on assessment of the hazard from contributory deficiencies in multiple locations. Advice is also given on what, if anything, should be measured, and what further investigations beyond those of an initial visual survey may be necessary. Any differences in the assessment relevant to multi-occupied buildings are identified.

The Hazard Profiles

Page

D PROTECTION AGAINST ACCIDENTS

Physiological Requirements

Hygrothermal Conditions

1 Damp and Mould Growth

DESCRIPTION OF THE HAZARD

1.01 This category includes threats to health associated with increased prevalence of house dust mites and mould or fungal growths resulting from the presence of dampness and/or high humidities. It includes threats to mental health and social well-being which may be caused by living with the presence of damp, damp staining and/or mould growth.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used in rating

1.02 The most vulnerable age group is all persons aged under 14 years

Average Likelihood and Health Outcomes for all Persons aged 14 years or under, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	446	0.0	1.0	10.0	89.0	11 (I)
	1920-45	400	0.0	1.0	10.0	89.0	12 (I)
	1946-79	446	0.0	1.0	10.0	89.0	11 (I)
	Post 1979	725	0.0	1.0	10.0	89.0	7 (J)
HMOs	Pre 1920	430	0.0	1.0	10.0	89.0	11 (I)
	1920-45	219	0.0	1.0	10.0	89.0	22 (H)
	1946-79	967	0.0	1.0	10.0	89.0	5 (J)
	Post 1979	644	0.0	1.0	10.0	89.0	8 (J)
All Dwellings		**464**	**0.0**	**1.0**	**10.0**	**89.0**	**11 (I)**

Basis of estimates

1.03 The statistics for Class I health outcomes were calculated from the mortality statistics for England and Wales for respiratory disease in children aged 0 to 14 years. The figures for Class II and III were calculated using the same criteria from data from the Hospital Episode Statistics. The estimates for Class IV health outcomes were taken from GP consultation rates for coughs and wheeze.

1.04 The calculation of these statistics assumed that damp related illness only occurs in dwellings affected by severe visible mould in at least one room. Recent research has shown that low levels of background ventilation, without visible mould or dampness, can result in indoor humidity levels that result in greatly increased house dust mite populations. In consequence the average likelihoods given may be an underestimate, and should be considered as conservative.

Health effects

1.05 The main physiological health threats are from house dust mite and mould allergens which primarily affect respiratory health. Mite populations and mould and fungal growth are dependent on hygrothermal conditions, that is, humidities and temperature. Damp conditions also typically affect the mental health of dwelling occupants, causing depression and anxiety, particularly where there is damage to decoration from mould or damp staining.

1.06 The detritus from house dust mites, and mould spores, are potent airborne allergens. Exposure to high concentrations of these allergens over a prolonged period is bound to result in sensitization of atopic individuals (those with a predetermined genetic tendency to sensitisation). However, non-atopic individuals can become sensitized following exposure to very high levels of allergen over a prolonged period.

1.07 Once a person (whether atopic or non-atopic) becomes sensitized, relatively low concentrations of the airborne allergen can trigger allergic symptoms such as rhinitis, conjunctivitis, eczema, cough and wheeze. When a sensitized individual is repeatedly exposed to an allergen this can cause asthma. There appears to be a dose response relationship associated with the exposure of sensitized asthmatic individuals, asthma severity increasing with increasing humidity, house dust mite and mould levels.

1.08 Deaths from all forms of asthma in the UK are around 1,500 a year, of which around 60% has been attributed to dust mite allergy. 20 to 30% of asthma sufferers are sensitized to mould spores. One in eight children suffer with asthma in the UK, compared with one in thirteen adults.

Dust mites

1.09 Allergens associated with house dust mites (found in the mite faecal pellets) are the most commonly found triggers of asthma today, and are also implicated as a causal agent of the illness. Around 80% of atopic children who suffer from asthma are sensitized to house dust mites, and about a third of all children, whether asthmatic or not, display some evidence of allergy to them.

Mould growth

1.10 Although less significant statistically in health terms than house dust mites, spores of many moulds and fungi (including timber attacking fungi) can be allergenic.

1.11 Mould and fungal spores can also be carcinogenic, toxic and cause infections; the potential health effect varying with species. Fungal infection, whilst not common, is usually associated with those vulnerable to infection (such as those on immuno-suppressant drugs). Some fungi, particularly when in very high concentrations, can also colonise the airways of susceptible individuals, particularly asthmatics. Toxins from some moulds (mycotoxins) can cause nausea and diarrhoea, can suppress the immune system, and have been implicated in cancers. Again, these health effects are uncommon, but serious if they occur.

THE IDEAL

1.12 Warm, dry and well-ventilated homes are the Ideal. To achieve optimum conditions the dwelling should conform with *BS 5250 Code of practice for control of condensation in buildings*, and satisfy Building Regulation *Approved Documents: C (site preparation and resistance to moisture), F (Ventilation of Buildings),* and *L (Conservation of Fuel and Power). BS 8102: Code of Practice for protection of structures against water from the ground* is also relevant.

CAUSES AND PREVENTIVE MEASURES

1.13 The indications are that house dust mite populations and indoor mould growth have increased over the last century, this resulting from reduced ventilation levels, increased humidities, and warmer indoor temperatures in winter months caused by changes in dwelling design and adaptations introduced when houses are renovated.

1.14 Both house dust mites and moulds flourish in damp or humid conditions, and their growth is also influenced by temperature.

Maintenance of indoor relative humidity between 40% and 60%, except for short periods of fluctuation, is the optimum to limit the growth of house dust mite populations, as well as being the recognized comfort zone. This relative humidity range will also prevent mould growth.

1.15 Where relative humidities are within the optimum range, 40 to 60%, increasing temperatures results in reduction in dust mite populations. However, where there are high humidities, outside the optimum range, increasing temperatures can result in increased mite populations and mould growth. Moulds can grow when the indoor relative humidity persistently exceeds 70%. Achieving the right balance of moisture production, ventilation, and indoor temperatures is therefore important.

Moisture production and ventilation

1.16 Moisture production within a dwelling is dependent on the design, construction and repair of the building, and also occupant density and activity.

The structure and finishes of a dwelling should be maintained damp free, including free from rising, penetrating and traumatic dampness, or persistent condensation. The dwelling should be able to cope with normal occupant moisture producing activities without there being persistently high relative humidities.

Rising and penetrating dampness should be prevented by proper and adequate damp-proofing including damp proof courses and membranes and detailing around door and window openings. The external fabric should be kept in repair to prevent rain penetration. Preventative measures including frost protection, will help avoid traumatic problems such as burst pipes and tanks.

All facilities which involve the use of water (for example, baths, wash hand basins, sinks, showers, and wc basins) should be properly installed to prevent or at least minimise the risk of dampness from splashing during normal use. Such facilities should be properly connected to a waste pipe capable of safely carrying waste water to a drainage inlet outside the dwelling.

There should be properly installed rain water goods, including eaves gutters and rainwater fall pipes, capable of safely collecting rainwater discharged from the roof and carrying it safely away from the dwelling either into a drainage inlet or other proper means of disposal.

Roof and underfloor spaces should be properly ventilated to ensure timber remains air-dry to minimize the chance of fungal infection.

1.17 Moisture is produced by occupants through their normal biological and domestic activities. Relatively low levels of moisture are generated through breathing and are spread out over the twenty-four hours. However, there are higher levels produced in peaks from cooking, clothes drying and bathing (or showering).

There should be provision for the safe removal of moisture-laden air during peak production. This should include extraction during cooking or bathing, either by mechanical means, or passive stack ventilation and direct venting of clothes drying facilities (whether tumble driers or drying cabinets) to the exterior.

1.18 It is also important that there is a continuous low-level of background ventilation. Small reductions in the ventilation rate below 0.5 air changes per hour can greatly increase the mite population. However, increasing the ventilation rate to above 0.7 air changes per hour can lead to an increase in the mite population in a dwelling which is not heated properly for a number of reasons including cost. Use of mechanical heat recovery ventilation systems (MHRV) can allow an increased air change rate without the same heat loss. Around 0.9 air changes per hour can be considered optimum with MHRV.

Where old windows are ill-fitting and there is no draught-stripping, and/or where there are open chimney flues, there may be no need for additional background ventilation. However, where there is draught-stripping, or replacement windows, provision for background ventilation may be necessary via trickle vents in replacement windows, insertion of high-level airbricks, or by a passive stack or a MHRV system.

There should be sufficient and appropriate means of ventilation to deal with moisture generated by normal domestic activities without the need to open windows. This is important, because opening windows can result in excessive heat loss, ingress of noise, and may be a security risk.

1.19 The amount of moisture produced is related to numbers in occupation. High occupant density tending to result in increased moisture production per unit volume of dwelling. Dwellings which can be expected to have high occupant density (typically those with small room sizes) may therefore require increased ventilation and heating/insulation to prevent problems.

Indoor temperatures

1.20 If moisture levels are controlled, through adequate ventilation, dust mite populations can be significantly reduced by raising indoor temperatures. This is dependent on the energy efficiency and cost of heating a dwelling.

Furnishing and housekeeping

1.21 The numbers of dust mites present is not solely dependent on dwelling hygrothermal conditions. Furnishing, especially the age and type of mattresses, and mode of housekeeping, are also relevant. However, the hygrothermal conditions are considered the most important limiting factor in house dust mite population growth.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

1.22 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Energy efficiency: –inadequate heating and insulation of the dwelling;
b) Background ventilation: – lack of controllable background ventilation
c) Extract ventilation: - lack of safe and accessible means for the extraction of moisture laden air during cooking, bathing or showering
d) Clothes drying facilities: – lack of facilities ventilated to the external air
e) Damp proofing: – in disrepair or otherwise inadequate, resulting in rising or penetrating dampness
f) Disrepair: - floors, walls or roofs allowing water penetration
g) Exposed water tanks and pipework: - inadequate frost protection
h) Water using appliances: - inadequately installed and sealed facilities, such as baths, showers, wash hand basins and wc basins which may permit splashing to cause dampness
i) Plumbing and waste pipes: – inadequately installed, or disrepair to, waste pipes or plumbing serving water using appliances (such as baths, showers, wash hand basins, bidets and sinks)
j) Rain water goods: – inadequate or defective (including gutters and down pipes)
k) Roof and sub-floor spaces: - inadequate ventilation
l) Small rooms sizes: - may result in high occupant density.

HAZARD ASSESSMENT

1.23 The many variables which affect this hazard mean that assessment is very much one of judgment rather than measurement. Consideration should be given to the design, condition and state of repair of the dwelling. The location, extent and permanence of any dampness identified are important determinants of the effect it may have on dust mite populations and mould growth, and the consequent potential for harm to human health.

1.24 Prevailing weather conditions should be taken into account in the assessment. A temporary spell of good weather may result in dry conditions when a survey is undertaken. However, the rating assessment is made over a twelve month period and this should be taken into account when scoring the hazard. Penetrating and rising dampness may be less prevalent during a spell of dry weather. Condensation dampness is not usually found outside the cold winter months. However, there may be damage to decoration, mould growth, and/or structural deficiencies which give a good indication of the extent of the problem, without actual dampness being present.

1.25 The exposure of the dwelling is also relevant in the assessment. Whether it is in an area of high rainfall is relevant to penetrating dampness, and the altitude and exposure to wind are relevant to the assessment of thermal efficiency and associated condensation/high relative humidities.

1.26 It is not possible to give an indication of the extent of dampness which might correlate with a particular hazard rating because there are too many variables associated. For example, a small sized dwelling can cope with less moisture than a larger dwelling. In addition the threat to health is partly dependent on the intended use of the room affected, and the proportion of rooms at the dwelling which show signs of damp. The intended use of a room is relevant because it may be possible to limit the amount of time spent in some damp affected areas. Bedrooms are probably the most important rooms to maintain dry, since mattresses tend to support larger dust mite populations than other furniture and furnishings. In addition, the most vulnerable age group, infants and children up to 14 years of age, normally spend a large proportion of the day in their bedrooms. The vulnerable group typically requiring between 9 and 14 hours sleep per day, depending on the age of the child. Bedrooms are often also used for homework. However, other rooms are important as well. Humidities throughout a dwelling tending to equalize as a result of vapour pressure, so that damp in one part of the dwelling usually has an impact on relative humidities in other parts of the dwelling.

1.27 The cause of the dampness is also relevant to the assessment. Condensation may by more critical than other damp causes, such as rising or penetrating damp, because condensation is a symptom of high humidities. Other types of dampness are potential causes of high humidities, rather than being symptoms themselves.

1.28 Measuring background ventilation rates and thermal efficiency of a dwelling may be appropriate in some circumstances. Background ventilation rates can be tested using fan pressurization tests in some dwellings, although this is clearly inappropriate for mechanical ventilation or passive stack ventilation systems. Dwelling thermal efficiency is usually assessed using the Government's Standard Assessment Procedure[36].

Flats and multi-occupied buildings

1.29 Where rooms are occupied for both living and sleeping, for example, in bedsit type accommodation, or in a studio flat, then the presence of dampness in a room may be more significant in health terms than if it were, for example, found in a bedroom when there is also a (dry) living room at the dwelling. Occupants can be expected to spend a greater proportion of time in a damp room if they do not have the option of

[36] DEFRA/BRE, The Government's Standard Assessment Procedure for Energy Rating of Dwellings, 2001, BRE, Watford

using an alternative room. In some multi-occupied dwellings, typically bedsit type accommodation, this situation can be compounded if there is one room provided which is used not only for living and sleeping, but also cooking. The burden from all moisture producing activities from the household being in one room can result in an increased risk of high humidities and associated increased house dust mite populations and mould growth.

Other hazards associated with the *deficiency* of dampness

1.30 When the deficiency of dampness is found in a dwelling it is likely that other hazards, as well as the *Damp and Mould Growth* hazard, will be present. The risks to health and safety resulting from these other hazards are scored separately under the relevant hazard categories, and are not considered as part of the assessment of *Damp and Mould Growth*. These other hazards, which can result from the deficiency of dampness, but which are otherwise unrelated to the *Damp and Mould Growth* hazard category, include –

- *Cold* - dampness to the structure of buildings typically causes a loss of thermal insulation capability. In addition, dampness to bedding resulting from condensation, will contribute to the hazard of excessive cold by reducing the thermal insulation provided by clothing and bedding.
- *Structural failure* - may result from dampness, when moisture results in degradation of the structural integrity of building materials (for example, timber may rot, metal may corrode).
- *Falls on the level,* and *Falls on stairs* - may be exacerbated by dampness, the presence of moisture typically reducing the friction of surfaces, increasing the likelihood of slip.
- *Domestic hygiene, pest sand refuse* – dampness may enable pathogenic organisms to remain viable for longer.
- *Food safety* – damp affected surfaces may degrade and become friable, presenting a risk of food contamination. Humid conditions can cause food to decay more quickly.

2 Excess cold

DESCRIPTION OF THE HAZARD

2.01 This category covers the threats from sub-optimal indoor temperatures on health. It is affected by the energy efficiency of the dwelling, taking into account the standard of the heating system and thermal insulation, any disrepair and dampness that may affect their efficiency, and the exposure and orientation of the dwelling.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

2.02 The most vulnerable age group is all persons over 60 years of age.

Cold
Average Likelihood and Health Outcomes for all Persons aged 60 years and over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	330	34.0	6.0	18.0	42.0	1,066 (**C**)
	1920-45	340	34.0	6.0	18.0	42.0	1,035 (**C**)
	1946-79	400	34.0	6.0	18.0	42.0	880 (**D**)
	Post 1979	530	34.0	6.0	18.0	42.0	664 (**D**)
HMOs	Pre 1920	340	34.0	6.0	18.0	42.0	1,000 (**C**)
	1920-45	290	34.0	6.0	18.0	42.0	1,035 (**C**)
	1946-79	370	34.0	6.0	18.0	42.0	951 (**D**)
	Post 1979	350	34.0	6.0	18.0	42.0	1,005 (**C**)
All Dwellings		**380**	**34**	**6**	**18**	**42**	**926 (D)**

Basis of Estimates

2.03 The figures in the above table relate to persons aged 60 years or over who suffered illness, including fatal illness, as a result of cold homes in England and Wales in the years 1997, 1998 and 1999. The statistics for Class I health outcomes were derived from data for cold/winter related mortality . The estimates for Class II and Class III outcomes include cardiovascular and respiratory illness serious enough to lead to hospital admission and are calculated from Hospital Episode Statistics. Data on new GP

consultations provided the information for Class IV outcomes and are estimated from the General Practice Research Database and from the Fourth Morbidity Survey of General Practice.

Health effects

2.04 A healthy indoor temperature is around 21°C, although cold is not generally perceived until the temperature drops below 18°C. A small risk of adverse health effects begins once the temperature falls below 19°C, but serious health risks occur below 16°C with a substantially increased risk of respiratory and cardiovascular conditions. Below 10°C the risk of hypothermia becomes appreciable, especially for the elderly.

2.05 There are approximately 40,000 more deaths between December and March than expected from the death rates in other months of the year. This seasonal fluctuation, Excess Winter Deaths, is greater in Britain than in most other countries of continental Europe and Scandinavia.

2.06 Cardiovascular conditions (eg, heart attacks and stroke) account for half the excess winter deaths, and respiratory diseases (eg, influenza, pneumonia and bronchitis), account for another third. The increase in deaths from heart attacks occurs about 2 days following the onset of a cold spell, the delay is about 5 days for deaths from stroke, and about 12 days for respiratory deaths.

2.07 Although there is some excess winter deaths in all age groups, it becomes significant for those in the 45+ age group. The risk increases with age in a roughly linear pattern up to the 85+ age group, after which there is a marked increased risk.

2.08 The main causal factor for excess winter deaths appears to be changes in ambient (outdoor) temperature, but seasonal infections, and changes in behavioural patterns, air pollution levels and micronutrient intake may also account for some of the seasonal pattern.

2.09 The full extent to which housing contributes is not clearly known, but the indication is that people living in dwellings that are poorly heated are at significantly greater risk than those in warm homes. While there is less evidence regarding the relationship between housing characteristics and health impacts other than mortality, it is very probable that the findings in relation to cold-related mortality can be extended in broad terms to cardio-respiratory morbidity and health related quality of life.

2.10 Low temperatures can impair the thermoregulatory system of the elderly. The very young whose thermoregulatory system is immature are also susceptible to low temperatures. Both the elderly and the young may spend a greater time in the home in cold weather and both will not move about as much as other groups in the cold.

2.11 Cold air streams may affect the respiratory tract and can slow the heart temporarily, increasing cardiovascular strain. When the whole body is cooled, blood pressure increases. The effect of cold air on the bronchial lining and immune system can reduce resistance to infection. Thus, sleeping in cold bedrooms has been shown to substantially increase the health risk.

2.12 The symptoms of rheumatoid arthritis can be worsened by cold. Low temperatures also aggravate sickle cell anaemia and the related thalassaemia, and can affect the healing of leg skin ulcers.

THE IDEAL

2.13 The Building Regulation standard for energy efficiency in dwellings is found in *Approved Document L1: Conservation of fuel and power in dwellings*. To prevent other problems, well insulated dwellings should also have provision for appropriate ventilation, as referred to in *Approved Document F: Ventilation of buildings*.

CAUSES AND PREVENTIVE MEASURES

2.14 The percentage rise in deaths in winter is greater in dwellings with low energy efficiency ratings, and in dwellings predicted to have low indoor temperatures during periods of cold. There is a gradient of risk with age of the property, the risk being greatest in dwellings built before 1850, and lowest in the more energy efficient dwellings built after 1980. Absence of central heating and dissatisfaction with the heating system also show some association with increased risk of excess winter death.

2.15 Cold related illness is thus in part determined by the characteristics of the dwelling, and offers a part explanation for Britain's high excess winter mortality. However, other factors are also important, such as under-occupation, which can result in either excessive heating costs or low indoor temperatures, related to the size of the accommodation rather than its fuel efficiency.

2.16 The statistical evidence shows that there is a continuous relationship between indoor temperature and vulnerability to cold-related death. The colder the dwelling, the greater the risk. There are indications that with temperatures up to 19oC there will be some excess death. However, for these statistics it has been assumed that no cold-related deaths occur in dwellings which achieve 18°C hall temperature when the external temperature falls to 5°C.

Energy efficiency

2.17 The energy efficiency of a dwelling depends on the thermal insulation of the structure, and on the fuel type, size and design of the means of heating and ventilation.

Thermal insulation

Thermal insulation should be provided to the building structure in order to minimise heat loss from the dwelling. The level of insulation necessary is in part dependent on geographical location and exposure, position in relation to other dwellings and buildings, and orientation. Where dwellings are appropriately designed, south facing glazing can be used to increase solar heat gain and so save energy.

2.18 Some forms of insulating material, such as glass fibre, will settle over a period and become less effective as a result.

2.19 Water readily conducts heat and excess moisture content (dampness) of the structure will reduce the thermal insulation provided. The effectiveness of some forms

of insulating material can become compromised by moisture. If bedding becomes damp because of high relative humidity levels it also loses its thermal insulation capabilities, increasing the risk of the *cold* hazard.

Provision for heating

The heating should be controllable by the resident , and safely and properly installed and maintained. It should be appropriate, having regard to the design, layout and materials used in construction, such that the whole of the dwelling can be adequately and efficiently heated.

Provision for ventilation

There should be means for background ventilation, capable of ensuring continuous low level ventilation without excessive heat loss or draughts. The means should be controllable, properly installed and maintained, and appropriate, having regard to the particular part of the dwelling. There should also be means for rapid ventilation at times of high moisture production in kitchens and bathrooms, achieved either through mechanical extraction, passive stack ventilation (PSV), or a mechanical heat recovery ventilation system (MHRV).

2.20 Openable windows can provide ventilation. However, opening windows can result in excessive ventilation and draughts, waste heat (energy), reduce air temperatures, and cause discomfort. Excess ventilation may result from too large, or inappropriately sited, permanent openings (eg, air bricks) or large openable windows. Draughts can also be caused by ill-fitting butt-jointed floor boarding or ill-fitting doors or windows.

2.21 Where windows are on the ground floor, occupiers may be reluctant to open windows for security reasons. There may be other reasons discouraging opening windows such as external noise levels and badly sited windows.

Flats and other multi-occupied buildings

In multi-occupied buildings provision for space heating may be centrally controlled. Such systems should be operated to ensure that occupants are not exposed to cold indoor temperatures. There should be controls to allow the occupants to regulate the temperature within their dwelling.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

2.22 Related matters contributing to the likelihood of a hazardous occurrence and the severity of the health outcome –

a) Thermal insulation:- inadequate insulation of the external envelope of the dwelling, including the presence of cold bridges;
b) Dampness:- in such a position, and sufficiently extensive and persistent as to reduce the effectiveness of the thermal insulating material and/or the structure;
c) Settling of insulation: -compression of the thermal insulating material negating its effectiveness;
d) Type of heating provision:- inappropriate or inefficient systems and appliances;
e) Size of heating system:- systems and appliances inadequate for the size of dwelling;
f) Maintenance of system:- inadequately installed or maintained heating systems;

g) Controls to heating system:- inadequate or inappropriate controls to the system or appliance;
h) Amount of ventilation:- inadequate or inappropriate provision for thorough ventilation of the dwelling;
i) Ventilation controls:- inadequate means of controlling the ventilation;
j) Disrepair to ventilation:- to the system or appliances;
k) Draughts:- uncontrollable draughts and those situated to cause discomfort

HAZARD ASSESSMENT

2.23 Indoor temperature is a function both of dwelling characteristics and the occupying household. In assessing the *Cold* ,it is only the dwelling characteristics, energy efficiency and the effectiveness of the heating system, which are considered, as these are within the control of the owner. The temperature at a dwelling is part dependent on energy efficiency, and also part dependent on occupant behaviour, including whether the dwelling is under-occupied, which are irrelevant to the rating. Simple measurement of indoor temperature is therefore inappropriate. In common with other hazards, the dwelling should be assessed on the basis that it is fully occupied by the most vulnerable age group.

2.24 The assessment should take account of the adequacy of the heating, insulation and ventilation. The assessment should include taking account of the dwelling energy rating using the Government's Standard Assessment Procedure (SAP)[37], and any other factors which might affect the indoor temperature, such as dampness, or disrepair to the structure or to the space and water heating system.

2.25 The energy efficiency of cooking facilities, lighting, and other energy using installations and appliances, should not be included in the *Cold hazard* assessment.

[37] DEFRA/BRE, The Government's Standard Assessment Procedure for Energy Rating of Dwellings, 2001, BRE, Watford

3 Excess heat

DESCRIPTION OF THE HAZARD

3.01 This category includes threats from excessively high indoor air temperatures.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

3.02 The most vulnerable age group is all persons over 65 years of age.

Heat
Average Likelihood and Health Outcomes for all Persons aged 65 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	All ages	0	31.0	8.0	25.0	36.0	0 (J)
Flats (why only flats)	Pre 1920	60,000	31.0	8.0	25.0	36.0	5 (J)
	1920-45	90,000	31.0	8.0	25.0	36.0	4 (J)
	1946-79	130,000	31.0	8.0	25.0	36.0	3 (J)
All (flats or dwls)	Post 1979	110,000	31.0	8.0	25.0	36.0	3 (J)
All Dwellings		**900,000**	**31.0**	**8.0**	**25.0**	**36.0**	**0 (J)**

Basis of Estimates

3.03 The figures in the above table relate to persons aged 65 years or over who suffered illness, including fatal illness, as a result of excess heat in their homes. The statistics for Class I health outcomes were derived from data for heat related mortality in this age group. The estimates for Class II and Class III outcomes include emergency hospital admissions for cardiovascular illness and are derived from the Hospital Episode Statistics. The figures for Class IV health outcomes are from data on new GP consultations, also for persons of 65 and over, and are estimated from the General Practice Research Database and from the Fourth Morbidity Survey of General Practice.

3.04 As there are no direct indicators for heat vulnerable dwellings that can be related to the health statistics, it has been assumed that the living and sleeping areas of 5% of

converted flats are immediately under the roof and suffer from significantly larger temperature rises during heat-waves. Consequently, there is a weak evidence base for these statistics, and the assumption is made that there is no risk from heat associated with houses.

Health effects

3.05 As temperatures rise, thermal stress increases, initially triggering the body's defence mechanisms such as sweating. High temperatures can increase cardiovascular strain and trauma, and where temperatures exceed 25°C, mortality increases and there is an increase in strokes.

3.06 Overall, the burden of heat-related mortality and morbidity in the UK has been modest, and data to allow quantifiable attribution to dwelling condition is weak. However, the summer of 2003 suggests there may be an increase, and rates are anticipated to be higher in future years.

3.07 The elderly, especially those with pre-existing cardiovascular disease, and the very young (infants) are more vulnerable than other groups.

THE IDEAL

3.08 The Building Regulation standard for energy efficiency in dwellings is found in *Approved Document Part L1: Conservation of fuel and power in dwellings*. The *2002 edition* of *Part L1* is primarily concerned with minimising heat loss, rather than protecting a dwelling from excess heat gain. However, *Part L* is being revised, with a new edition expected in 2005. Limitation of overheating in dwellings, as well as heat loss, is being considered as part of the *Part L* review.

3.09 Requirements for provision of ventilation in dwellings is found in Building Regulations *Approved Document F: Ventilation of buildings*. The *1995 edition* of *Part F* is being reviewed alongside the revisions to *Part L*. Also of relevance is the Chartered Institution of Building Services Engineers (CIBSE) *Guide A: Environmental design, and Guide B2: Ventilation and air conditioning*.

CAUSES AND PREVENTIVE MEASURES

3.10 Over the last century there have only been exceptional circumstances when there have been risks arising from over-heating of a dwelling. However, as a result of climate change, in recent years there have been increasing temperatures year round. Spells of very hot summer weather (heat waves) are forecast to become more common, and it is therefore anticipated that there will be an increase in mortality and morbidity rates resulting from excess heat associated with the inability to maintain a healthy temperature within dwellings.

3.11 The major dwelling factors having an impact on overheating are solar gain, ventilation rates, and thermal capacity of the structure. Levels of structural thermal insulation also have an impact. Smaller, more compact dwellings, and particularly attic flats, are more prone to overheating than are large dwellings.

3.12 Relevant to excess heat gain are the area and orientation of glazing, the degree of external shading, ventilation and/or air-conditioning provision, as well as the thermal capacity and level of thermal insulation at a dwelling.

3.13 Also relevant to dwelling overheating, and to the risk to health of occupants, is its ability to dissipate heat at night. Relevant to this are the thermal mass of the structure, the position of insulation in the structure (ie, whether the dwelling is externally clad, has cavity insulation, or has thermal dry-lining), and the night time ventilation rate.

The structure of the dwelling should provide or incorporate sufficient thermal insulation, having regard to its construction, its geographical location, its position in relation to other dwellings and buildings and its orientation.

Where there are large expanses of south facing glazing there should be appropriate shuttering or internal blinds to control heat in summer months.

There should be means for cooling during hot summer weather, either by natural ventilation or by air conditioning. The means should be controllable, properly installed and maintained, and appropriate, having regard to the particular part of the dwelling. Openable windows can provide ventilation. However, occupiers may be reluctant to open windows for security reasons, or because of external noise levels, especially at night. It may in some circumstances be appropriate to provide vents which are capable of providing up to ten air changes per hour, or to provide an air conditioning system.

3.14 Defects to a heating system, or the inability to control the dwelling's heating system, can also be a cause of excessive heat in dwellings.

There should be adequate controls to the heating system within the dwelling, particularly for district heating systems, enabling the occupier to control temperature.

Flats and other multi-occupied buildings

3.15 Dwellings that are most likely to be affected by excessively high indoor temperatures are those which are badly insulated, typically flats located immediately beneath an uninsulated roof, dwellings with only a south facing elevation, and dwellings with district heating systems not controllable by the occupier. Typically these will be dwellings in multi-occupied buildings.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

3.16 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of health outcome include:

a) Thermal insulation:- inadequate provision for thermal insulation particularly in attic flats;
b) Orientation of glazing:- large areas of south facing glazing in inappropriately designed dwellings;
c) Heating controls:- faulty, inappropriately designed, or inadequate controls to the heating system;
d) Ventilation provision:- inadequate or inappropriate provision for ventilation;

e) Ventilation control:- inadequate means of controlling the ventilation;
f) Disrepair to ventilation:- to the system or devices.

HAZARD ASSESSMENT

3.17 The assessment should take account of the provision for natural ventilation, particularly night-time ventilation, and the provision and condition of any mechanical ventilation or air conditioning system; the level of insulation and position of insulation; the extent of glazing, and orientation of glazing; and the state of repair of the heating system.

Pollutants (non-microbial)

4 Asbestos (and MMF)

DESCRIPTION OF THE HAZARD

4.01 This category includes the presence of, and exposure to, asbestos fibres and manufactured mineral fibres (MMFs) within dwellings.

4.02 Asbestos is a natural mineral fibre, which is a particularly effective fire resistant, insulation material. There are three main types of asbestos: chrysotile (white asbestos), and the "amphibole" forms, crocidolite (blue asbestos) and amosite (brown asbestos).

4.03 MMFs include rockwool and glass fibre blanket, which provide thermal and acoustic insulation.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

4.04 There is no specific vulnerable group considered in the average statistics, nor, therefore, in the hazard rating.

Hazards from Asbestos
Average Likelihood and Health Outcomes for all Persons, 1997-1999

Dwelling type & age	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class 1 %	Class II %	Class III %	Class IV %	
Pre 1920	-	19.0	1.0	0.0	80.0	0 (J)
1920-45	6,600,000	19.0	1.0	0.0	80.0	0 (J)
1946-79	1,700,000	19.0	1.0	0.0	80.0	0 (J)
Post 1979	-	19.0	1.0	0.0	80.0	0 (J)
All Dwellings	**3,300,000**	**19**	**1**	**0**	**80**	**0 (J)**

Basis of estimates

4.05 The risk estimates are based on extrapolations from studies of high exposure to asbestos – mainly involving occupational exposures. These extrapolations assume no threshold effect and a linear relationship between dose and risk. As these are probably conservative assumptions, the very low average likelihoods may tend to under-estimate the risk.

4.06 There is scarce evidence about the frequency of exposed asbestos material in dwellings of different kinds, but the risk is thought to be largely confined to housing constructed in the earlier post-war years and to, a lesser extent, to that built between the two world wars.

Health effects - Asbestos

4.07 The health risks from asbestos exposure are associated with inhalation. Risks from ingestion and skin contact are minimal.

4.08 In the domestic situation the inhalation of asbestos fibres can cause pleural disease (pleural plaques and fibrosis), lung cancer and mesothelioma (cancer of the pleura, the lining around the lung, or, less frequently, cancer of the peritoneum). Each of these conditions typically occurs decades after first exposure to asbestos. Pleural plaques may occur ten years after asbestos exposure, although they are likely to go unidentified. Lung cancer and mesothelioma typically occur 20 to 50 years after exposure. Asbestosis requires very high levels of exposure to asbestos. This is not found in the domestic situation, and is therefore not a health outcome considered here.

4.09 Lung cancer has very poor survival rates, and there is no known cure for mesothelioma. While pleural plaques are not in themselves harmful, they are included because, if discovered, they may cause significant anxiety about the risk of more serious asbestos-related conditions. They are included as Class IV harms.

4.10 The risk to health from inhalation of asbestos fibres depends on dose (the number of fibres per unit volume of air), the potency of the fibres (dependent on fibre dimension and bio-persistence or bio-solubility), and the duration of exposure. Chrysotile is more bio soluble than amphibole asbestos, and thus tends not to persist in the lung for as long as the other types of asbestos. This explains, at least in part, why amphibole asbestos is established as the most hazardous form, especially with regard to mesothelioma induction. It appears that mesothelioma may occur following relatively low levels of exposure to amphibole asbestos.

4.11 It is estimated that lung cancer or mesothelioma victims where dwelling exposure is the cause are at worst in double figures, and at best less than one per year.

4.12 Those at greatest risk include children and adults with long-term exposure to asbestos levels significantly increased above the ambient background level. Because the lag between exposure and clinical disease may be 30 to 50 years, the risks of exposure are less important for the elderly. Smokers are at increased risk as the combined effect of smoking and exposure to asbestos is more than additive in the risk of lung cancer. (Smoking, however, does not cause mesothelioma.)

Health effects - MMFs

4.13 MMFs are skin, eye and respiratory irritants, and there have been isolated reports of respiratory problems and dermatitis associated with exposure to MMFs in the home.

4.14 There is conflicting data on risks of lung cancer from inhaled MMFs, and the risks have been largely assessed on the basis of occupational exposure which is of greater significance than in the domestic environment.

4.15 In the domestic situation, the balance of evidence suggests that there is only a small clinical risk of Class I to IV harms following non-occupational exposure.

THE IDEAL

4.16 Asbestos should not be present in dwellings. Where MMF based materials are present, the material should be in good condition, sealed, inaccessible, labelled and the location recorded.

CAUSES AND PREVENTIVE MEASURES

Asbestos

4.17 Asbestos has been incorporated in a wide range of building products, including roofing, cladding, thermal and acoustic insulation, and fire resistant internal panelling. In most traditionally built houses and flats some products and materials containing asbestos (mostly chrysotile) may be present. Airborne fibre levels in these buildings are unlikely to exceed ambient background levels. This is because asbestos, in general, is not in locations that are routinely likely to be disturbed, and has not been extensively used.

4.18 However, non-traditionally or "system-built" flats constructed between 1945 and 1980 may contain large amounts of amphibole asbestos products, such as sprayed coatings and partitioning, as well as chrysotile materials, in positions vulnerable to damage and disturbance with high potential for fibre release. It is these dwellings that constitute the major concern with regard to asbestos-related health risks. Buildings most likely to be affected include high rise council estates built in the 1950s and 1960s. Peak use of asbestos occurred during the 1960s and it was around this time that the health effects began to be recognised, and a dramatic decline in the use of asbestos resulted. Only chrysotile is still used in the UK, mostly in asbestos-cement products.

4.19 The indoor air concentrations of asbestos in most dwellings, including those where asbestos is present but in good condition, present minimal risk to health. However, there is a risk of high concentrations arising inside buildings, notably non-traditionally built flats, from poorly maintained asbestos materials. Where asbestos materials are damaged and clearly releasing fibres, airborne asbestos fibre levels are normally higher. One week of exposure to damaged asbestos in a non-traditionally built flat can equate to 14 years of normal exposure at ambient levels.

Because removal of asbestos is likely to result in an increase in airborne fibre levels, existing asbestos should be managed *in situ* if it is–
- in good condition
- not likely to be damaged
- not likely to be worked on or disturbed

Management of asbestos materials involves –
- identifying the location and condition of asbestos
- ensuring it is effectively sealed
- making inaccessible to prevent occupiers damaging the sealing surface
- labelling
- keeping a record of the location of asbestos in the building

Where existing asbestos is damaged or is likely to be damaged or disturbed, an assessment needs to be made and action taken to repair, seal, enclose or remove the asbestos

Most work on asbestos insulation, asbestos insulating board and lagging, including sealing and removal, should normally be done by a contractor licensed by the Health and Safety Executive (HSE)

4.20 Activities such as plumbing and rewiring which involve disturbance of asbestos materials can generate much elevated airborne fibre levels. However, given that exposure to dwelling occupants to such activities is likely to be episodic, infrequent and short, the risk associated from one hour of the very high fibre levels typically equate to less than the equivalent of 2 years of exposure at ambient levels. Such elevated exposures are unlikely to add markedly to total lifetime "ambient" exposure. However, in the case of amphibole asbestos there is some uncertainty over the associated risk of mesothelioma, which may occur following low levels of exposure.

To avoid the possibility of adverse health effects, high peak exposures to asbestos fibres should always be avoided.

MMFs

4.21 Loft and cavity wall insulation are the most prevalent current uses of MMFs in dwellings. Over 15 million UK homes have MMF loft insulation. Most currently available MMF products do not readily release airborne fibres, few or any fibres which are released reach the deep lung, and those that do are not bio-persistent. The risk in most dwellings is therefore minimal.

Unnecessary exposure to any fibre should be avoided and exposure likely to result from maintenance, installation or removal of MMFs should be avoided or minimised.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

4.22 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Date of construction:- housing, particularly flats, built between 1946 and 1979 or between 1920 and 1945;
b) Presence of asbestos: - particularly in accessible positions;
c) Unsealed asbestos: - unsealed asbestos based materials;
d) Unlabelled asbestos: – unlabelled asbestos based materials;
e) Disrepair:: - damage or disrepair to asbestos based material; and
f) Presence of MMFs: – in accessible positions.

HAZARD ASSESSMENT

Asbestos

4.23 The assessment involves determination of the location of any asbestos, its vulnerability to damage, and the extent of any current damage and possible fibre release. Identifying the type of asbestos is very important, as damaged or friable amphibole asbestos poses much greater risks than chrysotile. Sampling may be considered necessary to confirm the presence of asbestos and the type.

MMFs

4.24 For MMF, the assessment should involve visual examination for disturbance of material likely to contain MMF.

5 Biocides

DESCRIPTION OF THE HAZARD

5.01 Biocides are chemicals used to treat timber and mould growth in dwellings, and to kill pest infestations (including insects and rodents). However, for the purposes of the HHSRS, timber and mould growth treatments only are considered. Insecticides and rodenticides introduced to dwellings to control pest infestations (eg, cockroaches or rats and mice) are not considered.

POTENTIAL FOR HARM

Most vulnerable group and statistical averages used for rating

5.02 There is no age specific vulnerable group.

Biocides
Average Likelihood and Health Outcomes by Persons of all ages

Dwelling type & age	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class 1 %	Class II %	Class III %	Class IV %	
All dwellings	10,000	0.0	0.0	10.0	90.0	1 (J)

Basis of Estimates

5.03 There is a weak quantitative evidence base, and therefore no revision has been made to the estimates of average likelihoods and outcomes from Version 1 of the HHSRS. These averages use a base population of people living in dwellings which have been recently built or refurbished, as these are most likely to be exposed to biocides.

Health effects

5.04 Biocides are intended to prevent growth or development of insects, fungi, moulds and bacteria (either singly or in combination), and in some instances to kill organisms that are already present. The potential for harm to human health is related to the individual biocide under consideration. However, the main route of exposure is inhalation. Skin contact and oral ingestion may also be routes of exposure, particularly

for small children. Although the greatest risks are to the operatives who apply the chemicals, there is a risk to occupants of treated dwellings.

THE IDEAL

5.05 Use of biocides in treating mould growth and timber should be in accordance with the various statutory controls, including the Biocidal Products Regulations 2001, the Control of Substances Hazardous to Health Regulations 2002, the Health and Safety at Work etc Act 1974, the Control of Pesticides Regulations 1986, as amended, the Wildlife and Countryside Act 1981, the Water Act 1989, and the Environmental Protection Act 1990.

5.06 Wood preservatives (fungicides and insecticides) and surface biocides (mould growth treatments), are the subject of review under the EC Biocides Review Regulations. These pesticides have had to be approved under the *Control of Pesticides Regulations 1986 (as amended)*, and, in accordance with the *Biocidal Products Directive (98/8/EC),* their safety for use is being reviewed under the *Biocidal Products Regulations 2001*. The Directive, and subsequent Regulations, will progressively replace, over a ten year period, the current UK national approval scheme for non-agricultural pesticides under the *Control of Pesticides Regulations1986 (as amended).*

5.07 Use of wood preservatives should follow the guidelines given in *Remedial Timber Treatment in Buildings – A guide to good practice and the safe use of wood preservatives* (1991, HSE).

CAUSES AND PREVENTIVE MEASURES

5.08 Where possible the use of biocides should be avoided. Biocides are often used to remove fungal growth or insect attack which has arisen as a consequence of dampness. Treatment of the main cause of the problem, remedying dampness and renewal of affected timber, will make the use of biocides unnecessary.

5.09 The use of biocides must be in accordance with the labelled instructions, and provided proper precautions are observed during use and afterwards to allow for fume dispersal, risks should be minimised. This will usually involve thorough ventilation before reoccupation of a treated home.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

5.10 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Use of biocides: - use particularly in living areas;
b) Misuse re. instructions etc:- failure to follow the instructions for use and other proper precautions.

HAZARD ASSESSMENT

5.11 In order to assess the hazard it will be necessary to identify the biocide(s) used, and determine whether the manufacturers precautionary procedures and recommendations for use of the product have been followed.

6 Carbon Monoxide and Fuel Combustion Products

DESCRIPTION OF THE HAZARD

6.01 This category includes hazards resulting from the presence of excess levels in the atmosphere within the dwelling of:

a) Carbon monoxide;
b) Nitrogen dioxide;
c) Sulphur dioxide and smoke.

6.02 Carbon monoxide, oxides of nitrogen, sulphur dioxide and smoke, are products associated with the combustion, or incomplete combustion, of gas, oil, and solid fuels used for heating and cooking in dwellings. While the health effects of carbon monoxide, oxides of nitrogen, and sulphur dioxide and smoke vary, the causes, preventive measures and dwelling characteristics affecting likelihood and harm outcome overlap, and so these are discussed together.

6-1 Carbon monoxide

POTENTIAL FOR HARM

6-1.01 There is no specific vulnerable group.

Carbon monoxide
Average Likelihood and Health Outcomes for all Persons aged 65 years and over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non-HMOs	Pre 1920	1,150	0.0	0.0	2.0	98.0	1 (J)
	1920-45	1,080	0.0	0.0	2.0	98.0	1 (J)
	1946-79	870	0.0	0.0	2.0	98.0	2 (J)
	Post 1979	-	0.0	0.0	2.0	98.0	-
HMOs	Pre 1920	1,410	0.0	0.0	2.0	98.0	1 (J)
	1920-45	1,160	0.0	0.0	2.0	98.0	1 (J)
	1946-79	630	0.0	0.0	2.0	98.0	2 (J)
	Post 1979	-	0.0	0.0	2.0	98.0	-
All Dwellings		**1,250**	**0.0**	**0.0**	**2.0**	**98.0**	**1 (J)**

Basis of estimates

6-1-02 For the Class I estimates data on reported carbon monoxide related deaths to persons aged 65 years and over were used. Although the reported number is very probably an underestimate, it was assumed that all these fatalities were concentrated in the 4 or 5% of dwellings which (from the 1996 EHCS) are estimated to have inadequate maintenance of combustion appliances. For classes II to IV, the emergency hospital admission rates for cardio-respiratory diseases for those aged 65 or over were estimated and 4% of these rates taken to be the number from dwellings with poorly maintained appliances or defective ventilation. Of these, it was assumed that 10% had their emergency hospital admission precipitated or exacerbated by elevated CO levels. It was further assumed that 5% of people in these dwellings suffered from some neuropsychological impairment from their CO exposure.

6-1.03 The averages given are almost certainly under-estimates because a proportion of carbon monoxide related poisonings, both fatal and non-fatal, go unrecognised or unreported.

6-1.04 The 0% given in the Spread of Health Outcomes for Class I and II harms does not mean that these harms do not occur as a result of Carbon Monoxide poisoning. It is because fatalities, and severe harms, are proportionately few of the carbon monoxide poisonings. Both represent less than 0.05% of the spread of harm outcomes (if a Class of Harm percentage is less than 0.05% it is shown as 0%).

Health effects

6-1.05 Carbon monoxide is a colourless and odourless gas, and extremely toxic. Blood haemoglobin has a greater affinity for carbon monoxide than it does for oxygen, which means that inhalation of this gas will reduce the ability of the blood to take up oxygen.

6-1.06 At high concentrations carbon monoxide can cause unconsciousness and death. At lower concentrations, it causes a range of symptoms from headaches, dizziness, weakness, nausea, confusion, and disorientation, to fatigue – symptoms which are sometimes confused with influenza and sometimes with depression. In people with ischaemic heart disease it can result in episodes of increased chest pain. Carbon monoxide may also impair foetal development.

6-1.07 The half-time for elimination of carbon monoxide by the blood is between 2 and 8 hours. Thus diagnosis of carbon monoxide poisoning can be difficult unless a blood test is taken within hours of exposure.

6-1.08 Because of the possibility of mis-diagnosis of non-fatal cases, the total burden of carbon monoxide poisoning is uncertain. It is likely that carbon monoxide contributes to a small number of unattributed deaths and acute episodes of cardiovascular disease. However, the reported figures show around 60 carbon monoxide related deaths occur per year, and about 300 acute non-fatal cases.

6-1.09 It is unclear what effects occur from long-term exposure to much lower, but above normal, concentrations of carbon monoxide. Many of the reported symptoms, including impairment of attention span and short-term memory loss, appear to be related to, and be symptoms of, damage to the central nervous system. It is estimated that over 100,000 people a year suffer low level carbon monoxide poisoning.

6-1.10 Those most vulnerable to carbon monoxide exposure include unborn children, infants, the elderly and people with anaemia or heart or lung disease.

6-1.11 The highest rate of deaths from carbon monoxide poisoning occurs in older age-groups, especially in people aged 75+ years. This may be for several reasons, including the increasing prevalence of cardio-vascular illness and neurological decline at older ages, and the fact that the elderly tend to spend a high proportion of their time at home indoors.

THE IDEAL

6-1.12 The maximum levels of carbon monoxide recommended by the World Health Organization are:

a) 100 mg/m^3 (87 ppm) for 15 minutes;
b) 60 mg/m^3 (52 ppm) for 30 minutes;
c) 30 mg/m^3 (26 ppm) for 1 hour; and
d) 10 mg/m^3 (9 ppm) for 8 hours.

6-1.13 The gas, oil and solid fuel burning appliances and associated flues should be properly installed and maintained by a competent person. In the case of gas appliances this should be a CORGI registered gas installer in accordance with the current *Gas Safety (Installation and Use) Regulations*. The appliance should satisfy the relevant *Gas Appliances (Safety) Regulations*. Building Regulations *Approved Document J Combustion appliances and fuel storage systems* covers requirements for air supply (ventilation) and discharge of products of combustion..

6-1.14 British standards dealing with ventilation requirements include *BS5440 Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd, and 3rd family gases) – Part 2: Specification for installations and maintenance of ventilation for gas appliances,* and *BS 7880 Code of practice for draught control of existing doors and windows in housing using draught strips.*

6-1.15 Other relevant British Standards include *BS 5482 Part I Domestic butane- and propane-gas-burning installations. Specification for installations at permanent dwellings* and *BS 5258 Part I Safety of domestic gas appliances. Specification for central heating boilers and circulators.*

6-2 Nitrogen dioxide

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

6-2.01 There is no specific vulnerable age group.

Nitrogen dioxide
Average Likelihood and Health Outcomes by Persons of all ages

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses and Flats	Pre 1920	32	0.0	0.1	10.0	89.9	125 (**F**)
	Post 1979	56	0.0	0.1	10.0	89.9	71 (**G**)
All Dwellings		**All**	**32**	**0.0**	**0.1**	**10.0**	**89.9**

6-2.02 There is a weak quantitative evidence base. Therefore no revision has been made to the estimates of average likelihoods and outcomes from Version 1 of the HHSRS. These averages use a base population of people living in dwellings where the main space heating fuel was gas, bulk LPG, bottled gas, or oil, or the fuel used for cooking was mains gas, bottled gas or oil, and where the ventilation was defective.

Health effects

6-2.03 Nitrogen dioxide affects the respiratory system, damaging the lining of the airways. At low levels it may cause narrowing of the airways in asthmatics and may exacerbate reactions to allergens such as house dust mites. Asthmatics are therefore more vulnerable than others, particularly if exposed to other airborne allergens.

6-2.04 Exposure to high levels of nitrogen dioxide may also increase susceptibility to bacterial and viral infection of the lung.

6-2.05 A no-effect level for sub chronic or chronic nitrogen dioxide exposure concentrations has not yet been determined.

THE IDEAL

6-2.06 The World Health Organisation (WHO) has recommended a short-term guidance value of 200 ug/m³ (0.11 ppm) nitrogen dioxide as a one hour average daily maximum. The WHO long-term guidance value, based on epidemiological studies of increased risk of respiratory illness in children, is 40 µg/m^3 (0.023 ppm) annual average.

6-2.07 Gas, oil and solid fuel burning appliances and associated flues should be properly installed and maintained by a competent person. In the case of gas appliances, this should be a CORGI registered gas installer in accordance with the current *Gas Safety (Installation and Use) Regulations*. The appliance should satisfy the relevant *Gas Appliances (Safety) Regulations*. Building Regulations *Approved Document J Combustion appliances and fuel storage systems* covers requirements for air supply (ventilation) and discharge of products of combustion.

6-2.08 British standards dealing with ventilation requirements include *BS5440 Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70kW net (1st, 2nd, and 3rd family gases) – Part 2: Specification for installations and maintenance of ventilation for gas appliances,* and *BS 7880 Code of practice for draught control of existing doors and windows in housing using draught strips.*

6-3 Sulphur dioxide

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

6-3.01 There is no specific age vulnerable group.

Sulphur dioxide
Average Likelihood and Health Outcomes by Persons of all ages

Dwelling type & age	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class 1 %	Class II %	Class III %	Class IV %	
Pre 1920	18	0.0	0.1	10.0	89.9	222 (E)
Post 1979	32	0.0	0.1	10.0	89.9	125 (F)
All Dwellings	**18**	**0.0**	**0.1**	**10.0**	**89.9**	**222 (E)**

6-3.02 There is a weak quantitative evidence base. No revision has been made to the estimates of average likelihoods and outcomes from Version 1 of the HHSRS. These averages use a base population of people living in dwellings where the main space heating

fuel was oil, house coal, smokeless fuel, anthracite, or wood, or the fuel used for cooking was solid fuel or oil, and where the ventilation was defective.

Health effects

6-3.03 Sulphur dioxide from open fires is implicated in respiratory conditions, particularly bronchitis and breathlessness. People with asthma are the most vulnerable.

6-3.04 The World Health Organisation have stated that the concentrations at which health effects start to be observed are 1,000 ug/m³ as a ten minute average daily maximum, 250 ug/m³ as a daily average, and 100 ug/m³ as an annual average.

THE IDEAL

6-3.05 The World Health Organisation (WHO) recommend a short-term guidance value of 500 ug/m³ sulphur dioxide as a ten minute average daily maximum, and 125 ug/m³ as a twenty four hour average maximum.

6-3.06 Building Regulations *Approved Document J Combustion appliances and fuel storage systems* covers requirements for air supply (ventilation) and discharge of products of combustion.

Carbon monoxide, oxides of nitrogen, and sulphur dioxide

6.03 The causes and preventive measures in dwellings, and features relevant to hazard assessment, for each of these indoor air pollutants overlap, and they are therefore discussed together.

CAUSES AND PREVENTIVE MEASURES

6.04 The main source of carbon monoxide within dwellings is the incomplete combustion of all fuels containing carbon, including gas, oil, and solid fuels.

6.05 The main sources of nitrogen dioxide are gas and oil burning appliances.

6.06 Sulphur dioxide has a noticeable smell, and is produced by burning fuels containing sulphur, mainly oil and solid fuel burning appliances.

Gas, oil and solid fuel burning appliances must be correctly installed and maintained. All such appliances should be provided with an adequate air supply for combustion and appropriately sited and connected to adequately sized flues to safely take away combustion gases. Rooms with gas, oil or solid fuel burning appliances should be provided with adequate and appropriate ventilation.

6.07 Open flued appliances can discharge combustion gases back into rooms where there is a negative pressure, for example, caused by too powerful extract fans.

All flues should be regularly checked and kept clean. Flues should not be sited close to an openable window or other ventilators, otherwise flue gases may enter the dwelling.

Gas heating appliances should be fitted with balanced flues which take in air for combustion from outside and discharge combustion gases outside.

There should be a ventilated lobby between an integral garage and living accommodation to limit carbon monoxide from engine exhaust penetrating into dwellings.

6.08 Gas cookers discharge combustion gases into the dwelling and, without appropriately sited extract ventilation, WHO guideline levels are likely to be exceeded. Flueless gas or oil heaters also discharge the combustion gases into the dwelling. Even in well ventilated rooms, these are likely to produce carbon monoxide and nitrogen dioxide levels above the WHO recommended levels for periods of time when the appliances are in use.

Properly sited and maintained carbon monoxide detectors of a suitable type will warn occupants of danger, enabling them to take action to prevent further build-up of the gas or escape from the dwelling.

DWELLING CHARACTERISTICS AFFECTING LIKELIHOOD AND HARM OUTCOME

6.09 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of health outcome include:

a) Open flued appliances;
b) Flueless appliances: - gas or oil burning appliances, including cookers;
c) Disrepair to appliance: - to gas, oil or solid fuel burning appliances resulting in incomplete combustion;
d) Inadequate ventilation: - particularly of rooms with gas, oil or solid fuel burning appliances;
e) Disrepair to ventilation: - disrepair to the means of ventilation;
f) State of flues: - Lack of proper and regular cleaning of flues serving gas, oil or solid fuel burning appliances;
g) Disrepair to flues: - serving gas, oil or solid fuel burning appliances;
h) Flue outlet siting: - sited adjacent to openable window;
i) Extractor fans: - in dwellings with open flued appliances;
j) Ventilation lobby: -no lobby between a garage and living accommodation;
k) Carbon monoxide detectors – lack of, or defects to, detectors.

HAZARD ASSESSMENT

6.10 There should be visual inspection of the gas, oil and solid fuel appliances, their flues, and the ventilation arrangements at the dwelling. Where there are indications that there may be an above average risk, further investigation and a safety report from an appropriate engineer may be necessary to fully appraise the hazard.

7 Lead

DESCRIPTION OF THE HAZARD

7.01 There are two main sources of lead within dwellings – paint and water pipes. Other sources of lead include soil, particularly around older buildings contaminated by flaking external paintwork, and adjacent to industrial premises using (or previously having used) lead. In addition, there may be residual lead in soil close to busy roads from the exhaust fumes from leaded petrol.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

7.02 The most vulnerable age group considered in rating this hazard are all persons aged under 3 years.

Lead
Average Likelihood and Health Outcomes for all Persons aged under 3 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	39,060	0.0	1.0	9.0	90.0	0 (J)
	1920-45	40,710	0.0	1.0	9.0	90.0	0 (J)
	1946-79	99,580	0.0	1.0	9.0	90.0	0 (J)
	Post 1979	179,600	0.0	1.0	9.0	90.0	0 (J)
HMOs	Pre 1920	38,680	0.0	1.0	9.0	90.0	0 (J)
	1920-45	33,730	0.0	1.0	9.0	90.0	0 (J)
	1946-79	63,930	0.0	1.0	9.0	90.0	0 (J)
	Post 1979	59,740	0.0	1.0	9.0	90.0	0 (J)
All Dwellings		**58,400**	**0.0**	**1.0**	**9.0**	**90.0**	**0** (J)

Basis of estimates

7.03 The risk statistics in the above table are based upon the best available evidence. However, mainly US studies or high exposure area studies were used to generalize current background rates of lead exposure for children in the U.K. Data for the harm

classes was also difficult to obtain. Although there are published studies showing a decrease in IQ for increasing lead levels, there is no routinely collected data to allow an attributable risk to be calculated, and there is little detailed data showing recent lead levels in UK dwellings, or blood lead levels of children residing in UK houses. Thus, there is some uncertainty in the production of these statistics.

7.04 Existing epidemiological studies do not allow conclusions to be drawn as to whether there is a threshold below which lead has no effects. The World Health Organisation's maximum lead in blood action level is 10 ug/dl.

Health effects

7.05 Lead is a heavy metal, and toxic to humans. When lead is ingested it accumulates in the body. It has toxic effects on the nervous system, cognitive development and blood production. Continual exposure at low levels has been shown to cause mental retardation and behavioural problems in children. Lead is readily absorbed from the intestinal tract, especially in children, and its absorption is enhanced by dietary deficiency of iron and calcium. There are around 100 cases a year of acute lead poisoning, most of which are attributed to ingestion of lead from paint. There are up to about 10 fatalities each year result from lead poisoning. However, the most prevalent risk is Intelligence Quotient (IQ) deficiency in children, rather than acute poisoning. Even with relatively low levels of lead in blood, there are indications that it affects the IQ of children.

7.06 The highest risk group is young children aged 0-3 years because of lead's potential effect on neurological development, and because physiologically they take up lead more readily. Children may also ingest lead from paint (pica) or dust. Pregnant women and foetuses have also been identified as a risk group, mainly in relation to levels of lead in water. The elderly are more susceptible to health effects than younger adults, because as part of the aging process lead may be released from bone changes, and toxic effects may be observed from relatively low lead exposures.

THE IDEAL

7.07 Installation of lead pipework is now prohibited in UK dwellings. Leaded paints are no longer generally available (although EU legislation allows the use, by professional decorators, of white lead for the restoration and maintenance of listed buildings).

7.08 Ideally, lead in drinking water should not exceed the World Health Organization's maximum of 10 ug/l. The *Water Supply (Water Quality) Regulations 2000*, as amended, are reducing the UK minimum standard for lead in public (mains) drinking water to 25 ug/l from the end of 2003, and to 10 ug/l from December 2013. The *Private Water Supplies Regulations 1991* stipulate the minimum standard for lead in private water supplies, which is currently 50 ug/l. It is expected to be updated shortly to 25 ug/l, in accordance with European Council (EC) Directive 98/83/EC.

7.09 The current UK guidelines for lead in soil, published by the Environment Agency (EA) in relation to contaminated land for residential use, refer to 450 mg of lead per kg of dry weight soil.

7.10 There is no UK guideline level for lead in house dust. However, the UK Expert Panel on Air Quality Standards recommended a value of 0.25 ug/m³ for airborne lead, and the EU lead in air standard is currently 0.5 ug/m³.

CAUSES AND PREVENTIVE MEASURES

7.11 Before 1970 lead was widely used in both paint and water supply pipework in dwellings, and where this remains it can present a hazard.

7.12 The consideration of lead in water under the HHSRS is limited to contamination occurring after water has been delivered to the premises. The quality of water supplied to the premises (typically, at the point where it leaves the suppliers' pipework) is not considered by HHSRS.

7.13 Water from public suppliers (mains water) should meet the quality standards referred to in the *Water Supply (Water Quality) Regulations 2000,* as amended. These are enforced by the Drinking Water Inspectorate. These standards at a minimum comply with the European Council (EC) Directive 98/83/EC (on the quality of water intended for human consumption), and in some areas are more stringent, with adoption of the higher minimum standards of the World Health Organisation. The quality of water from private supplies is controlled under the *Private Water Supplies Regulations 1991,* which are enforced by local authorities. These regulations are soon to be updated in accordance with the EC Directive.

7.14 As there has been increasing understanding of the potential health effects of lead, there has been tighter control over its use. Lead is no longer found in petrol, and there is tight control of environmental contamination by industry. This means that where there is domestic exposure to lead in paintwork or lead in drinking water, it can present a significant source of lead intake.

There appears to be no threshold for the neurotoxic action of lead, and therefore exposures from all sources should be as low as possible.

Lead in paint, dust and soil

7.15 The main exposure to lead in UK homes is through the removal of lead based paint on redecoration. Lead was widely used in domestic paint up until the 1960's, and since then restrictions on the use of lead in paint mean that there is likely to be little risk in post-1970 properties.

7.16 If paintwork is completely sound, then overcoating old lead paint is often a safer option than removal. However, if the paintwork has deteriorated, removal will be necessary.

Proper precautions should be observed during paint removal to prevent ingestion of airborne lead particles, and to prevent the deposition of lead particles in the building or on surrounding land. To avoid particles becoming airborne or dispersed as fume when removing old lead paint, it should not be dry-sanded, scraped or burnt off. Old paint should be removed by either wet-abrasion, solvent- or caustic- based paint stripper, or by a hot air gun operated so as to only soften and not burn the paint.

Lead in water

7.17 Lead does not normally occur in natural water supplies but is the result of the use of lead pipework or lead-based solder in the water distribution systems and domestic pipework. Any lead pipework within a supplier's distribution system, whether it is a mains (public) or a private supply, is the responsibility of the water supplier. Mains water is supplied to 99% of the UK population, and the majority of lead has already been replaced by non-toxic materials in the water companies' distribution systems. The water suppliers' responsibility for pipework, however, ends at the boundary of private properties, where it becomes the property owner's responsibility. Because lead has already been removed from most of the UK's water distribution system, any lead contamination of water is therefore most likely to be the result of lead within the domestic system, and assessed under this hazard category.

7.18 Up to 9 million dwellings in the UK have lead water pipes, and, where the water has high plumbo-solvency capabilities, lead will be dissolved.

Even in areas where water is of low plumbo-solvency, lead pipework should not be present in dwellings.

7.19 Lead in drinking water can also arise from leaching of lead solder in copper pipe fittings, as well as from old lead pipes.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

7.20 Relevant matters which may increase the likelihood of a hazardous occurrence and increase the severity of the health outcome:

a) Date of construction:- dwellings constructed before 1970.
b) Old paintwork:- the presence of old paint likely to contain lead;
c) Disrepair to old paint:- damage and/or flaking of old paintwork likely to contain lead;
d) Previous lead paintwork:- where allowed to flake or inappropriately removed resulting in accessible lead in dust or garden soil.
e) Lead pipework:- the presence of such pipework for domestic water;
f) Plumbo-solvent water:- water of high acidity likely to dissolve lead in pipes. .

HAZARD ASSESSMENT

Lead in paint, dust, and soil around the house

7.21 Visual examination will allow identification of the condition of paintwork, and whether there is an immediate problem with paint flaking. However, sampling is necessary to determine lead content.

7.22 Lead is more likely to be found where paint layers are thick, and where oil-based paints are typically used, on woodwork and metalwork (both internally and externally). Lead paint is less likely to be found on plaster surfaces, however, distempers which were used as an early form of whitewash, occasionally contained lead. Confirmation of the presence of lead in paint requires sampling and analysis.

7.23 If lead in garden soil is suspected, a sample can be taken for analysis.

Lead in water

7.24 Lead pipework is grey in colour, and where it is painted it is usually fairly easy to identify, because it is a soft metal and non-uniform in shape. If a small amount of paint is scraped away the dull grey metal should be revealed. It is sometimes difficult to determine whether the underground supply pipe leading from the distribution network up to the property is lead or not, but examination of where the rising main enters the premises may give an indication, as may opening the flap of the stop valve outside the property.

7.25 To determine the lead content of water, sampling and analysis must be undertaken.

8 Radiation

DESCRIPTION OF THE HAZARD

8.01 The primary consideration under *hazards from radiation* is therefore that of airborne radon. Radon dissolved in water, particularly in private water supplies, is also considered. However, it is less prevalent in concentrations which pose a significant threat to health, than airborne radon.

8.02 Concern has been expressed about the possible health effects of electromagnetic fields (EMFs). These are non-ionising forms of radiation. At low frequencies, electric and magnetic fields are considered separately. These low frequency fields are produced whenever an electric current is flowing and can be found in the vicinity of power lines, electricity sub-stations and electrical appliances. At high frequencies (microwave and radio frequencies), the fields are often considered together as components of electromagnetic fields. Mobile telephones and their masts, television and radio transmitters, microwave ovens and radar produce such high frequency fields. At present, there is no clear evidence of a risk to health from low level exposure to the EMFs normally found in the domestic environment.

8.03 Leakage from microwave ovens might also be considered under this hazard category where the oven is provided by a landlord in furnished accommodation. However, the incidence of significant microwave leakage is extremely rare.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

8.04 The most vulnerable age group considered in rating this hazard are all persons aged between 60 and 64 years who have had lifetime exposure to the radon level under consideration.

Radiation
Average Likelihood and Health Outcomes for all Persons aged 60-64 years, following lifetime exposure to radon gas

Measured Radon Level Bq.m-3	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class 1 %	Class II %	Class III %	Class IV %	
800	277	90.0	10.0	0.0	0.0	3,285 (**B**)
400	518	90.0	10.0	0.0	0.0	1,757 (**C**)
200	1,000	90.0	10.0	0.0	0.0	910 (**D**)
150	1,322	90.0	10.0	0.0	0.0	688 (**D**)
100	1,961	90.0	10.0	0.0	0.0	464 (**E**)
50	3,902	90.0	10.0	0.0	0.0	233 (**E**)
25	7,853	90.0	10.0	0.0	0.0	116 (**F**)

Basis of Estimates

8.05 Calculations of excess annual risk of lung cancer are based on the models presented in the (BEIR) VI Report[38] This contains tabulations of lifetime relative risks of lung cancer against lifetime indoor exposure to radon. In the above table, the likelihood is still for the average annual risk, but only refers to persons aged 60 to 64 uears who have already had a lifetimes exposure to radon. The spread of health outcomes are based on the assumption that there is only a 10% survival rate for lung cancer, and that even for survivors the degree of harm is severe.

Radon gas

8.06 There is a relatively strong basis of evidence for the attributable risk of radon in homes, resulting in a high confidence level for the statistical averages given.

8.07 The statistical averages do not refer to dwelling age ranges and types because these are much less relevant to the risk than is the geology of the ground on which the dwelling is built. The risk is directly related to the radon gas level within a dwelling, which can be measured.

8.08 The statistical averages given relate to *annual risk* of lung cancer following *lifetime exposure*. The basis of the averages is therefore different from that given for other hazard categories, where *lifetime exposure* is not considered. In the above table, the likelihood is still for the average *annual risk*, but only refers to persons aged 60 to 64 years who have already had a *lifetime exposure* to radon at the level considered. The average statistics are presented in this way because the risk is dependent on the size of the cumulative dose received over a long period. The risk, even in a house where radon concentrations are particularly high, is a function of the duration of exposure.

8.09 Since the risk of lung cancer rises with age and duration of exposure, using an older age group for the calculation of averages, for example the 75-79 year age group, would have markedly increased the hazard scores.

38 Biological Effects of Ionizing Radiation (BEIR) VI Report: "The Human Effects of Exposure to Indoor Radon", Washington, DC: National Academy Press, 1998.

8.10 The averages given are for the overall population in the given age group, including both smokers and non-smokers. Smokers have a substantially greater excess risk than non-smokers, and if the high risk group were defined to be smokers, then the average hazard scores would be appreciably larger.

Health effects

8.11 Radiation is the process of energy emission as waves or particles. There are two forms: ionising radiation and non-ionising radiation. Ionising radiation can pass through the tissues of the body and has sufficient energy to damage DNA and cause genetic mutation. Alpha (□)particles resulting from the decay of radon are an example of ionising radiation found in dwellings. Non-ionising radiation does not have sufficient energy to damage DNA directly. Examples of non-ionising radiation found in dwellings are ultraviolet radiation, microwave, and radio-frequency radiation.

8.12 Ionising radiation comes from natural and man-made sources. The natural sources comprise 85% of the total exposure to ionising radiation of the UK population, the majority of which is from radon gas in buildings. Radon dissolved in water supplies is another source of ionising radiation found in dwellings, and only found in significant quantities in private water supplies, particularly in areas where there are also problems with high levels of radon gas in buildings. Radon is odourless and colourless, and it is not possible to determine its presence, either in the air or in water, without testing and measurement.

Radon

8.13 The main source of harmful radiation in dwellings is from radon gas. It is the second most important cause of lung cancer after smoking, and most radon exposure occurs at home. Risk estimates suggest that up to one in 20 cases of lung cancer in the UK can be attributed to residential radon exposure, and this figure will be higher in some areas. This amounts to around 3,000 lung cancer deaths per year, of which 1,000 are in non-smokers.

8.14 The risk of lung cancer is directly attributable not to radon gas itself but to its decay products, which are themselves radioactive. Radon decays rapidly, and the resulting products can very quickly attach themselves to particles in the air, which are inhaled and can be deposited in the lungs. Continuing the process of radioactive decay □ particles are emitted which can cause cells lining the lungs to be genetically mutated, and initiate cancer, or facilitate a process already initiated by other carcinogens. The risk related to radon increases with dose and duration of exposure.

8.15 Whilst there is strong epidemiological evidence that radon gas is a cause of lung cancer, there is weaker association with other cancers. However, the indications are that other organs may be targeted by radon through ingestion and skin contact. Malignancies resulting from these exposures may include leukaemia (acute lymphatic leukaemia in children) and skin cancer.

8.16 Radon is soluble in water. Radon can be ingested in drinking water resulting in the organs of the gastrointestinal tract receiving the largest dose. Whether radon is ingested or inhaled, other body organs will be irradiated to some extent, although the doses involved are usually much smaller than those to the organs of intake.

8.17 Radon in air presents a greater hazard than radon in water, certainly in terms of the number of people exposed to high levels, and probably in terms of the maximum risk. However, high levels of radon in a water supply may be associated with high levels in domestic air and the health burden from the radon in water would be independent of and additional to that posed by radon in air.

8.18 Since 1990 the Government has set 200 Bq m^{-3} as the "action level" for radon gas in homes. This is the recommended limit for the annual average radon gas level in homes. The *lifetime risk*[39] for smokers at the action level of 200 Bq m^{-3} is a 10 to 15% risk of lung cancer, whereas that for non-smokers is a 1 to 3% risk of lung cancer. For the general UK population of non-smokers and smokers the *lifetime risk* following exposure to 200 Bq m^{-3} of radon is 3 to 5%.

8.19 The European Union have proposed an "action level" for radon in drinking water supplies of 1,000 Bq per litre, so that the risk to a typical person drinking such water is similar to, but probably a little lower than, the risk from breathing air which contains radon at the "action level" of 200 Bq m^{-3}. Exposure to the proposed action level for radon in drinking water as the principal source of water for a lifetime might be expected to lead to an additional cancer risk of between 1% and 3% for smokers and non-smokers alike.

EMFs

8.20 The levels of non-ionising radiation, or EMFs, usually found within dwellings are insufficient to cause significant harm to health, and in any case, most sources of EMFs within a dwelling would not be within the control of the owner, and therefore not considered by the rating system. However, in the case of a dwelling let on a furnished basis, then a microwave oven might be provided by the landlord. The incidence rate for injuries arising from microwave oven leakage is minimal and derives almost entirely from reports published in the USA.

8.21 Microwaves act by depositing energy within the centre of a material, and the potential health effect from exposure to leakage is that microwaves could be absorbed within the body tissue thus raising its bulk temperature. Thermal damage has been shown to occur at radiation intensities of 100 mW cm^{2} and above.

THE IDEAL

Radon

8.22 New dwellings should be constructed to achieve radon gas levels as low as is practicable, with reference to *The Building Regulations 1991: Approved Document C – Site Preparation and Resistance to Moisture,* 1992 edition, and the Building Research Establishment's *Radon: guidance on protective measures for new buildings,* published 1999. These documents identify radon affected areas: those parts of the country with a 1% probability or more of present or future homes being above the Action Level (200 Bqm^{-3}). Similarly, in existing dwellings, remedial measures should be adopted with the intention to reduce radon to levels that are as low as practicable.

39 This *lifetime risk* is *annualized* for the purposes of the HHSRS statistical averages.

8.23 The 1993 World Health Organization guideline values for the radioactivity of water are 0.1 Bq/l for total alpha and 1 Bq/l for total beta activity.

EMFs

8.24 For domestic microwave ovens the maximum leakage rate is set in BS EN 60335-2-25 as 50 W cm^{-2} at 50 mm from any surface of the oven.

8.25 *Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields* are published by the International Commission for Non-Ionizing Radiation Protection (ICNIRP). The National Radiological Protection Board (NRPB) propose that the ICNIRP Guideline levels be adopted in the UK as a precautionary measure. There is no evidence to suggest that levels above those set in the Guidelines are hazardous to health, taking into account concerns of the public about EMFs.

CAUSES AND PREVENTIVE MEASURES

Radon

8.26 All exposures to ionising radiation are assumed to carry some risk, though the risks from very low doses are very small. It follows that there is no completely safe level of radon. However, the risk at low levels, for example at the UK average level of 20 Bq m^{-3} for airborne radon in dwellings, is small.

Radon gas

8.27 The principal concern in the UK is from radon in air entering a building from the ground beneath. Radon gas is naturally occurring, formed from the decay of radium, which in turn comes from the decay of uranium. Small quantities of uranium are found in all soils and rocks, but the amount varies from place to place. Concentrations tend to be highest in areas where the underlying rock is granite, but high radon levels are also found outside granite areas. Radon diffuses into the air from the soil, and sometimes from water (in which it may be dissolved). In the open air it is diluted to very low concentrations, but in confined spaces, such as within a building, radon can accumulate and reach concentrations hazardous to health.

8.28 The main areas of the country in which radon is a problem are the granite areas of Cornwall and Devon, and the limestone areas of Derbyshire, Northamptonshire, North Oxfordshire, Lincolnshire, and Somerset. However there are many other areas in England and Wales affected by radon.

8.29 Indoor radon levels depend on the concentration of radon in the ground, the design and state of repair of the house, and the way the house is heated and ventilated. Radon levels between similar houses, even those in the same street, can vary widely.

8.30 The gentle suction created by the normally lower atmospheric pressure within buildings draws radon gas in through holes, cracks and gaps in the floor, and other similar matters of disrepair. Any breaches of solid floors or damp proof membranes will allow the gas to penetrate into the dwelling.

Sealed solid floors with a damp proof membrane that extends across the whole of the floor and through the walls provide the best protection, while suspended timber floors, the least.

To reduce radon levels in existing dwellings the most effective remedial technique is to provide a radon sump, a hollow under the floor with a low power fan to disperse the gas into the open air, together with careful sealing of all cracks and holes, particularly around service entry points. Other options for reducing radon levels, but which are less effective than provision of a radon sump, are increasing air flow under a timber floor and installing a whole house positive pressurisation or positive supply ventilation system.

8.31 Improving dwelling ventilation can also contribute to reduction of radon levels, although this is the least effective method. Ventilation through ground floor windows tends to have a beneficial effect, by diluting the radon laden air. However, both upper floor ventilation, and the presence of open chimney flues (whether used or unused), can create a stack effect, drawing radon-rich air from under the dwelling. Extractor fans can sometimes aggravate radon problems, if a suitable air inlet is not provided, as they may draw soil gas into the house.

Radon in water

8.32 Radon is not found in major public water supplies in concentrations which pose a significant threat to health, because the water treatment process results in losses of excess radon before the water is supplied. Private water supplies may have elevated levels of radon, particularly in areas where there are elevated levels of uranium and radon in the underlying rock and soil. This is typically those areas where there are also problems with radon gas in homes.

8.33 Less is known about the risks from radon in drinking water than that in air. For example, it is not known to what extent pouring or boiling reduces the radon concentration. However, if the radon is released to air in the dwelling, then it may be that the benefit from reduced radon in water is off-set by an increase in the concentration of air-borne radon.

Radon and Multi-occupied buildings and flats

8.34 Problems with radon gas typically affect houses and dwellings in the lower storeys of a building. Flats located above ground floor level, and which are separated from the lower flats, by, for example, fire resisting construction, tend to be less affected by radon.

EMFs

8.35 Lack of cleanliness and poor maintenance of door seals on ovens can lead to microwave leakage. However, even where there is some leakage this decreases rapidly with distance.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

8.36 The primary relevant matter is whether the dwelling is sited in an Affected Area. If it is then the following matters may increase the likelihood of a hazardous occurrence :

a) In an Affected Areas:- the dwelling is sited in an Affected Area and thus liable to have elevated radon levels;
b) Timber ground floor:- ground floor of suspended timber construction particularly if without adequate sub-floor ventilation;
c) Disrepair to solid floor:- holed, cracked or other disrepair to a solid ground floor;
d) Lack of DPM:- lack of or defective damp proof membrane to solid floor;
e) Sealing around services:- inadequate sealing around service entry points, and similar disrepair;
f) Ventilation rates:- high upper-level ventilation rates;
g) Open fires:- use of open fires and solid-fuel-effect open fires, without additional through the wall ventilation;
h) Remedial measures:- disrepair to any remedial measures, such as a radon sump or associated fan;
i) Extractor fans:- continuous use of extractor fans in kitchens, bathrooms or wcs;
a) Private water supply: particularly if from a borehole or well.

HAZARD ASSESSMENT

Radon in the air

8.37 Assessment of possible airborne radon levels is made by consideration of whether the dwelling is in an *affected area*, and the construction, repair, and provision for ventilation at the dwelling. However, because radon levels can vary widely between apparently identical dwellings, the only way to determine whether or not there is a high level in a particular dwelling is to measure it.

8.38 Radon levels in houses vary substantially from day to day and month to month as they are influenced by weather conditions, and heating and ventilation at the dwelling. For this reason, it is preferred that radon measurements are carried out with two detectors (in a bedroom and living room) and are conducted over a reasonable period of time, typically three months or more. This averages out short-term fluctuations. (Radon levels tend to be higher in winter months when buildings are typically less well ventilated.) A laboratory validated by the NRPB should be used to take the measurements.

8.39 It is inadvisable to take radon measurements when a dwelling is unoccupied, because the radon level may change when occupied. Dwellings undergoing structural alteration also cannot be measured accurately; it is best to wait until building work is complete and the dwelling occupied in a normal manner.

8.40 Once radon corrective measures have been put into effect radon measurements should again be taken to check radon levels have been successfully reduced.

Radon in the water supply

8.41 Unacceptable radon levels in water are most likely to be found in areas where there are also problems with radon gas in dwellings (ie, those in Affected Areas).

8.42 As is the case with radon gas, the only way to determine whether or not there is a high level in a particular water supply is to measure it. A single sample should suffice. However, if the concentration is found to approach or be in excess of the action level of 1,000 Bq per litre, then further sampling may be appropriate.

EMFs

8.43 Microwave oven doors are designed with at least two features which ensure that power is cut off immediately the door is opened. However it is possible for microwaves to leak out around the edges of a badly fitting or damaged door. If a door does not fit squarely and operate smoothly or if it shows signs of corrosion or damage, then measurements can be made of the leakage level of microwaves from the oven. However, microwave oven leakage levels which exceed the recommended levels are extremely rare.

9 Uncombusted fuel gas

DESCRIPTION OF THE HAZARD

9.01 This category includes the threat of asphyxiation resulting from the escape of fuel gas into the atmosphere within a dwelling.

9.02 It does not include hazards associated with poisoning associated with incomplete combustion of gas and the spilling of combustion products back into a dwelling (on which see *6.1 Carbon monoxide*). Nor does it include explosions resulting from uncombusted fuel gas (on which see *27 Explosions*).

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

9.03 There is no specific vulnerable age group used for statistical purposes.

Uncombusted Fuel Gas
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	48,807	0.3	0.0	48.4	51.4	0
	1920-45	117,830	3.1	0.0	24.2	72.7	0
	1946-79	103,618	0.5	0.0	38.9	60.6	0
	Post 1979	181,609	5.9	0.0	75.3	18.8	1
Flats	Pre 1920	58,411	0.3	0.0	24.9	74.8	0
	1920-45	2,395,541	100.0	0.0	0.0	0.0	0
	1946-79	53,065	0.2	10.0	39.9	49.9	1
	Post 1979	201,933	4.7	0.0	95.3	0.0	0
All Dwellings		**83,784**	**1.2**	**2.3**	**41.4**	**55.2**	**0**

Basis of estimates

9.04 The figures in the above table relate to persons of all ages who were harmed, including fatally harmed, by un-combusted fuel gas in their home, in England and Wales

in the years 1997, 1998 and 1999. The Class I figures are based on the number of persons killed by gas poisoning, as recorded by mortality statistics, while the Class II to IV estimates are based on the number of such accidents, as reported by the Home Accident Surveillance System. The figures specifically exclude those harmed by carbon monoxide and smoke, fumes or gas from an uncontrolled fire.

9.05 Small sample sizes mean that the statistical evidence for *uncombusted fuel gas* is relatively weak and should be treated with caution. In such cases, the averages for all dwelling will be significantly more accurate than those for individual dwelling types and the likelihood figure more accurate than those for the spread of health outcomes.

Health effects

9.06 Fuel gases can cause asphyxiation. This occurs when the fuel gas builds up within the dwelling, displacing the air to such an extent that the occupants are unable to obtain sufficient oxygen to breathe. The critical oxygen level resulting in asphyxiation is 14% (normal levels being around 21%).

9.07 The number of fatalities varies from year to year and may be anything from less than 10 to around 40.

9.08 Very young children (those aged under 5 years) are most likely to suffer injury as a result of exposure to uncombusted fuel gas. Elderly persons, aged 60 years or more, are also vulnerable because, although they are the least likely to be involved in such an accident, the proportion of fatalities is comparatively high. Pregnant women are also vulnerable.

THE IDEAL

9.09 Gas supplied to dwellings should satisfy the requirements of the current Gas Quality Regulations. The gas installation should be properly installed by a competent person (ie, CORGI registered) and in accordance with the relevant Gas Safety (Installation and Use) Regulations, and appliances should satisfy the relevant Gas Appliances (Safety) Regulations[40].

9.10 Building Regulation *Approved Document J* includes requirements for safe storage of liquid fuel, as well as other safety requirements relating to combustion appliances.

9.11 Relevant British Standards include *BS 5258 Safety of domestic gas appliances Part I Specification for central heating boilers and circulators* and *BS 5482 Domestic butane- and propane-gas-burning installations - Part 1:Specification for installations at permanent dwellings.*

CAUSES AND PREVENTIVE MEASURES

9.12 The most common gas used in dwellings is mains gas (formerly known as natural gas), although there is now an increasing use of liquid petroleum gas (LPG) particularly in

40 Currently the 1998 version (SI 1998 No 2451), and the 1995 version (SI No 1629) respectively.

isolated and rural areas, and some use of landfill gas. Mains gas is primarily methane and is less dense than air, while LPG is denser than air.

Gas should be supplied by an authorised supplier and be of standard composition and at a standard pressure.

There should be appropriate properly designed and installed pressure regulators, meters and pipework. The installation should be regularly tested to ensure there are no leaks or other defects, and in particular where there have been any alterations to the dwelling or to the gas installations.

Appliances should be properly designed and installed. The appliances should be regularly serviced and maintained by a competent person.

Where LPG is used, it being heavier than air, there should be adequate low level ventilation or means of ensuring any gas escaping can drain safely away. This is particularly important where the floor level is below the adjacent ground level.

Gas detectors are available which should provide warning to occupants if fuel gas is building up within the dwelling, enabling them to take action and/or to escape. The appropriate siting of such detectors will depend on which gas is being supplied.

9.13 Both mains gas and LPG are odorised to have distinctive smells, to alert users to the danger of escaped gas.

If there is any indication, either through smell, visually, or through defects to appliances or gas pipework, that there may be a leak, the gas should be turned off at the main shut off valve. For natural gas – the British Gas Emergency number should be called. For a major leak of LPG - the fire brigade should be called on 999, for a minor leak there will usually be an arrangement with the gas supplier. All naked flames should be extinguished, and windows and doors opened to ventilate the dwelling, and electrical switches not operated. If the leak is outside people should be evacuated to a place upwind of the leak.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

9.14 Relevant matters contributing to the likelihood of a hazardous occurrence include:

a) Gas supply: – the supply of gas from a non-authorised supplier;
b) Gas installations: - defects to the installation, including pressure regulators, meters and pipework;
c) Gas appliances: – defects to boilers, fires etc;
d) Maintenance defects:- lack of evidence of regular testing and servicing of the gas installation and/or appliances;
e) Siting of appliances: – locations adjacent to windows or doors where there is a risk of flames blowing out.

9.15 Matters affecting the severity of health outcome include:

a) Gas detector provision: – the lack of correctly sited detectors;
b) Defects to detectors.

HAZARD ASSESSMENT

9.16 After both a visual inspection and checking for the smell of the relevant gas, if there are indications that there may be a leak the gas should be turned off at the supply valve, and the gas leak reported as an emergency. If there are indications that there may be an above average risk from this hazard, even if no current leak is detected, further investigation and a safety report from an appropriate engineer may be necessary to fully appraise the hazard.

10 Volatile Organic Compounds

DESCRIPTION OF THE HAZARD

10.01 Volatile organic compounds (VOCs) are a diverse group of organic chemicals that are gaseous at room temperature, and are found in a wide variety of materials in the home. Formaldehyde is included in this hazard category.

POTENTIAL FOR HARM

10.02 The majority of individual VOCs that are found in the home have no reported health effects. However, some may cause short term irritation and allergic reactions to the eyes, nose, skin and respiratory tract. Higher concentrations can result in headaches, nausea dizziness and drowsiness.

10.03 People's sensitivity to formaldehyde varies. It can be detected by nearly all people at a low level of concentration, typically 0.5 ppm by volume. Some people can detect it at a level of 0.2 ppm, while others may be unaware of its presence below 1.0 ppm. Above 0.5 ppm it can be irritating to the eyes, nose and respiratory tract.

10.04 Allergy sufferers, such as asthmatics, are most vulnerable, and may react to VOC exposure at levels below those that would affect others.

Most vulnerable age group and statistical averages used for rating

10.05 There is no specific vulnerable age group.

Volatile organic compounds
Average Likelihood and Health Outcomes by Persons of all ages

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses and Flats	Pre 1920	560	0.1	0.1	10	89.8	9 (J)
	Post 1979	320	0.1	0.1	10	89.8	16 (I)
	All	**560**	**0.1**	**0.1**	**10**	**89.8**	**9 (J)**

Basis of estimates

10.06 There is a weak quantitative evidence base. Therefore no revision has been made to the estimates of average likelihoods and outcomes from Version 1 of the HHSRS.

These averages use a base population of people living in dwellings which have been recently built or refurbished as these are most likely to be exposed to VOCs..

THE IDEAL

10.07 Means of ventilation should comply with Building Regulation *Approved Document F: Ventilation.*

10.08 British Standard *BS 5618* indicates criteria for the selection of suitable buildings and defines the procedures and precautions to be followed to provide for the satisfactory injection of urea-formaldehyde foam insulation (UFFI).

CAUSES AND PREVENTIVE MEASURES

10.09 VOCs, including formaldehyde, produce vapours at room temperatures. Many of the sources in dwellings are within the control of occupiers rather than building owners.

10.10 Sources typically within the control of building owners, and therefore considered in HHSRS rating include:

a) Urea formaldehyde foam insulation (UFFI);
b) Particle board, chipboard, plywood;
c) Combustion of fuel.

10.11 Sources typically within the control of occupiers, and therefore not usually considered in HHSRS rating include:

a) Normal metabolic products from occupants and pets;
b) Products such as cleaning agents and cosmetics;
c) Tobacco smoke;
d) Food preparation;
e) Paints, glues, solvents, furnishings and wall and floor coverings (see also biocides, below).[41]

10.12 Typical levels of VOCs found in UK homes do not present a risk to health. However, exposure to higher levels may be found, for example, during painting for extended periods of time.

10.13 Emission rates are affected by temperature, relative humidity, ventilation rates and occupant activity. Emission from building materials and treatments normally falls over the first year, although it will be affected by ventilation rates. Furnishings such as carpets and other fabrics will absorb, or if they have been pre-treated with VOCs, will release them later.

10.14 Emissions of volatile organic compounds from building materials and treatments and from furnishings should be minimised. Low emission materials and products should be used where possible. Dwellings should also be provided with means of ensuring adequate and appropriate ventilation.

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41 These sources may fall within the control of the owner, and if this is the case, would be considered in the HHSRS assessment of VOCs.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

10.15 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) VOC emitting materials - the use of materials during construction, alteration or maintenance which emit high levels of volatile organic compounds;
b) VOC emitting treatments - the use of treatments during construction, alteration or maintenance which emit high levels of volatile organic compounds;
c) Inadequate ventilation - inadequate or inappropriate provision for ventilation;
d) Disrepair - to the ventilation system.

HAZARD ASSESSMENT

10.16 Determination of the source of the odour is obviously necessary. It should be borne in mind that suspected VOC emission may be confused with other problems, such as faulty gas appliances and heating systems. Other potential sources of the odours should therefore also be checked. Where VOCs are the source of the problem it is necessary to establish whether or not they are building related, and therefore to what extent they will be considered in the HHSRS assessment.

Psychological Requirements

Space, Security, Light and Noise

11 Crowding and Space

DESCRIPTION OF THE HAZARD

11.01 This category includes all hazards threatening health that are associated with lack of space and crowding. This takes into account both the psychological requirements for social interaction and privacy, and the effects of crowding on space requirements for household activity.

11.02 It does not include consideration of the level of provision of sanitary appliances (water closets, wash basins, baths/showers, sinks) and kitchen facilities, in relation to the size of the dwelling. This is considered under *Personal hygiene, sanitation, and drainage* and *Food safety*

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

11.03 There is no specific age group more vulnerable than others.

11.04 The following table shows the average annual number of fatalities (Class I), hospital emergency admissions (Classes II and III) and GP consultations (Class IV), associated with overcrowding, for all age groups in different types of dwelling, mainly for the 3 years 1997 to 1999.

Crowding and Space
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	6,950	14.0	7.0	26.0	53.0	22 (**H**)
	1920-45	8,000	14.0	7.0	26.0	53.0	19 (**I**)
	1946-79	8,510	14.0	7.0	26.0	53.0	18 (**I**)
	Post 1979	12,570	14.0	7.0	26.0	53.0	12 (**I**)
Flats	Pre 1920	4,710	14.0	7.0	26.0	53.0	33 (**H**)
	1920-45	7,540	14.0	7.0	26.0	53.0	21 (**H**)
	1946-79	2,840	14.0	7.0	26.0	53.0	55 (**G**)
	Post 1979	-	14.0	7.0	26.0	53.0	0 (**J**)
All Dwellings		**8,000**	**14.0**	**7.0**	**26.0**	**53.0**	**19** (**I**)

Basis of Estimates

11.05 The statistics in the above table are based on regression analysis of data on mortality and on morbidity for persons of all age, as applied to dwellings that are below the bedroom standard and adjusted for socio-economic status, region and population density. The data for Class I comes from national mortality statistics, for Classes II and III from the Hospital Episode Statistics for 1996/97 to 1999/0 and for Class IV from the General Practice Research Database and the Fourth Morbidity Survey in General Practice.

11.06 For Class I the reported strong association between over-crowding and mortality may be reflecting socio-economic factors rather than the direct effects of crowding. Generally, there is a relatively weak evidence base for the production of these averages, due to the relatively small number of relevant cases and the influence of socio-economic factors as well as crowding.

11.07 There are difficulties in quantifying the effect of crowding on population mortality and morbidity This results from complications associated with differences in cultural practices, people spending only a proportion of their time at home, and other confounding socio-economic factors. People who live in crowded conditions also tend to suffer multiple deprivation, and separating the effect of poverty from crowding is difficult.

Health effects

11.08 Lack of space and overcrowded conditions have been linked to a number of health outcomes, including psychological distress and mental disorders, especially those associated with a lack of privacy and childhood development. Crowding can result in an increased heart rate, increased perspiration, and reduction of tolerance and of the ability to concentrate. Crowded conditions are also linked with increased hygiene risks, an increased risk of accidents, and spread of contagious disease.

11.09 There appears to be no particular age group which is more vulnerable than others. However, those most vulnerable will be those who spend the most time at home, typically the elderly, the very young, the mobility impaired and their carers.

THE IDEAL

11.10 There are no current model standards for overall space requirements which are mandatory for use in all dwellings.

11.11 However, the Housing Corporation, the regulatory body for all Registered Social Landlords (RSLs)[42], uses space standards related to probable occupancies (identifying the number of rooms required by different numbers of people), and identifies space requirements for typical furniture provision in rooms, and also requirements for accessibility and use by disabled people. These standards are applied to all new RSL developments by the Housing Corporation's *Scheme Development Standards*[43] through the Unit Size and Layout sections of the *Housing Quality Indicator system (HQI)*[44].

11.12 The Joseph Rowntree Foundation have developed a sixteen point *Lifetime Home*[45] standard, which includes space requirements in rooms and corridors. The *Lifetime Homes* standard promotes the concept that dwellings should be constructed to enable later adaptation to cope with residents' future disabilities, should they arise, whether the disability is of a temporary or permanent nature.

11.13 Many designers of new and converted dwellings, both in the private and public sectors, use the *Metric Handbook – Planning and Design Data*[46] as a guide to design standards. This refers to the Parker Morris standards, both the original Parker Morris[47] whole dwelling floor area standard, and Room Area standards (which are colloquially referred to as Parker Morris standards) and used in the housing association sector, and also by some planning authorities for their Unitary Development Plans. The *Metric Handbook – Planning and Design Data* quotes these Park Morris standards as minima, and also quotes recommended floor areas of a somewhat better standard.

11.14 The British Standards do not address whole dwelling requirements for space. However, *BS 6465 Pt II* deals with space requirements for sanitary installations (including

42 Registered Social Landlord (RSL) is the technical name for social landlords that are registered with the Housing Corporation — most are housing associations, but there are also trusts, co-operatives and companies.

43 Housing Corporation *Scheme Development Standard, 5th Edition*, 2003, Housing Corporation, London

44 *HQI* is a measurement and assessment tool designed to allow housing schemes to be evaluated on the basis of quality rather than simply of cost. See: ODPM, *Housing Quality Indicators form (Version 2)*, 2000, ODPM, London

45 Carroll, C, Cowans, J, Darton, D, *Meeting Part M and designing Lifetime Homes,* 1999, Joseph Rowntree Foundation,

46 David Adler, ed, *Metric Handbook – Planning and Design Data,* Second edition 1999, Architectural Press, Oxford

47 The space standards in *Homes for Today and Tomorrow*[47] published by the Parker Morris Committee in 1961 set out minimum floor areas for dwellings for various numbers of occupants for use in design of local authority housing. The application of these standards ceased to be mandatory for publicly funded buildings in 1981, and were never mandatory for private buildings.

bathroom and kitchen appliances). *BS 6465 Pt I* deals with the level of provision and separation of sanitary appliances in dwellings of varying sizes and types.

CAUSES AND PREVENTIVE MEASURES

11.15 Within a dwelling there should be sufficient space for the separation of different household activities, either by physical separation or by a clearly defined space within a larger space. The degree of separation is partly dependent on the number of people who can be expected to share the space, and whether or not they are expected to be part of the same household.

11.16 For some activities physical separation is more necessary than others. For example, whereas an open-plan arrangement can be acceptable for cooking, dining, relaxing and sleeping in a dwelling designed for occupation by a single person or couple (a common arrangement in a studio flat), where the accommodation is designed for occupation by a family, bedspaces should be in separate bedrooms. There should always be separation of bathing and toilet facilities. Indoor and outdoor play and recreation space is necessary in accommodation housing children. Outdoor play space should be readily visible from within the dwelling and safely separated from public and neighbouring areas

Social space and privacy

11.17 There should be sufficient space to provide for social interaction between members of the household, while allowing for private time away from other household members. However, too much space may lead to a sense of physical and social isolation, particularly for single persons.

11.18 Personal space and privacy needs are important for the individual members of the same household as well as for individuals or households sharing rooms and/or facilities. These needs vary reflecting both individual and cultural perceptions. Adolescents may need more space than the elderly. Small children need at least as much space as an adult. The need for privacy begins to develop from the age of eight and will be fully formed during puberty.

11.19 There should be a living area of sufficient size for the household or potential household.

11.20 To provide for adequate privacy for the user, each bath or shower should be sited in a bathroom and each sanitary closet should be sited in a bathroom or separate compartment provided with a lockable door. At least one wc compartment and one bathroom should be accessible from a circulation area (even where all bedrooms have en suite bathrooms).

11.21 There should be sufficient bedrooms for the household (or bedspace in a studio flat or bedsit designed for occupation by a single person or couple). A bedroom should not be accessed via another bedroom, it should lead off a circulation space. Bedrooms should be large enough to be useable for sleeping and for study or relaxing away from the other members of the household.

Effect of crowding on other hazard categories

11.22 Deficiencies with space and crowding can increase the risks associated with a number of other hazards. Generally, the risk of domestic accidents increases with increasing numbers of people per unit floor area. Where people and their belongings and furniture are crowded together, it may not be possible to keep circulation space or functional space around appliances clear. There may not be enough space in a kitchen if designed to cater for fewer people than are in occupation.

11.23 Space and crowding deficiencies can result in beds being placed too close to fixed heating appliances. The possible multi-use of socket outlets may overload an electric circuit, increasing the risk of fire.

11.24 Hygiene is also an issue. Where facilities are over-used, it may be difficult to maintain a good standard of personal and domestic hygiene, and sanitation.

11.25 Crowded conditions can result in a moisture burden above that which the dwelling is designed to safely deal with, and this can be a cause of condensation and high humidities, giving rise to associated health risk.

Multi-occupied buildings

11.26 Most of the issues identified above will be compounded by space and facilities being shared with other households. In terms of privacy, a higher standard may be expected where facilities are shared with other households. For example, whereas a partially glazed door may be acceptable to a single household bathroom, it would be unacceptable to a shared bathroom.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

11.27 Matters contributing to the likelihood of a hazardous occurrence and affecting the severity of outcome:

a) Living area: - lack of living area of an adequate size for the household or potential household;
b) Kitchen area: - lack of a separate kitchen area of adequate size;
c) Personal washing area: - lack of a separate, or an appropriately sited, or sized personal washing area;
d) Washing area door: - no door to the personal washing area or lock on door or glazed door;
e) Sanitary accommodation: - lack of separate, or an appropriately sited or sized , sanitary accommodation compartment;
f) Sanitary accommodation door: - no door to the sanitary accommodation compartment;
g) Number of bedrooms: - inadequate number of bedrooms for the household or potential household;
h) Bedroom size: - inadequate size of bedrooms;
i) Bedroom location: - inappropriately sited bedrooms;
j) Recreational space: - lack of safely fenced or guarded recreational space, readily visible from within the dwelling.

HAZARD ASSESSMENT

11.28 The assessment involves consideration of adequacy of provision for social and psychological needs in term of privacy, social space, children's play space, etc. Where deficiencies in space or crowding increase the risk from other hazards these other hazards are considered as *secondary hazards* to *crowding and space*.

11.29 Consideration of the hazard involves a two stage approach. First, with regard to the size and layout of rooms, and the occupancy level that might be expected to use the dwelling. Typically, depending on the sex of household members and their relationship, and the size of rooms, a dwelling containing one bedroom is suitable for up to two persons, irrespective of age. A dwelling containing two bedrooms is suitable for up to four persons. One containing three bedrooms is suitable for up to six persons, and one containing four bedrooms is suitable for up to seven persons.

11.30 At this stage, current occupancy is ignored, as is the case with all other hazard assessments, and the dwelling rated.

11.31 There is a supplemental stage to assess risks from crowding resulting from current occupancy. This involves a consideration of the number of people the dwelling is considered adequate for in the first stage of the assessment, above, and then determination of whether the dwelling is over-occupied, and if so the risk associated. The second stage of the approach, unlike all other hazard assessments, involves consideration of the crowding and space having regard to the current occupancy of the dwelling. The *Crowding and space* hazard is rated again for the current occupants, taking account of their ages and relationships. For example, whereas a two bedroomed house with one living room may be suitable for occupation by up to four people (irrespective of their ages), if it is occupied by a couple with their teenage son and daughter, it would be over-occupied, as the son and daughter require separate bedrooms.

Multi-occupied buildings

11.32 As with other hazard categories, the *crowding and space* assessment is made separately for each individual unit of accommodation, taking into account any shared space and amenities. Although the assessment is made for the unit of accommodation, account should be taken of the number of other households that could be expected to make use of shared spaces.

12 Entry by Intruders

DESCRIPTION OF THE HAZARD

12.01 This includes difficulties in keeping a dwelling secure against unauthorised entry and the maintenance of defensible space.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

12.02 There is no specific vulnerable age group.

Entry by intruders
Average Likelihood and Health Outcomes for Persons of all ages, 1999-2000

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Flats	Council	8	0.0	0.1	10.0	89.9	11 (**I**)
	HMOs	12	0.0	0.1	10.0	89.9	22 (**H**)
All Dwellings		**40**	**0.0**	**1.0**	**10.0**	**89.0**	**11** (**I**)

Basis of estimates

12.03 In the above table, the likelihood estimates are based on statistics from the British Crime Survey for 1999 and 2000 for all domestic burglaries in different types of neighbourhood area, as categorised by the ACORN classification system. The spread of health outcomes are those used for version 1 of the HHSRS and are based on a sample of dwellings from the English House Condition Survey 1996 with insecure doors and windows. It is assumed that for all burglaries there is some mental harm, the likelihood for aggravated burglary for all dwellings being only 1 in 5,556.

12.04 The average hazard scores are high because it is assumed that for all entry there is some harm. This attribution of harm may be an over-estimation; given emotional impact following burglary affected 83% of victims in 2002/03. However, there are occupiers who, while they have not been a victim of burglary, suffer worry and fear of being burgled and this mental stress is assessed as Class IV harm.

12.05 For aggravated burglary (burglary that involves some physical injury to an occupier) the average likelihood is 1 in 5,556 for all dwellings; 1 in 1,000 for areas of council flats with greatest hardship and a high proportion of lone parents; and 1 in 1,667 for multi-occupied houses in multi-ethnic low income areas. This is on the basis that the Home Office crime statistics indicate that on average the ratio of burglary to aggravated burglary to is about 139:1.

Health effects

12.06 Potential effects are:

a) the fear of a possible burglary occurrence or recurrence;
b) the stress and anguish caused by a burglary; and
c) injuries caused to occupants by an intruder (aggravated burglary).

12.07 Each year around 2% of households experience burglary with entry, and 1.5% of households experience attempted burglary. Offenders use violence in about 9% of burglaries, although in many incidents involving violence the offender has some prior relationship with the victim.

12.08 The most common harm suffered as a result of burglary, or fear of burglary, is emotional stress, with 28% of victims being affected "very much", 31% "quite a lot", and 24% "just a little" [48]. The emotional impact is greater for burglaries where there is successful entry to the dwelling.

12.09 Socio-economic circumstances are related to the risk of burglary and fear of burglary. Fear of burglary is brought about by knowing someone who has been burgled and by publicity about crimes. Whilst elderly people may be more fearful of walking on the streets after dark, they are less anxious about burglary than other age groups.

12.10 Generally, economically disadvantaged households are at a higher risk of burglary, with run-down inner city and the poorest council estates being most at risk. Also at high risk are flats and terraced properties. However, the risks are associated more with socio-economic factors (poverty and drugs), than with physical attributes, such as estate design and home security. For example, although areas of detached houses are generally at low-risk, in areas with a particular level of crime such housing tends to be at higher risk than other types.

12.11 There is variation in patterns of burglary, and fear of burglary, on a geographical basis. The highest levels of worry about burglary are in Yorkshire and Humberside and the North West, the West Midlands, and London regions. As might be expected, there is correlation with the level of actual burglary that occurs in these areas.

12.12 Tenure is also important, with occupiers of rented dwellings (private or social) being nearly twice as likely to be victims of burglary or attempted burglary than owner occupiers.

48 Crime in England and Wales 2002/2003, Home Office, London

THE IDEAL

12.13 British Standard *BS 82200 Guide for security of buildings against crime – Part 1: Dwellings* gives guidance and information on layout, landscaping, and security measures aimed at deterring burglars from selecting and entering dwellings, whether new or existing, single or multiple units. It covers measures to enhance the security of windows and external doors, access control, the use and deployment of security lighting, CCTV, intruder detection systems, and measures to improve security and reduce fear of crime.

CAUSES AND PREVENTIVE MEASURES

12.14 Estates should be laid out so that possible areas of concealment for burglars and intruders are reduced to a minimum. This includes providing both public and private space that the residents feel is theirs (defensible space), ensuring pedestrian routes are well lighted and defined, and siting dwellings so as to provide a natural view of neighbouring properties. Although estate design and layout are not usually the responsibility of building owners. However, the surrounding area, including both the estate design and the level of crime, affect the level of security appropriate at a dwelling.

The dwelling itself should be capable of being secured against unauthorised entry, which will both delay and deter intruders and will make the occupants feel safer. The design of the building and its curtilage should include clearly defensible space.

12.15 In the majority of successful burglaries, some force is used to effect entry. The risk of entry increases with declining levels of security. The use of window locks or deadlocks, burglar alarms, security lights and window grilles reduce risk of an occurrence considerably. Spy holes and chains on entrance doors can help. Fencing can hinder burglars. It can also help them if it is easy to climb, or they can hide behind it.

12.16 However, creating fortress-like dwellings may have a negative effect on the health of occupiers. There is a balance to be made between security features and any associated increased risks from other hazards. Security measures can hamper or obstruct means of escape in case of fire, and the fire brigade may have difficulties and be delayed in rescuing occupants, thus increasing risks associated with the *fire* hazard. For example, in multi-occupied buildings mortise deadlocks fitted to external doors present an increased risk, because keys are unlikely to be readily to hand in the event of fire. If security features result in windows not being readily openable, this can increase the risks from excessively high room temperatures as well as fire. The risks associated with fire and room temperatures can outweigh the benefits to security.

Multi-occupied buildings

12.17 In multi-occupied buildings there have been reductions in crime and fear of crime where concierge systems or entry-phone controls have been introduced.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

12.18 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of health outcome include:

a) Location: - high level of poverty and crime in the area;
b) Defensible space: - both public and private around the dwelling;
c) Lighting: - pedestrian routes to an estate or immediate neighbourhood, entry points to dwelling, including any security lighting;
d) Pedestrian routes: – definition of routes to an estate or immediate neighbourhood;
e) Housing layout: – no natural unobtrusive view of neighbouring dwellings;
f) Doors and windows: - insubstantial construction, disrepair or inadequate locks;
g) Door viewers: - lack of viewers to external doors;
h) Door chains: - lack of or broken chains to external doors;
i) Concierge etc: - concierge or entry-phone system to a block of flats; and
j) Burglar alarms: - lack of or defective alarm system.

HAZARD ASSESSMENT

12.19 The level of physical security features at a dwelling need to be appropriate to the overall crime rate in the neighbourhood, and the assessment should take both into account.

12.20 In both the assessment of likelihood and the spread of harm outcomes fear of crime as well as the risk of any actual burglary (whether aggravated or not) should be considered.

Multi-occupied buildings

12.21 There are elevated risks of burglary associated with multi-occupied buildings. Not only is security of the building important (ie, restricting unauthorized entry into the building), but security within the building is also an issue, both in terms of entry by intruders, and security of individual householders' belongings from other residents of the same building. These risks must also be taken into account in the overall *entry by intruders* hazard assessment.

13 Lighting

DESCRIPTION OF THE HAZARD

13.01 This category includes threats to physical and mental health associated with inadequate natural and/or artificial light. Also included is the psychological effect associated with the view from the dwelling through glazing.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

13.02 No particular age group appears more vulnerable than others.

Lighting
Average Likelihood and Health Outcomes by Persons of all ages,

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses and Flats	Pre 1920	320	0.1	1.0	10.0	89.0	18 (**I**)
	Post 1979	1,000	0.1	1.0	10.0	89.0	6 (**J**)
All Dwellings		**560**	**0.1**	**1.0**	**10.0**	**89.0**	**11 (I)**

Basis of estimates

13.03 There is a weak quantitative evidence base, and no revisions have been made to the estimates on average likelihoods and outcomes from Version 1 of the HHSRS. The Version 1 averages used a base population of people living in dwellings with defective lighting[49].

49 Note that for Version 2 averages generally the base population for hazard statistics is the total population in the vulnerable group.

13.04 There is little quantitative information on the numbers of people affected by threats associated with *lighting*, particularly those suffering from Class I to III harms. However, there are in excess of 100,000 people affected by Class IV harms annually.

Health effects

13.05 There are a number of distinct types of health conditions which can be caused by inadequate light –

a) Depression and psychological effects can result from a lack of natural light or the lack of a window with a view. Increasing numbers of people are disturbed by intrusive artificial external lighting at night.
b) Eye strain can result from glare and a lack of adequate light (natural or artificial).
c) Flicker caused by certain types of artificial light causes discomfort and may cause photo convulsive reactions to those susceptible.

13.06 The elderly and those with impaired vision are more likely to be unable to detect potential hazards, where there is inadequate or excessive light. In addition, the vision of the elderly is slow to adjust to changes in light levels.

THE IDEAL

13.07 British Standard *BS8206 Code of Practice Parts 1 and 2* refer to requirements for artificial and natural lighting.

13.08 The Chartered Institution of Building Services Engineers (CIBSE) publish various guides on lighting, including *Code for Lighting, Lighting Guide LG10: Daylighting and Window Design,* and *Lighting for communal residential buildings.*

CAUSES AND PREVENTIVE MEASURES

The layout of the dwelling, particularly living rooms and kitchens, and of recreation space, should provide for access to sunlight. There should be sufficient natural light during daylight hours to enable normal domestic tasks to be carried out without eyestrain.

There should not be excessive overshadowing by adjacent buildings or other features such as trees which may obstruct daylight.

Windows should be of adequate size, and of appropriate shape and position to allow for reasonable daylight penetration into rooms. Basement and sub-ground level rooms can pose particular problems, but there should be sufficient adequate open space outside the window to allow for adequate light penetration.

Artificial lighting should be so positioned to provide sufficient light to enable domestic and recreational activities to be carried out without eyestrain and without creating glare or shadows. Artificial light is particularly important where domestic tasks require adequate light, for example in the kitchen over worktops, sinks and cookers. Glare and obvious flicker should be avoided to allow for safe use and movement by occupants throughout the dwelling.

There should be a view out of all rooms other than those where privacy is required such as bathrooms and wc compartments. The view should be of open space and should also provide for supervision of outside recreation space and of the means of access to the dwelling for security purposes.

Windows should be wide enough to provide for a reasonable view of the immediate surroundings. Sills in living areas should be low enough to allow a seated person a reasonable view, however this must be balanced with risks associated with *falls from windows, landings and balconies,* and safety glass should be provided in vulnerable locations. Window heads should be above the eye level of someone standing.

Flats and other multi-occupied buildings

13.09 The worst problems with lighting are often found where dwellings are located wholly at basement level. On occasions there are also problems where dwellings are entirely at attic level and are fitted solely with Velux type windows or skylights, affording no other view than the sky. This can lead to feelings of isolation.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

13.10 Matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Obstruction - of windows by buildings or other features;
b) Size, shape and position - Inadequate size, inappropriate shape and/or position of windows preventing reasonable penetration of daylight into room;
c) Position of artificial lighting - Inadequate means and/or inappropriate siting of artificial lighting;
d) Control of artificial lighting - Lack of sufficient, accessible switches to control artificial lighting;
e) Glare etc - Artificial lighting causing glare, shadows and/or obvious flicker;
f) Window view - Inappropriate shape and/or size of window preventing view of outside;
g) Outlook - Lack of reasonable view through living room windows.

HAZARD ASSESSMENT

13.11 The assessment involves consideration of the proportion of rooms and other areas where lighting, or views from rooms, is defective, and the seriousness of those problem areas. The adequacy of both artificial and natural lighting should be considered, and the assessment, as with all hazards, is of the dwelling as a whole.

14 Noise

DESCRIPTION OF THE HAZARD

14.01 This category includes threats to physical and mental health resulting from exposure to noise in the home.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

14.02 There is no age group more vulnerable than others.

Noise
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	760	0.0	1.0	9.0	90.0	6 (J)
	1920-45	870	0.0	1.0	9.0	90.0	5 (J)
	1946-79	940	0.0	1.0	9.0	90.0	5 (J)
	Post 1979	940	0.0	1.0	9.0	90.0	5 (J)
HMOs	Pre 1920	620	0.0	1.0	9.0	90.0	7 (J)
	1920-45	670	0.0	1.0	9.0	90.0	7 (J)
	1946-79	840	0.0	1.0	9.0	90.0	5 (J)
	Post 1979	2,070	0.0	1.0	9.0	90.0	2 (J)
All Dwellings		**900**	**0.0**	**1.0**	**9.0**	**90.0**	**6 (J)**

Basis of estimates

14.03 For Class I to III health outcomes there are specific codes in the 10th version of the International Classification of Diseases (ICD-10) that relate to the psychological effects of noise and these potentially allow an examination of mortality from suicide and Class II and III harms associated with hospital admissions. For Class IV it has been

assumed that around 5% of the population have some evidence of common mental disorder, and that of these one in twenty are adversely affected by noise.

14.04 It is unclear, however, how well these figures reflect the true risks from noise as patients may be admitted (or die) under other more general diagnosis codes. Consequently, there may be some under-estimation of the risks attributable to noise, in particular in relation to Class I, II and III harms, and the assumptions made in estimating the incidence of Class IV harms are broad.

14.05 There are difficulties in estimating the total number of people who suffer ill-health as a result of noise each year, especially as the non-auditory effects (resulting in cardio-vascular disease and allergies, etc), are unquantifiable at present. However, between 7.5 and 18% of households (that is 1.2-2.9 million) in the UK are dissatisfied because of noise from neighbours; 5.5% because of road traffic noise; and 4.0% because of people outside.

Health effects

14.06 The best understood effects of noise are psychological disturbances and physiological changes resulting from annoyance and sleep disturbance. Typical health effects are stress responses, sleep disorders and lack of concentration. There is some evidence of correlation between noise and stress induced raised blood pressure and altered blood constituents. Headaches, anxiety and irritability are also associated with noise induced stress, and the effects of sleep disturbance may affect mood the following day. Extreme psychological outcomes include suicide, and assault due to aggravation over noise. However, hearing loss and impairment caused by noise in dwellings is unlikely.

14.07 There is less certainty about the physiological effects resulting from exposure to noise, other than those linked with annoyance and stress. However, there is increasing evidence that noise causes problems without consciously awakening the individual from sleep. This noise induced arousal causes secretion of cortisol, especially in the first half of the night, and can lead to increased risk of cardiovascular disease.

14.08 Children under combined exposure to traffic related noise and air pollution have been found to have relative risks of chronic bronchitis, asthma and skin allergies, which cannot be explained by air pollution alone.

14.09 Those most vulnerable are those who are likely to spend more time at home, including the elderly, the very young and their carers. Noise causing sleep disruption will affect all groups, but particularly the elderly.

14.10 Men tend to respond to noise with outwardly directed aggression, describing their feelings as annoyance, aggravation, bitterness and anger. Women tended to suppress their reactions to noise and direct them inwards, saying that they are tense, fraught or anxious.

THE IDEAL

14.11 Dwellings should be provided with sufficient sound insulation to prevent excessive noise penetrating. At a minimum, the requirements of Building Regulations *Approved Document E* should be achieved.

14.12 The World Health Organisation Guidelines[50] indicate the values for the onset of health effects from noise exposure, as follows. Indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for single sound events. To protect the majority of people from being seriously annoyed during the daytime, the sound pressure level on balconies, terraces and outdoor living areas should not exceed 55 dB LAeq for a steady, continuous noise. To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB LAeq. At night sound pressure levels at the outside facades of the living spaces should not exceed 45 dB LAeq and 60 dB LAmax, so that people may sleep with bedroom windows open.

CAUSES AND PREVENTIVE MEASURES

14.13 Noise in the home is a common complaint; a national noise attitude survey found that one in three people said that environmental noise disturbed their home lives to some extent. In making comparison with the World Health Organisation Guideline levels, referred to in the Ideal above, it is worthwhile noting that in England and Wales around 56% of the population are exposed to daytime noise levels exceeding 55 LAeq, and that around 65% are exposed to night-time noise levels exceeding 45 LAeq (as measured outside the house in each case in 1993). Many of these people who are disturbed by noise will not suffer any Class I to IV harms.

14.14 People vary greatly in their sensitivity and tolerance to noise, tolerance may in part be determined by age, sex, working status, lifestyle and personality. While noise levels can be measured, people differ in what sources of noise they find offensive. Noises likely to be tolerated are from neighbours in the daytime, some traffic noise and deliveries of milk, post and newspapers. Unlikely to be tolerated are usually loud and continuous noises which seem to go on indefinitely, noises thought to be unnecessary or inconsiderate, noises with uncertain sources, especially at night. Emotive and frightening noises, shouting and violent rows are badly tolerated.

14.15 Residents of rented accommodation are more likely to report noise as a serious problem than owner occupiers, particularly those who rent flats.

14.16 There are strong indications that night time traffic noise exposure is more dangerous to health than day time noise exposure.

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50 WHO, *Guidelines for Community Noise,* 1999, WHO, Geneva. See also http://www.euro.who.int/eprise/main/WHO/Progs/NOH/Home

To prevent problems from traffic and other outside noise, the level of insulation should relate to the ambient noise levels. Where noise levels are high, double or secondary glazing and lobbies to external doors may be necessary. Triple glazing may be necessary close to airports or other sources of very high noise levels. Insulation of the upper floor ceiling and roof space will be important where aircraft noise is likely.

Noise from plumbing, including from water closets and cisterns, can be reduced by siting them away from a separating wall. Bathrooms and wc compartments in flats should not be sited above living rooms or bedrooms.

14.17 Poor workmanship in construction or conversion, particularly to partition and party walls, can reduce the sound attenuation properties of a structure.

Separating walls and floors, particularly in flats and maisonettes, should be properly constructed to reduce impact and airborne sound transmission.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

14.18 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Site of dwelling:- located in a particularly noisy environment;
b) Internal insulation: -inadequate construction and/or insulation of floor/ceiling structure within the dwelling or between the dwelling and other premises;
c) External insulation: - inadequate levels of sound insulation to external structure;
d) Disrepair:- despair of windows and/or external or internal doors allowing increased noise penetration;
e) Siting of plumbing: - inappropriate siting of plumbing fittings and/or facilities;
f) Equipment: - Noisy equipment or facilities
g) Door closers - overly powerful mechanisms resulting in banging.

HAZARD ASSESSMENT

14.19 Where ordinary domestic noise(for example the noise from the use of electric switches, toilet flushing, television, ordinary conversation, etc) from one dwelling enters another, this is associated with poor sound insulation. It will be included in the assessment of the *noise* hazard. Traffic, or other ambient external noise, is also relevant. However, where noise originates from the unreasonable behaviour of neighbours (whether domestic or commercial), then this is not taken into consideration in the assessment.

14.19 The initial examination will usually be a subjective assessment of noise together with a visual examination, where possible, of sound insulation provision. The inspection may have to be carried out at night. Measurement of noise levels using properly calibrated noise meters can be helpful to confirm the subjective assessment.

14.20 Building Regulation *Approved Document E* sets out sound insulation tests which are appropriate to measure compliance with current standards of construction and alteration, and refers to British Standard tests for sound insulation. A dwelling that complies with current Building Regulations would not usually present a noise problem, although this may not always be the case.

14.21 In making the HHSRS assessment, it is more appropriate to consider the noise levels that are experienced within the dwelling than to measure the performance of the building. This will more readily take into account the noise conditions of the immediate environment in which the dwelling is located. In some situations it may be appropriate to provide additional insulation measures above those required by the Building Regulations, for example where the dwelling is located in the flight path to an airport.

Protection against Infection

Hygiene, Sanitation and Water Supply

15 Domestic Hygiene, Pests and Refuse

DESCRIPTION OF THE HAZARD

15.01 This category covers hazards which can result from:

a) Poor design, layout and construction such that the dwelling cannot be readily kept clean and hygienic;
b) Access into and harbourage within the dwelling for pests; and
c) Inadequate and unhygienic provision for storing and disposal of household waste.

15.02 It does not include hazards associated with sanitation and drainage, domestic water, personal washing facilities and food safety. However, defects to those facilities that could result in a hazard from pests, are considered under *15Domestic hygiene, pests, and refuse.*

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

15.03 There does not appear to be any age specific vulnerable group more vulnerable than others.

Domestic Hygiene etc
Average Likelihood and Health Outcomes by Persons of all ages

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses and Flats	Pre 1920	56	0.0	0.1	1.0	98.9	25 (H)
	Post 1979	100	0.0	0.1	1.0	98.9	14 (I)
All Dwellings		**100**	**0**	**0.1**	**1**	**98.9**	**25 (H)**

Basis of estimates

15.04 There is a weak quantitative evidence base, and no revision has been made to the estimates of average likelihoods and outcomes from Version 1 of the HHSRS. These averages use a base population of people living in dwellings with defective cleanability in the kitchen or bathroom, or where pests are present.

15.05 The risk that pests and poorly stored or accumulated refuse pose to health is difficult to quantify as little epidemiological work in this area has been reported recently.

Health effects

15.06 The potential health outcomes are gastro-intestinal disease (from spread of infection), and asthma and allergic rhinitis (from allergens). Household waste may, in addition, present a physical hazard of cuts to young children. Emotional distress is also commonly associated with pest infestations, and accumulations of refuse and premises which are difficult to keep clean may be a cause of depression and anxiety.

15.07 Insect pests can cause allergic reactions. Children who live in dwellings visibly infested with cockroaches show high levels of sensitivity to cockroach allergen. Contact with cockroaches can cause dermatitis, uticaria, rhinitis, bronchitis and asthma. Some people have an aversion to cockroaches amounting to a phobia and can suffer anxiety when in the presence of the insects.

15.08 Insects are also responsible for food spoilage, rendering it unpalatable if not inedible. Insect pests, including flies and cockroaches, are known to be mechanical vectors of diseases, picking up disease causing organisms on their bodies from one source and transferring it. Their behaviour means that they travel from matter such as rotting garbage and animal fæces that are infected to food intended for human consumption.

15.09 Rats and mice are known to be infected with pathogenic organisms. Rats have been found to be infected with such zoonotic agents as Yersinia entercolitica (Yersiniosis), Listeria spp (Listeriosis), Cryptosporidium parvum (Cryptsporidiosis), Toxoplasma gondii (Toxoplasmosis), Leptospira spp (Leptospiral Jaundice or Weil's disease), Trichinella spiralis and Trichuris spp (Whipworm infection).

15.10 Birds, such as pigeons, can cause nuisance, carry diseases including Salmonella and can harbour biting insect pests such as the Martin Bug in their nests.

15.11 All age groups may be vulnerable to infections associated with dirt, dust and those passed on by pests. Young children may be the most vulnerable to infection and cuts associated with poorly stored refuse, through lack of awareness of dangers. Asthmatics and those with pest allergies will be most vulnerable to allergic reactions to pests.

THE IDEAL

15.12 Building Regulations *Approved Document H* covers rodent control in relation to drainage systems.

15.13 British Standard *BS5906 Code of Practice for Storage and on-site treatment of solid waste from buildings* includes recommendations for methods of storage for refuse from residential premises, including both individual houses and multi-occupancy buildings, and lays down recommended practices for collection and hygiene.

CAUSES AND PREVENTIVE MEASURES

The design, construction and subsequent maintenance of the dwelling should enable it to be kept clean, preventing the build-up of dirt and dust which may enable organisms to multiply. Areas of the dwelling intended for personal washing, sanitation or for food storage, preparation and cooking should be capable of being maintained in a hygienic condition.

15.14 Pests create a risk of cross-contamination and infection, carry disease and can infect food and surfaces. Structural defects, such as broken vents to suspended timber floors, can enable the entry of pests and rodents to the house. There are also instances where rats have gnawed through plastic covers to wall ventilators. Urban rat infestations do show an association with poor environments and areas of poor quality or multi-occupied housing.

The design and construction should reduce, so far as is possible, any means of access by pests from the outside into the dwelling. Possible harbourage sites within the dwelling should be limited, and should be accessible for treatment if necessary.

Walls and ceilings should be smooth and even to enable them to be easily cleaned and decorated. Walls and ceilings should be free from cracks which could provide harbourage for insect pests. Floors should be smooth and even so they can be easily kept clean. All internal surfaces should be smooth, even and free from cracks and crevices which may allow entry by, or give harbourage to, pests. Joints between walls and floors and between walls and doors and windows should be effectively sealed. Wherever possible materials should be resistant to attack by pests, including attack by gnawing. The exterior of the dwelling should be free of cracks and unprotected holes. Where

breaches of the walls or roof are necessary, grilles or other methods should be used to protect these.

15.15 Service ducts and holes around pipes such as central heating pipes can provide harbourage for insects such as cockroaches and tropical ants. They may also provide routes for access between dwellings in blocks.

Any spaces within the dwelling such as service ducting, roof spaces and under floor spaces and service ducting, should be capable of being effectively sealed off from the living area. There should be means of access to these spaces for treatment in case of any infestation.

Generally, dwellings should be designed and constructed so as to reduce, so far as is possible, gaps or voids that may be inaccessible to the dwelling occupants, and which may provide harbourage for pests. Particular attention should be given to the siting of such fittings as hot water tanks and boilers.

15.16 Rodents are perpetual inhabitants of the sewers, from where they can readily gain access to drains. Unless prevented, they will travel from drains into dwellings where they may spoil large quantities of food both by gnawing and through indiscriminate fouling.

All openings into drains should be sealed with an effective water seal; this includes openings such as into the wc basin and drainage inlets for waste and surface water.

15.17 Damaged or ill fitting doors and windows can provide means of access for rats and mice.

To prevent mice entering there should be no holes or gaps in excess of 6.25mm (¼ in). Service entry points should be effectively sealed as should any points in walls penetrated by waste, drain or other pipes or cables.

There should not be any holes through roof coverings, eaves and verges which might allow access into the roof space of rats, mice, squirrels or birds. Any necessary holes for ventilation should be covered with grilles.

15.18 Household waste should be stored in such a way that children do not have access to it, and that pests can not have easy access. One of the major sources of harm from inadequate waste disposal is through the harbouring of pests enabling them to multiply. If the household waste is stored securely and regularly collected there is little risk of infection.

15.19 Poorly stored food waste will attract pests including flies, cockroaches, ants, wasps, mice, rats, birds, foxes, squirrels, cats and dogs. Some of the insect pests may use the waste for harbourage, as a site for egg-laying and development of larval stages, and all can be vectors for pathogenic organisms which may breed in the food-associated waste. These pests may then come into contact with food before it is prepared or eaten or may come into direct contact with persons.

15.20 Unless properly disposed of, the potential dangers from household waste will increase as pathogenic organisms multiply. In addition, the waste will become a source of smells.

There should be suitable and sufficient provision for the storage of refuse awaiting collection or disposal outside the dwelling. There should also be suitable and sufficient provision for the storage of household refuse within the dwelling. The storage provisions should be readily accessible to the occupants, but sited so as not to create a danger to children. The refuse facilities should not cause problems of hygiene, nor attract and allow access to pests.

For houses, bungalows and houses converted to self-contained flats, there should be a clearly defined area for refuse containers. This is best in the open air, and away from windows and ventilators, and, if possible, in shade or in a shelter.

Multi-occupied buildings

For dwellings in purpose built blocks with not more than four storeys, refuse provision can be either by use of chutes, or by waste storage containers with free ventilation.

For dwellings in purpose built blocks with more than four storeys, communal chutes are recommended (unless solid fuel appliances are installed). The chutes should discharge into large containers within a store. Any such store should be designed, constructed and maintained to reduce, so far as is possible, invasion by pests. It should also be sited, designed, constructed and maintained so as not to allow air from the store to enter any living space.

15.21 Multi-occupied buildings with common service ducts, and particularly those with district heating systems and consequent year-round warm conditions, can present ideal conditions for infestations of German cockroaches (*Blattella germanica),* and for tropical ants (eg, *Monomorium pharaonis).* Treatment of infestations requires a coordinated approach to ensure pockets of infestation do not re-infest treated parts of a building.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

15.22 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Internal walls and ceilings:- uneven and/or cracked internal walls and/or ceilings;
b) External walls & roof:- missing or damaged brickwork, including airbricks, to external walls and other disrepair to external walls and roof;
c) Ventilators:- other unprotected ventilators to walls and/or roofs;
d) Solid floors:- uneven and/or cracked solid floors;
e) Suspended floors:- uneven and/or open-jointed boarding to suspended timber floors;
f) Under floor space:- ill fitting covers or lack of means of access to under floor spaces to facilitate treatment;
g) Roof space:- ill fitting covers or lack of means of access to roof spaces to facilitate treatment;

h) Skirting and architraves:- loose and/or ill-fitting skirting boarding or architraving;
i) Windows and doors:- ill fitting doors and/or windows;
j) Windows and door frames:- open joints between window and/or door frames and adjacent walls;
k) Ducts and pipework:- open joints to service ducting and/or pipework;
l) Access to ducts:- lack of means of access into service ducting to facilitate treatment;
m) Service entry points:- open joints to service entry points;
n) Water seals:- defective water seals to wc basins and/or drainage inlets;
o) Disrepair to drains:- including sewers and/or inspection chambers;
p) Open vent pipes:- missing guards to drainage vent pipes;
q) Design deficiencies:- harbourage points created through poor design and/or construction;
r) Internal refuse areas:- the lack of, or defects to, any internal refuse storage space;
s) External refuse areas:- the lack of, or defects, to any clearly defined area for refuse containers;
t) Refuse chutes etc:- the lack of or defects to means of disposal of refuse to each floor of multi-occupied buildings.

HAZARD ASSESSMENT

15.23 It is the overall combined risk from potential infestations and any problems associated with refuse disposal and domestic hygiene generally, which is considered in the one assessment under this hazard category.

16 Food Safety

DESCRIPTION OF THE HAZARD

16.01 This category includes threats of infection resulting from inadequacies in provision and facilities for the storage, preparation and cooking of food.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

16.02 There is no age specific vulnerable group used for statistical purposes or for rating.

Food Safety
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	3,590	0.0	2.0	22.0	76.0	3 (J)
	1920-45	4,880	0.0	2.0	22.0	76.0	2 (J)
	1946-79	5,730	0.0	2.0	22.0	76.0	2 (J)
	Post 1979	20,270	0.0	2.0	22.0	76.0	0 (J)
HMOs	Pre 1920	3,150	0.0	2.0	22.0	76.0	3 (J)
	1920-45	3,700	0.0	2.0	22.0	76.0	3 (J)
	1946-79	4,420	0.0	2.0	22.0	76.0	2 (J)
	Post 1979	-	0.0	2.0	22.0	76.0	0 (J)
All Dwellings		**4,960**	**0.0**	**2.0**	**22.0**	**76.0**	**2 (J)**

Basis of estimates

16.03 In the above table, Class I heath outcomes are derived from the mortality statistics, Class II and III from the Hospital Episode Statistics and Class IV from notified cases of food poisoning, inflated to allow for a suggested non-random under estimation of infectious intestinal disease in GP data. A number of assumptions have also been made to establish relative risks for food safety relating to the condition of the dwelling. These include establishing how many cases arise in the dwelling compared to elsewhere

and how many of these are due to personal behaviour and ignorance of the risks involved in food preparation. It has been estimated that 40% is associated with poor personal behaviour.

16.04 There is, therefore, some difficulty in attributing reported illness directly to housing conditions. This and the fact that no mental ill-health has been attributed to this hazard category in the generation of the statistics means that the average likelihoods probably represent an under estimation of the true risk..

Health effects

16.05 Foods (and liquids such as milk) can become a source of food poisoning through contamination, the multiplication of micro-organisms through poor or inappropriate storage, or through inadequate cooking. Illnesses resulting from food poisoning range from mild stomach upset through to death from infectious gastro-intestinal disease, or hospital admission because of severe diarrhoea, vomiting and dehydration. However, the majority of mild gastro-intestinal infections which result from food poisoning go unreported, and are not shown in the statistics used in this Guidance.

16.06 It is estimated that in the general UK population there are approximately 86,000 cases of food poisoning annually (just over half are formally notified and data on the others is from other sources). It is estimated that at least 50% of these cases arise in the home, with some estimates putting the figure even higher – 86% for Salmonella and 97% for *Campylobacter*.

16.07 Food poisoning is observable in all age groups, and in residents of all types and ages of dwelling. However, those most susceptible are the young, especially infants, the elderly and pregnant women These groups may also suffer more severe outcomes.

THE IDEAL

16.08 The hygienic and safe design and layout of domestic kitchens is not covered by a national model standard applicable to all dwellings. However, the Housing Corporation, the regulatory body for all Registered Social Landlords (RSLs)[51], in its *Scheme Development Standards*[52] identifies space and layout requirements in kitchens through the Unit Layout section of the *Housing Quality Indicator system (HQI)*[53].

16.09 Requirements concerning sink installation and space requirements are addressed by British Standard *BS 6465 Parts I and II*. There are a number of other British Standards which deal with the design requirements of different types of sinks, and cookers.

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51 Registered Social Landlord (RSL) is the technical name for social landlords that are registered with the Housing Corporation — most are housing associations, but there are also trusts, co-operatives and companies.

52 Housing Corporation Scheme Development Standard, Fifth edition, 2003, Housing Corporation, London

53 HQI is a measurement and assessment tool developed by the Government and designed to allow housing schemes to be evaluated on the basis of quality rather than simply of cost. See: ODPM, Housing Quality Indicators form (Version 2), 2000, ODPM, London

CAUSES AND PREVENTIVE MEASURES

16.10 Hygienic facilities for the storage, preparation and cooking of food will help reduce the risk of food poisoning and will promote safe food practice.

Kitchen facilities should be in a properly designed room or area, laid out so as to make safe and hygienic preparation and cooking of food easy.

Storage

16.11 To help slow down deterioration and decomposition, food should be stored appropriately. In particular, storage facilities should enable cooked and uncooked food to be kept separate to prevent cross contamination.

16.12 There should be facilities of adequate size (see above) for the number of occupants for the hygienic storage of fresh foods such as meat, milk, dairy products and fish. Each such facility should consist of a food cupboard or larder. In addition to larder or food cupboard, there should be sufficient space for a refrigerator and a freezer for each household. Such spaces should be appropriately sited and adjacent to each should be appropriate power sockets.

These facilities should be finished internally and externally with smooth impervious surfaces capable of being readily cleansed and maintained in a hygienic condition. There should be separate shelves to enable different foods to be stored apart. The facilities should be cool and dry and protected against direct sunlight.

Preparation

16.13 Sinks are used for the washing and preparation of food, for the washing-up of food preparation and cooking equipment and utensils, and for the washing-up of cutlery and crockery. They may also be used for clothes washing (see *17 Personal hygiene, sanitation and drainage)*. Cracks, chips or other damage to the internal surface may prevent thorough cleansing and provide for harbourage of pathogenic and food spoiling organisms.

There should be an adequately sized sink. There should be a drainer which drains into the sink, or, as an alternative, a dual sink. The sink should be strong enough to safely take the weight of the water and equipment and utensils.

A supply of cold water is necessary for food washing and preparation. For washing-up of equipment and utensils, and for cleaning worktops and cookers, there should be a supply of hot water. The sink should be properly connected to pipes which safely carry away waste water to discharge it into a drainage system.

The internal surfaces of the sink and drainer should be smooth, impervious and capable of being readily cleansed and maintained in a hygienic condition.

16.14 Worktops are used for the preparation of food, including rolling out pastry, supporting chopping boards for cutting raw and cooked food, and for the dishing-up of food from cooking utensils into serving bowls and onto plates. Cracks, chips or other damage to the surface may prevent cleansing and provide for harbourage of pathogens and food spoiling organisms. Electrical equipment such as kettles, food processors and microwave cookers will also be used on worktops.

Worktops should be of adequate size for all the equipment and other food preparation activities and securely fixed. The surface of a worktop should be smooth, impervious and capable of being readily cleansed and maintained in a hygienic condition.

There should be at least four appropriate power sockets associated with the worktop(s), as well as two sockets for general use.

Cooking

16.15 There should be space for the installation of cooking facilities should be sufficient to take facilities of adequate size for the household, with appropriate connections for fuel (gas or electricity).

In furnished accommodation, cooking facilities provided should be of adequate size for the household. The various parts of the facilities should be capable of being readily cleansed and maintained in a hygienic condition.

Design, layout and state of repair

16.16 Damp affected surfaces may degrade and become friable, and may also support growth of micro-organisms, presenting a risk of contamination of food. Humid conditions can cause food to decay more quickly.

Kitchen areas and the facilities for the storage, preparation and cooking of food should be constructed, designed, and maintained, so as to enable food to be stored and prepared safely and hygienically.

The surface of the floor to the kitchen area should be reasonably smooth and impervious and capable of being readily cleansed and maintained in a hygienic condition. Corners and junctions should be sealed and covered to avoid uncleanable junctions.

Wall surfaces should be smooth and capable of being readily cleansed. Surfaces immediately adjacent to cookers, sinks, drainers and worktops should be of an impervious finish and the joint between any sink, drainer or worktop and the adjacent wall should be sealed and watertight.

The layout and relationship of facilities should ease the stages of preparation, cooking and serving.

There should be adequate and appropriate lighting to the kitchen area and particularly over the facilities.

There should be appropriate means of ventilation of the whole of the kitchen area and in particular the cooking area.

Flats and other multi-occupied buildings

16.17 A degree of lack of communication between individuals from different households is to be expected, and this leads to an increased risk of food poisoning. For example, if a single household uses facilities, it is easier to ensure that boards for

chopping raw meats are not used for chopping cooked food, than if there are multiple households sharing the facilities.

16.18 When facilities are shared there is often confusion over responsibility for cleaning, or poor management of cleaning, which can lead to a poor standards of hygiene.

16.18 Often there is a higher ratio of people to facilities than is usually found in singly occupied dwellings when facilities are in shared use, and this also leads to a higher risk of infection.

16.19 Separate food storage, preparation and cooking facilities for different households will reduce the risk of food poisoning and also reduce stress and anxiety associated with shared use.

16.20 Where a kitchen is for shared use, provision of hygienic and readily cleansable surfaces (floor, walls, worktops, etc) is even more important than in kitchens for single household use.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

16.21 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

Storage

a) Food storage facilities:- the absence of properly designed facilities of adequate size for the household;
b) Impervious surfaces:- lack of smooth, easily cleansed surfaces;
c) Disrepair to storage facilities:- or dampness to the facilities;
d) Space for fridge and freezer:- lack of appropriately sited space for a refrigerator and freezer; and
e) Power sockets:- lack of sufficient power socket outlets.

Preparation

f) Sink provision:- the absence of a kitchen sink, with a separate supply of cold drinking and hot water for each household;
g) Drainer to sink:- the absence of a drainer to each sink or the absence of a dual sink;
h) Kitchen worktops:- the lack of sufficient worktops with adjacent power sockets; and
i) Disrepair:- to the sinks, drainers or worktops.

Cooking

j) Provision for cooking:- the absence of cooking facilities, including an oven and hob;
k) Size of cooking facilities:- inadequately sized oven and/or hob having regard to the number and size of the (potential) household/s;
l) Disrepair to cooking facilities:- defects or disrepair to the oven and/or hob;

m) Space for cooking facilities- the absence of sufficient space for the installation of an oven and/or hob;

Design, layout and state of repair

n) Kitchen floor:- uneven, porous, damp, or otherwise defective surface to the floor of the kitchen area;
o) Walls and ceilings:- uneven, damp, or otherwise defective walls or ceiling surfaces;
p) Impervious finishes:- lack of such finishes adjacent to a cooker, sink, a drainer or a worktop;
q) Defective seal:- between a sink, a drainer, or a worktop and the adjacent wall surface;
r) Kitchen lighting:- inadequate or inappropriate natural or artificial lighting to the kitchen area;
s) Ventilation:- inappropriate or defective means of ventilation of the kitchen area.

HAZARD ASSESSMENT

16.22 The level of hygiene will normally depend on the actions of the occupants. Assessment of the dwelling should focus on the facilities available, the ratio of facilities to (potential) occupants, and the ease with which safe food practice can be maintained by occupants.

Multi-occupied buildings

16.23 Relevant to the assessment is whether the people using a kitchen are expected to be part of the same household or not. Where people from different households share facilities, it can be assumed that there will be poor communication or co-operation between them, increasing the risk.

17 Personal Hygiene, Sanitation and Drainage

DESCRIPTION OF THE HAZARD

17.01 This category includes threats of infection and threats to mental health associated with personal hygiene, including personal washing and clothes washing facilities, sanitation and drainage.

17.02 It excludes problems with pests associated with defective drainage facilities, which are considered under the *Domestic hygiene, pests and refuse* hazard category.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

17.03 The most vulnerable age group is all persons aged under 5 years.

Personal hygiene, sanitation and drainage
Average Likelihood and Health Outcomes for all Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	7040	0.0	2.0	22.0	76.0	1 (J)
	1920-45	5550	0.0	2.0	22.0	76.0	2 (J)
	1946-79	9260	0.0	2.0	22.0	76.0	1 (J)
	Post 1979	24040	0.0	2.0	22.0	76.0	0 (J)
Flats	Pre 1920	5790	0.0	2.0	22.0	76.0	2 (J)
	1920-45	5340	0.0	2.0	22.0	76.0	2 (J)
	1946-79	12140	0.0	2.0	22.0	76.0	1 (J)
	Post 1979	3930	0.0	2.0	22.0	76.0	2 (J)
All Dwellings		**7750**	**0.0**	**2.0**	**22.0**	**76.0**	**1 (J)**

Basis of Estimates

17.04 The figures in the above table relate to persons aged under 5 years who suffered illness as a result of poor personal hygiene, sanitation and drainage in England and Wales in the years 1997, 1998 and 1999. The statistics are based on –

a) extrapolations from the few epidemiological studies that have made direct assessments of the risks associated with inadequate sanitation; and
b) calculation of mortality and hospital admission rates for gastro-intestinal disease by housing type and socio-economic group.

17.05 Because of the importance of behavioural factors and the difficulty in attributing reported illness to housing conditions, the estimation of the risk is inevitably imprecise. The confidence levels for the averages are therefore low. However, the fact that no mental ill-health has been attributed in the generation of the statistics, suggests that the average likelihoods may represent an under-estimation of the risk.

17.06 There are between 2,000 and 20,000 notified cases of dysentery each year and in excess of 80,000 cases of viral gastro-enteritis. It is not clear how many of these are related to sanitation and drainage, whether domestic or other.

Health effects

17.07 The health outcomes from both poor personal hygiene and poor sanitation include gastro-intestinal illness, and, more rarely, skin infections. Illnesses resulting from gastro-intestinal infection can range from mild stomach upsets through to death from diarrhoeal and gastro-intestinal disease, and severe dysentery, and gastro-enteritis. The majority of mild gastro-intestinal infections go unreported, and are not used in the statistics for the Rating System.

17.08 Dysentery (*Shigella sonnei)* and rotavirus infections are frequent causes of diarrhoea carried by the faecal-oral route. Even if the illness is contracted elsewhere up to 50% of family members may become infected if the hygiene levels are poor.

17.09 Although not a direct cause of physical illness, odours associated with poor hygiene, the visual appearance of facilities which are difficult to clean or have stained surfaces, damaged decoration and furnishings resulting from splashing or leaking appliances or drainage, can be a cause of stress and depression. This is particularly the case where the occupant has little control over the situation, typically in rented accommodation, and where facilities are shared. As well as causing anxiety and depression, it can also cause tension between people sharing facilities.

17.10 The highest risk groups are the very young (0-4), the elderly and the immuno-compromised. Those in houses in multiple occupation with shared personal hygiene and sanitary facilities are at increased risk, as are low socio-economic groups.

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17.11 Building Regulations *Approved Document G: Hygiene* covers requirements for sanitary conveniences, washing facilities and bathrooms. *Approved Document H: Drainage and waste disposal* covers foul water drainage, waste water treatment systems and cesspools, rainwater drainage, building over sewers, separate systems of drainage, and solid waste storage.

17.12 The most relevant British Standard is *BS 6465 Sanitary installations Parts I and II. Part I* is a code of practice for scale of provision, selection and installation of sanitary appliances. This includes requirements for water closets, wash basins, baths, showers, and sinks. *BS6465 Part 2* is a code of practice for space requirements for sanitary appliances, which discusses appliance space and the functional space requirements.

17.13 Also relevant, is British Standard *BS 8000 Part 13: Workmanship on building sites. Code of practice for above ground drainage and sanitary appliances* – which gives technical details of how appliances and above ground drainage facilities should be installed.

17.14 There are numerous other British Standards dealing more specifically with particular appliances and drainage features.

17.15 Storage facilities for greywater and rainwater to be reused within a dwelling are covered by the Water Regulations Advisory Scheme Information and Guidance Note: *Reclaimed Water Systems - Information about installing, modifying or maintaining reclaimed water systems.*

CAUSES AND PREVENTIVE MEASURES

17.16 The greatest risks appear to arise from the sharing of facilities and personal hygiene behaviour, rather than from the design and condition of facilities provided. These in the UK are generally to a relatively high standard. However, where there are deficiencies with the facilities themselves, this clearly can increase the risk from this hazard.

Personal hygiene

17.17 There should be a sufficient number of baths or showers for the occupants or potential occupants. Each bath or shower should be stable and properly and securely fitted. They should be strong enough to safely take the weight of the user and the water. They should be connected to a supply of water at a controlled temperature or to supplies of hot and of cold water. They should also be properly connected to pipes which safely carry away the waste water to discharge it into the drainage system.

17.18 To encourage and facilitate use, each bath or shower should be sited in a properly designed bathroom which is properly heated, lighted and ventilated. The bathroom should be provided with a door which is capable of giving privacy.

17.19 There should also be a sufficient number of wash hand basins for the occupants or potential occupants, with separate supplies of cold water and hot water over each basin. Each wash hand basin should be sited so as to encourage and facilitate use. To encourage hand washing after using sanitary accommodation, a wash hand basin should be provided either in the same compartment or immediately adjacent. However, it is preferable for an additional wash hand basin to be within the room containing the WC, even when it is next to a bathroom. A wash hand basin should also be provided in every bath or shower room.

17.20 Ideally, there should be a sink for each household, for the hand washing of clothes, in addition to the kitchen sink. However, it is acceptable for a sink to be used

for both hand washing of clothes and for washing and preparation of food and for washing up food and cooking equipment and crockery, cutlery, etc. The internal surfaces of the sink should be smooth, impervious, and capable of being readily cleansed and maintained in a hygienic condition. Cracks, chips or other damage to the internal surface may prevent thorough cleansing.

17.21 There should be separate supplies of cold water and hot water over each sink. Each sink should also be properly connected to pipes which safely carry away the waste water to discharge it into the drainage system.

17.22 There should be space for a washing machine with an appropriate power socket adjacent. There should also be clothes drying facilities, preferably both outside and internally. Internal provision can consist of a cabinet with a means of heating at low level. Alternatively, there should be space for the installation of a clothes drier with a connection for the vent outlet and an appropriate power socket adjacent.

Sanitation

17.23 The most widespread type of sanitary closet is the modern water closet connected directly to the sealed drains or through a macerator and small bore high pressure pipe discharging into the public sewerage system or into private storage or treatment tanks. Other means include composting closets and chemical closets.

17.24 There is no evidence linking modern conventional water closets, the wash-down and the siphonic, with increased risk of spread of disease. Obsolete water closets (such as the long and short hoppers, and the wash-out) are considered insanitary, as are slopwater closets.

17.25 A water closet includes the basin, a flushing mechanism and a connection to the drainage system.

The basin to a water closet should have a smooth and impervious surface (such as vitreous china) and be self-cleansing. It should be connected to a proper working flushing cistern provided with a supply of water, and also properly connected to a drain capable of safely carrying waste out of the dwelling and into the drainage system. The design of the basin should ensure there is a water seal of adequate depth to prevent foul air escape from the system. It should be securely fixed and capable of carrying the weight of users. It should be fitted with a hinged seat and hinged lid of impervious material.

17.26 To be effective and safe, a water closet relies on an adequate supply of water. Without a sufficient flush of water the water closet cannot be considered sanitary.

The water to cleanse the water closet bowl and carry away the solid and liquid waste is usually delivered by means of a flushing cistern which should be connected to the basin with a water-tight seal capable of withstanding the pressure. The operating lever to the flushing cistern should be of impervious and readily cleansable material to limit the possibility of the spread of pathogens from one user to the next (the cistern usually being used before hands are washed).

Where a macerator is installed, the safe operation of the water closet relies on a supply of electricity as well as water for flushing.

17.27 It seems that the major risk of spread via the faecal-oral route is transfer by hands through contact with the seat or the basin. The flushing action may spread some organisms in aerosol form, but, providing wall surfaces are dry, this is not considered a main route of infection.

17.28 An insufficient number of sanitary closets for the number of occupants will increase the risk of spread of pathogens, particularly if the closets are shared by two or more dwellings when responsibility for cleaning may be confused.

There should be a sufficient number of sanitary closets for the occupants. The number of sanitary closets should be related to the number of levels in the dwelling and to the number of persons (irrespective of age).

The sanitary accommodation should be located in a separate compartment or a bathroom which should be of a hygienic design and construction. The compartment or bathroom should be ventilated to the external air. There should be a door to the compartment or bathroom capable of being locked from the inside (although, in an emergency, openable from the outside).

There should be a hinged seat fixed to the basin and, to help limit the aerosol effect, there should be a hinged lid which can be closed on flushing. Both the seat and the lid should be of an impervious and readily cleansable material.

Drainage

17.29 Discharge of untreated foul waste onto paths or gardens will introduce faecal contamination, with associated micro-organisms, create offensive odours, and may attract pests. If there are any air leaks to drains these will be offensive, and no air should be released at low level or close to windows or vents.

17.30 Waste water discharged onto paths or gardens, if allowed to accumulate and stagnate, will be a source of offensive smells, and may attract pests.

Foul waste, once outside the dwelling, must be safely removed for disposal. No air should be released at low level or close to windows or vents.

All sinks, wash hand basins, baths, showers, bidets and other water using facilities must be properly connected to adequately sized waste pipes capable of safely carrying the waste water out of the dwelling and discharging it into a drainage inlet. Each waste pipe should incorporate a trap to provide a water seal of adequate depth to prevent draughts and foul air entering the dwelling. Where a single waste pipe serves more than one appliance or facility, it should be properly designed or provided with ventilation to prevent siphonage.

Where waste water from a bathroom (greywater) is to be recycled, it should be stored in a container outside the dwelling. Any overflow from the greywater storage container should be safely connected to the main drainage system or a soakaway.

Waste water should be discharged into properly designed trapped drainage inlets or directly in vertical drains connected to the main sewerage system. Where there is a private treatment or storage system for foul sewage, waste water should be delivered safely to a properly located, designed and constructed soakaway.

A WC basin must be connected to a drain which safely carries the water-borne waste to the public sewerage system, a properly functioning private treatment system or storage tank (such as a cesspool). All connections, between the basin and the drain and between drain pipes, must be air-tight to avoid leakage of the foul sewage or smells. The system should be adequately ventilated to prevent pressure causing siphonage of traps and facilities connected to the drain or sewer. The system should be designed and constructed so as to ensure that the pipes do not block in normal use.

A composting closet when useable from inside the dwelling should have a water tight container that can only be emptied from outside. There should be a hygienic and effective means of ensuring deodorising material is discharged into the container.

17.31 There are several types of chemical closets. There are small free-standing units with an integral holding tank. Others are water closets, which usually operate with only a small amount of flush water, and which are connected to a separate holding tank. These are located away from the dwelling or, if inside, capable of being emptied from outside the dwelling.

Surface water drainage

Surface water should be discharged into properly designed trapped drainage inlets connected to the main drainage system. Where there is a private system, surface water should be discharged safely away from the dwelling. Where rainwater is collected to be used for irrigation or wc flushing, it should be properly stored and kept separate from the drinking and other domestic water supply.

Multi-occupied buildings

17.32 A degree of lack of communication between individuals from different households is to be expected, and this leads to an increased risk of infection when personal hygiene and/or sanitation facilities are shared. This is particularly the case when one household has an infectious illness which other households sharing the facilities are unaware of.

17.33 When facilities are shared there is often confusion over responsibility for cleaning, or poor management of cleaning, which can lead to a poor standards of hygiene.

17.34 Often there is a higher ratio of people to facilities than is usually found in singly occupied dwellings when facilities are in shared use, and this leads to a higher risk of infection.

17.35 In multi-occupied buildings leaking personal hygiene or sanitary facilities and associated drainage may be unknown to users of the facilities but may be affecting another dwelling in the same building. The cause of the problem is typically more difficult to identify and resolve than it would be in a singly occupied building, presenting increased risks of infection.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

Personal hygiene

17.36 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Bath or showers:- lack of sufficient and/or appropriately sited baths or showers for the number of occupants or potential occupants;
b) Wash-hand basins:- lack of sufficient and/or appropriately sited wash hand basins for the number of occupants or potential occupants;
c) Hot and cold water supply:- inadequate supplies of hot and cold water (or water at a controlled temperature) to each bath, shower and wash hand basin;
d) Kitchen sink:- the lack of a sink for each household with separate supplies of cold and hot water;
e) Clothes drying facilities:- the lack of sufficient and/or appropriately sited facilities in the dwelling or building;
f) Disrepair to facilities:- disrepair or defects to, or associated with, a bath, shower, wash hand basin, hot or cold water supply, sink or clothes drying facility;
g) Inadequate lighting: - to the room containing the personal washing facilities;
h) Shared facilities:- personal hygiene facilities shared by more than one household;

Sanitation facilities

17.37 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Sewage system:- no or an obsolete means for the sanitary collection and removal of human excreta from the dwelling;
b) Sanitary provision:- insufficient numbers of sanitary closets (whether water, composting or chemical) for the numbers in occupation;
c) Sanitary closet siting:- inappropriate or inconvenient location of a sanitary closet;
d) Disrepair of sanitary closet.: - cracked or otherwise non-impervious bowl to a water closet or other sanitary appliance;
e) Water to wc:- inadequate supply of water to the flushing cistern serving a water closet;
f) Effective flush:- defective mechanism to a flushing cistern serving a water closet;
g) Macerator defects:- defective mechanism to a water closet;

h) Earth closet defects:- ineffective means of supplying deodorising earth or similar material to an earth closet;
i) Seat/lid to sanitary closet:- missing or non-impervious seat and/or lid to a sanitary closet basin;
j) Ventilation to compartment:- inadequate ventilation to the compartment or room housing a sanitary closet;
k) Unhygienic compartment:- defective design, construction and/or maintenance of the surfaces to the walls and floor of the compartment resulting in them not being capable of being kept clean and hygienic;
l) Inadequate lighting: - to the compartment or room containing a sanitary closet;
m) Door to compartment:- missing or defective door to the compartment;
n) Adjacent wash hand basin:- lack of a wash hand basin in the room, compartment or immediately adjacent room.

Drainage

17.38 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Soil and waste pipe provision:- the lack of an adequately sized soil or waste pipe connected to a water-using facility able to carry foul or waste water safely to the drainage system;
b) Pipe defects:- defects to a soil or waste pipe serving a water using facility;
c) Traps and water seals:- the lack or disrepair of a trap and water seal;
d) Ventilation of pipes:- inadequate ventilation to a soil or waste pipe;
e) Disrepair to system:- defects to the foul or waste water drainage systems;
f) Private sewage systems:- missing or defective private foul sewage treatment system or private foul sewage storage cistern;
g) Soakaway:- missing, defective or badly located soakaway for surface water;
h) Surface water drainage:- inadequate or defective drainage;
i) Recycling system:- defects to grey water or rainwater recycling system.

HAZARD ASSESSMENT

17.39 The statistical averages for likelihood reflect the generally good level of provision for drainage, sanitary and personal hygiene facilities in UK homes. Where there are problems, either as a result of poor hygiene, particularly in shared accommodation, or with defects to the level, nature, or repair, of facilities provided, this can result in greatly elevated risks above the average.

17.40 It is the overall combined risk from personal hygiene, sanitation, and drainage, which is considered in the one assessment under this hazard category.

Multi-occupied buildings

17.41 As is the case with all hazards, the assessment in multi-occupied buildings is made for each individual dwelling unit separately, and included in this assessment is the contribution of any deficiencies with shared facilities. The number of people and households that might be expected to share facilities will contribute to the assessment of risk, whether or not all dwelling units associated with the shared facilities are fully occupied at the time of the assessment.

17.42 Shared use of facilities can result in problems with cleanliness. This is taken into account by considering the number of people and households who may use the facilities, but not by consideration of the standard of cleanliness evident at the time of inspection. Since this is a management function of the building, and can easily change with change of occupancy or management.

18 Water Supply for Domestic Purposes

DESCRIPTION OF THE HAZARD

18.01 Water is used in the home for drinking and cooking, and also for personal and domestic hygiene, and sanitation purposes. This hazard category deals with both the adequacy of the drinking water supply in terms of availability, and the quality of the water supplied for drinking, cooking, washing, cleaning and sanitation.

18.02 The quality of water can be affected by contamination with bacteria, protozoa, parasites, viruses, and chemical pollutants. However, contamination of water by radon and lead are not considered under this hazard category (on which see hazards: *7 Lead* and *8 Radiation)*..

18.03 Water quality issues are limited to the supply after delivery to the dwelling. The quality of water supplied to the premises (typically, at the point where it leaves the suppliers' pipework) is not considered under HHSRS. However, the arrangements for connecting to a sufficient supply of water are considered.

18.04 Water from public suppliers (mains water) should meet the quality standards referred to in the *Water Supply (Water Quality) Regulations 2000,* as amended, which are enforced by the Drinking Water Inspectorate. These standards at a minimum comply with the European Council (EC) Directive 98/83/EC (on the quality of water intended for human consumption), and in some areas are more stringent, with adoption of the higher minimum standards of the World Health Organisation. The quality of water from private supplies is controlled under the *Private Water Supplies Regulations 1991,* which are enforced by local authorities. These regulations are soon to be updated in accordance with the EC Directive.

POTENTIAL FOR HARM

Most vulnerable group and statistical averages used for rating

18.05 All persons are considered for rating purposes, there is no particular vulnerable age group used for this hazard.

Water supply for domestic purposes
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	1,292,201	0.0	1.0	9.0	90.0	0 (J)
	1920-45	1,019,217	0.0	1.0	9.0	90.0	0 (J)
	1946-79	1,700,211	0.0	1.0	9.0	90.0	0 (J)
	Post 1979	4,414,406	0.0	1.0	9.0	90.0	0 (J)
HMOs	Pre 1920	1,063,416	0.0	1.0	9.0	90.0	0 (J)
	1920-45	980,981	0.0	1.0	9.0	90.0	0 (J)
	1946-79	2,229,732	0.0	1.0	9.0	90.0	0 (J)
	Post 1979	720,721	0.0	1.0	9.0	90.0	0 (J)
All Dwellings		**1,423,649**	**0.0**	**1.0**	**9.0**	**90.0**	**0** (J)

Basis of estimates

18.06 The statistics are for persons of all ages and are largely derived from the report *Health Risks from Private Water Supplies (1996)* which compares concentrations of Cryptosporidium and Campylobacter and reported infections from these causes for private water supplies in England. For Legionnaire's disease, PHLS Disease facts (2001) has been used to estimate that in the year 2000, less than 13 cases of *Legionella* arose in the home due to the infection from domestic water systems within the home, of which less than 2 proved fatal.

18.07 Generally, however, as there are many causes of gastro-intestinal illness it is difficult to make risk attributions for water related illness. While *Legionella* related illness can be better attributed, overall, there is a weak basis for the estimates used in the production of these statistics.

Health effects

18.08 Water is essential to sustain life. At normal temperature, with little or no exercise, an adult needs to consume around 2.5 litres of fluid each day, but in hot conditions and with heavy exercise the output rises substantially. Mild dehydration is associated with fatigue, headaches, dry skin, constipation, bladder infections, and poor concentration. Almost all dwellings in the UK have provision for supply of water, and dehydration through lack of supply is virtually unknown.

18.09 The main problems in the UK result from contamination of water. Microbiological pathogens which affect drinking water typically cause gastro-intestinal illness. *Campylobacter* and *Cryptosporidium* are the most common causes of gastro-intestinal illness associated with drinking water. *Legionella,* which typically causes respiratory infection, also presents an infection risk from domestic water systems.

18.10 Young children and the immuno-compromised are most at risk from ingested pathogens, and the elderly and immuno-compromised are most at risk from *Legionella*.

18.11 Private water supplies may be untreated, and, as a result, become contaminated more readily. However, although water from private supplies typically has greater levels of micro-organisms, there is a lower rate of reported illness. This may be due to some acquired immunity. However, visitors may be at risk from water which the dwelling occupants are used to.

18.12 In 2000 there were 173 reported cases of Legionnaires' disease, of which 76 (44%) were community acquired. As it is estimated that 1 in 6 community acquired cases is due to domestic water systems, then around 13 cases annually (7.3%) are from this source. Most infections with *Legionellas* are respiratory infections, although other infections can occur, such as wound infections from contact with contaminated water. The commonest result of infection is an acute pneumonia: Legionnaires disease, where 10 to 15% of cases prove fatal.

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18.13 The water pipework and storage facilities should be provided and maintained so as to satisfy the requirements of BS6700 Specification for design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Plumbing systems should meet the requirements of the Water Supply (Water Fittings) Regulations, 1999.

18.14 Where greywater and rainwater are stored for reuse within a dwelling, the storage facilities should comply with Building Regulation Approved Document H, and the Water Regulations Advisory Scheme Information and Guidance Note: Reclaimed Water Systems - Information about installing, modifying or maintaining reclaimed water systems.

18.15 There is no national mandatory model standard applicable to all dwellings for storage temperature for water. However, the National Care Standards Commission (NCSC) has set a national minimum standard (which apply to premises such as care homes) that water is stored at a temperature of at least 60ºC and is distributed at 50ºC minimum, to prevent risk of Legionella. (The NSCS also has a requirement for thermostatic valves at bath and basin taps to prevent a risk of scalding.)

CAUSES AND PREVENTIVE MEASURES

18.16 The vast majority of dwellings in the UK are served by public mains water, with around 1% of the population served by private water supplies. Private supplies may become contaminated more readily because water is usually pumped into a storage tank within the dwelling.

Regular sampling and analysis of drinking water which has been stored in a vessel is recommended.

18.17 The entire installation (taps, pipes, any storage tanks) should not adversely affect the quality of the water –

a) by allowing ingress of contamination (eg, tanks should be covered to prevent access to mice, birds and insects)
b) by stagnation, particularly at high temperatures (eg, there should not be any dead-ends in pipework, particularly for the supply of hot water)
c) by materials in contact with the water being unsuitable for the purpose (eg, tar lined tanks are not allowed);
d) as a result of backflow of water from water fittings, or water using appliances, into pipework connected to mains or to other fittings and appliances;
e) by cross-connection between pipes conveying water supplied for drinking water with pipes conveying water from some other source.

Drinking water should be wholesome, and the supply to and within the dwelling should not be interrupted, except in emergencies.

All dwellings should have at least one tap for drawing drinking water, and there should be adequate arrangements for connection to a wholesome supply of drinking water. This will usually mean connection to a mains or private water supply, with facilities provided to ensure that water is readily available, and the supply not unduly interrupted, including ensuring that water does not freeze in pipes.

Drinking water taps can be supplied direct from the supply pipe, from a pump delivery pipe drawing water from a supply pipe, or from a distributing pipe drawing water exclusively from a storage cistern supplying wholesome water.

The water should be supplied at a pressure adequate for appliances at a dwelling, if necessary, with the use of a booster pump

Legionnella

18.18 *Legionella* can be dispersed into the air during use of showers, and this, although rare, is the most likely route for transmission of Legionnaires' disease in homes. *Legionella* thrive between 20ºC and 45ºC.

To prevent *Legionella* growth hot water needs to be maintained above 55ºC. To achieve this hot water tanks should be set store hot water at above 60ºC. However, the benefit from maintaining hot water at this temperature may be offset by the risk of scalding, unless there are thermostatic mixer valves at taps, particularly bath taps (see *25 Hot Surfaces and materials).*

18.19 It should also be noted, that if hot water is used regularly and not stored for long periods, this reduces the risk of an infective dose of *Legionella*. Other risk factors for the domestic acquisition of Legionnaires disease include low chlorine levels, most commonly found with a private water supply, and cold water stored, or held in pipework, at above 20ºC.

Cold water should be stored and held in pipework at a temperature as low as possible below 20ºC.

Water softening treatments

18.20 Typically water softeners introduce sodium into the water, which should not be used for infants in the preparation of powdered milk for feeds, or for those on a low-sodium diet.

18.21 There is a link between cardiovascular disease and consumption of naturally soft water. No link is proven with artificially softened water. However, as a precaution it is usually recommended that softened water is not used for drinking.

Where a water softening treatment system is installed, there should be a tap providing unsoftened water for drinking and cooking.

Filters

18.22 There is potential for pathogens to proliferate in filters attached to taps, or in a plumbed in filter.

Any filters attached to taps, or plumbed in, should be fitted properly and the filter cartridge changed regularly according to the manufacturer's instructions.

Water quality – toilets and gardens

18.23 Water for drinking, cooking, washing and laundry, needs to be of high quality. However water for flushing toilets and irrigating gardens, can be of lower quality, and it is possible to use reclaimed rainwater or grey water (bathroom waste water).

If rainwater or grey water replaces mains water for toilet flushing, then it should be treated by filtration and disinfection. Maintenance is required to ensure that treatment remains effective.

Flats and other multi-occupied buildings

18.24 Where there is inadequate pressure from mains water to supply blocks of flats water is stored in tanks. In older blocks, water may be stored in a header tank at the top of the block. However, it is now more common to find storage tanks at lower level with booster pumps to supply water to flats.

18.25 *Legionella* are more likely to be found in the water systems of large multi-occupied buildings than in other domestic accommodation.

Where drinking water is stored to supply multiple dwellings it should be sampled and analysed regularly. This is particularly recommended for new installations in large buildings, and where extensive repairs or alterations have been carried out to the installation.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

18.26 Matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Water supply tap:- lack of a tap for drawing wholesome water for drinking within the dwelling;
b) Intermittent supply:- regular or prolonged interruption of supply;
c) Water pressure:- water delivered to taps at inappropriate pressure;

d) Water temperature:- water stored at an inappropriate temperature;
e) Defective pipework etc :- inappropriate materials used for pipework, storage tanks, or fittings;
f) Contamination of tanks:- inadequate protection against contamination of water storage tanks;
g) Water filter defects:- poor maintenance of water filters;
h) Water softening system:- poor maintenance of water softening system.

HAZARD ASSESSMENT

18.27 A visual examination of the installations and fittings within the dwelling for supply of water, should be followed by checking the water visually and for odours. However, where there is justification for further investigation, sampling and analysis of water will be necessary to properly determine its quality. The appropriate procedures for sampling water are set out in *Water Supply (Water Quality) Regulations 2000*, as amended.

18.28 In multi-occupied buildings, where there are greater risks from *Legionella,* checks should be made on the temperature of water in pipes, cold water cisterns, hot water storage vessels, and the discharge from taps, and water sampling and analysis may also be appropriate.

Protection against Accidents

Falls

19 Falls associated with Baths etc

DESCRIPTION OF THE HAZARD

19.01 This category includes any fall associated with a bath, shower or similar facility, whether that fall is on the same level, or from one level to another.

POTENTIAL FOR HARM

Mostvulnerable age group and statistical averages used for rating

19.02 The most vulnerable age group is all persons 60 or more years of age.

Falls associated with baths, etc
Average Likelihood and Health Outcomes for all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	4,428	3.0	1.5	13.9	81.6	8 (**J**)
	1920-45	3,861	2.4	5.9	4.4	87.3	8 (**J**)
	1946-79	4,324	0.8	3.3	5.7	90.2	3 (**J**)
	Post 1979	2,915	0.6	0.0	20.5	78.9	5 (**J**)
Flats	Pre 1920	2,758	2.8	0.0	21.6	75.6	13 (**I**)
	1920-45	1,976	4.7	10.6	21.2	63.5	33 (**H**)
	1946-79	4,015	3.4	6.2	21.8	68.5	12 (**I**)
	Post 1979	4,448	0.0	9.1	0.0	90.9	2 (**J**)
All Dwellings		**4,026**	**1.88**	**3.63**	**10.33**	**84.16**	**7** (**J**)

Basis of estimates

19.03 The figures in the above table relate to persons aged 60 years or over who were injured due to a fall associated with a bath in their home in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such fatal falls in the total population sample, as reported by Coroners. The Class II to IV estimates are based on the number of falls where the main article involved is a bath or shower, including drowning and near drowning in a bath, as reported by the Home Accident Surveillance System.

19.04 There is a strong evidence base for production of accident statistics in general, and a high confidence level for the statistical averages for *falls associated with baths etc.* However, there may be under-representation of the proportion of Class I harms from when an elderly person dies several weeks or months after a fall. This may not be directly from the physical injury, but from ill-health, such as cardio-respiratory illness, precipitated by the fall. The cause of death may not be attributed to the fall.

Health effects

19.05 The most common injuries that result from bath falls are cuts or lacerations (27%), swelling or bruising (26%), or fractures (11%).

19.06 Although typically the harm suffered from a fall is a physical impact type of injury, the health of an elderly person can deteriorate generally following a fall, and the cause of death of an elderly person within weeks or months of the initial fall injury can be cardio-respiratory illness, including heart attack and pneumonia.

19.07 Children younger than 5 years are most likely to fall in the bath or shower. However, because of their more severe health outcomes, the elderly are most at risk.

THE IDEAL

19.08 British Standard *BS6465 Sanitary installations – Part 1 Code of Practice for space requirements for sanitary appliances* sets out the space requirements for appliances, and for activity spaces necessary to enable safe use of the sanitary appliances (including baths, showers, wash basins, and water closets).

19.09 British Standard *BS 6340 Shower units,* states that the shower tray, or bath, should have a slip resistant surface or a suitable mat should be used.

CAUSES AND PREVENTIVE MEASURES

19.10 The main cause of falls in bathrooms is slipping when getting into or out of the bath.

19.11 The slip resistance of the internal surfaces of baths and showers when wet will affect the likelihood of an incidence occurring. The provision of suitably located handles or grab rails will help users to steady themselves or save themselves from a fall.

19.12 The position of taps and waste controls can also affect both the likelihood of an occurrence and the severity of the outcome. Inappropriate siting may mean a user has to reach awkwardly across the appliance, increasing the risk of a fall.

19.13 Similarly, the inappropriate siting of openable windows may affect the likelihood of an occurrence if a user has to reach over a facility to reach a window. The position of the door, and whether it opens inwards may also increase the likelihood of a fall. If the fall is likely to result in collision with taps or other projections, this may make the outcome more severe.

19.14 Inadequate functional space immediately adjacent to the appliance may make it more difficult to enter or leave the bath or shower, increasing the likelihood of a fall.

19.15 Provision of lighting in the bathroom is also relevant. Glare can increase the likelihood of a fall, as can a light switch remote from the doorway.

19.16 Cold impairs movement and sensation, and a lowered body temperature affects mental functioning such that falls are more likely in the cold. A fall may therefore be more likely in a bathroom which cannot be adequately heated, and the consequent harm suffered as a result of a fall may be more severe.

Baths and showers should be stable and securely fitted, provide for slip resistance and incorporate safety features such as handles or grab rails and side positioning of taps and waste controls. Each bath or shower should be sited in a bathroom with space to enable users (including an adult assisting a child) to be able to undress, dry themselves and dress without increasing the likelihood of a fall.

Multi-occupied buildings

19.17 For the assessment of common bathrooms in multi-occupied buildings, as well as the features discussed above, there are a number of additional factors that may increase

the risk of a fall which include: furniture or other objects stored in the bathroom; the slip resistance of the flooring; missing light bulbs etc.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

19.18 Matters contributing to the likelihood of a hazardous occurrence include –

a) Poor friction:- of the internal surface of a bath or shower;
b) Siting of taps and waste:- inappropriate sitings increasing the risk of falls.
c) Siting of windows:- inappropriate siting of opening lights
d) Handles & grab rails:- lack of, or insecurely fitted;
e) Unstable appliance: - unstable fitting of a bath or shower
f) Inadequate space:- for the functional area immediately adjacent to the appliance;
g) Inadequate lighting:- lack of adequate natural or artificial lighting;
h) Glare: - from natural or artificial lighting;
i) Light switch: - inappropriately located;
j) Space heating:- inadequate means of heating the bathroom.

19.19 Matters which may affect the severity of harm resulting from a hazardous occurrence include –

a) Siting of taps and waste: - inappropriate siting increasing the risk of harm;
b) Projections:- the presence of sharp edges, heating installations, or glass;
c) Inadequate space: - between appliances;
d) Space heating:- inadequate means of heating the bathroom.

HAZARD ASSESSMENT

19.20 Relevant to the assessment is the number of people sharing the bathroom. If a bathroom is in heavy use then the floor may be more prone to remaining wet and slippery between users. Where there are two or more bathrooms etc, then the assessment will involve consideration of the risk of a fall in each bathroom.

Multi-occupied buildings

19.21 Where more than one household share a bathroom, this may affect the state of the room and facilities and should be taken into account in the assessment.

20 Falls on the Level

DESCRIPTION OF THE HAZARD

20.01 This category includes falls on any level surface such as floors, yards, and paths. It also includes falls associated with trip steps, thresholds, or ramps, where the change in level is less than 300mm.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

20.02 The most vulnerable age group considered in rating this hazard are all persons over 60 years of age.

Falls on the level
Average Likelihood and Health Outcomes for all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	124	0.2	13.8	27.3	58.7	198 (**F**)
	1920-45	139	0.2	12.8	26.2	60.9	165 (**F**)
	1946-79	152	0.2	13.3	28.7	57.8	165 (**F**)
	Post 1979	126	0.1	13.8	33.9	52.2	201 (**E**)
Flats	Pre 1920	87	0.1	14.3	18.6	67.0	248 (**E**)
	1920-45	101	0.2	14.4	24.4	61.0	244 (**E**)
	1946-79	132	0.3	15.3	22.6	61.7	194 (**F**)
	Post 1979	112	0.1	17.5	24.9	57.5	236 (**E**)
	All	**135**	**0.2**	**13.8**	**27.3**	**58.8**	**181** (**F**)

Basis of estimates

20.03 The figures in the above table relate to persons aged 60 years or over who were injured due to a fall on the level in or around their home, including communal homes, in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such fatal falls in the total population sample, as reported by Coroners. The Class II to IV estimates are based on the number of non-fatal falls on the same level,

whether inside or outside, including falls at the porch/threshold, as reported by the Home Accident Surveillance System.

20.04 There is a strong evidence base for production of accident statistics in general, and a high confidence level for the statistical averages for *falls on the level*. However, although unknown types of fall have been accounted for, there may still be under-representation of the proportion of Class I harms. This is because when an elderly person dies several weeks or months after a fall, apparently not directly from the physical injury, but from ill-health, such as cardio-respiratory illness precipitated by the fall, the cause of death is not likely be attributed to the fall.

20.05 Children younger than 5 years are most likely to fall on the level., However people aged 60 years and over have substantially higher average HHSRS ratings. This is because of their more severe health outcomes and they are therefore the most vulnerable group.

Health effects

20.06 Falls result in physical injury, such as bruising, fractures, head, brain and spinal injuries. The nature of injury is in part dependent on the distance of a fall, and in part dependent on the nature of the surface fallen upon. Falls on the level tend to result in more minor injuries than falls on stairs or between levels. However, falls on the level occur more frequently.

20.07 Following a fall, the health of an elderly person can deteriorate generally, and the cause of death following an initial fall injury can be cardio-respiratory. This may include heart attack and pneumonia, and may not necessarily result directly from the impact injury sustained at the time of the fall.

THE IDEAL

20.08 Floors should be properly and safely constructed to satisfy Building Regulations *Approved Document A: Structure,* and British Standards *BS 5385* and *6431* dealing with floor tiling. However, there is no reference to slip resistance in the Building Regulations.

CAUSES AND PREVENTIVE MEASURES

20.09 As well as safe construction, the evenness, inherent slip resistance, drainage (for outdoor path surfaces), and maintenance of the floor or path surface, all affect the likelihood of an occurrence. A lack of sufficient space to carry out tasks or manoeuvres may also increase the likelihood of an occurrence.

20.10 The seriousness of the health outcome of a fall will be affected by the task being undertaken. For example, whether the person is carrying something, and the type of flooring, its finish and whether or not it is covered. Hard surfaces such as uncovered stone, concrete, or ceramic tiled floors being more unforgiving than carpeted floors.

20.11 Lighting, temperature and distracting noise may affect the possibility and outcome of an occurrence.

Evenness and maintenance

20.12 The likelihood of a slip or trip occurring is affected by how level is the floor, path or yard, its evenness and the state of maintenance.

Surface variations of 5mm to floors and of 20mm to paths will increase the likelihood of a trip, an even surface will help prevent falls.

Slip resistance and drainage

20.13 The possibility of a slip occurring is affected both by the slip resistance of the floor surface and by the characteristics of any footwear. The type of floor covering will determine the final slip resistance. Slip resistance is worsened when a surface is damp or wet, which may be the result of a building deficiency, or be expected given the use of the area in question.

20.14 Effective drainage of surface water is important for outdoor paths and yards to reduce the chances of occurrences because of ponding of water, and in adverse weather, patches of ice.

Space

Each room and part of a dwelling should have sufficient space and be laid out so as to allow for the carrying out of appropriate tasks and manoeuvres without increasing the chances of a slip.

Lighting

20.15 Adequate lighting will enable users to identify any obstructions and any trip steps or projecting thresholds.

Artificial lights and windows should be sited to avoid shadows and dark corners where users cannot clearly see where they are going. Switches or controls for artificial lighting should be sited for ease of use. Glare from windows should be avoided.

Temperature

20.16 Cold impairs movement and sensation, and a lowered body temperature affects mental functioning, such that falls are more likely in the cold. The thermal efficiency of the dwelling is therefore relevant to fall hazards as well as the *cold* hazard category. It may also therefore be more hazardous using external paths in cold weather, irrespective of whether they are wet or icy.

Flats and other multi-occupied buildings

20.17 In common parts, where the dwelling owner or manager is responsible for floor coverings, furniture, cleaning etc (which might otherwise be considered occupant factors) should be taken into account where they are likely to affect the assessment.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

20.18 Relevant matters contributing to the likelihood of a hazardous occurrence include –

a) Lack of floor:- no properly constructed floor, path, or yard where needed;
b) Excessive slope: - to the floor, path or yard;

c) Uneven surface: - to the floor, path, or yard;
d) Trip steps/threshold: - the presence of such steps or projecting thresholds;
e) Disrepair:- to the structure and surface of the floor, path or yard;
f) Poor slip resistance: - to the surface of the floor, path or yard;
g) Inadequate drainage:- of surface water from the path or yard;
h) Inadequate space:- for the carrying out of appropriate tasks and manoeuvres;
i) Poor lighting or glare;
j) Thermal efficiency:- inadequate heating and insulation at the dwelling.

20.19 Relevant matters which may affect the severity of harm resulting from a hazardous occurrence include –

a) Hard surfaces:- unforgiving or abrasive surface to the floor, path or yard;
b) Projections etc:- the presence of sharp edges, heat producing appliances, or glass, in the area where the fall might occur;
c) Nature of area:- and of the activities which will be undertaken in the area where the fall might occur;
d) Thermal efficiency: - inadequate heating and insulation at for the dwelling.

HAZARD ASSESSMENT

20.20 The assessment is one of the overall risk at the dwelling from falling on the level. Deficiencies internally, such as, changes in level between rooms of under 300mm, projecting thresholds at external doorways, and uneven paving externally, are considered in the one assessment.

20.21 When considering the statistical averages it should be remembered that the average dwelling will normally have some trip or slip features.

20.22 The matters which affect likelihood are the things which can cause a fall, such as, uneven or loose paving or floor surface material; poor friction of the surface (either by its nature, or as a result of moisture, ice, or leaves, etc); obstructions; trip features; and poor lighting. The expected frequency of use of the area also contributes to the assessment of likelihood. An area where little traffic is expected, for example at the edge of a room away from a doorway, would not present the same likelihood of a fall, for the same condition of flooring, as it would at a doorway.

20.23 Assessment of the severity of outcome will include consideration of the surface collided with in the fall, the nature of the external paving or floor surface. The more unforgiving the surface the worse the expected outcome; and the presence of architectural features or installations, such as a cooker, fixed heating appliance, sharp edge, hard projection, radiator, or glass, can also increase the severity of harm suffered.

20.24 Some criteria, such as the expected activity in the area, can contribute to both the likelihood and severity of outcome. For example, in a kitchen people can be expected to be carrying hot liquids, knives, etc, and this increases both the likelihood of a fall, because they can concentrate less on where they are putting their feet, and it also affects the severity of outcome resulting from a fall.

21 Falls associated with Stairs and Steps

DESCRIPTION OF THE HAZARD

21.01 This category covers any fall associated with a change in level greater than 300mm and includes falls associated with –

a) internal stairs or ramps within the dwelling unit;
b) external steps or ramps within the curtilage of the dwelling;
c) internal common stairs or ramps within the building containing the dwelling unit and giving access to the dwelling or shared facilities; and
d) external steps or ramps within the curtilage of the building containing the dwelling unit and giving access to that dwelling or shared facilities.

21.02 It does not include trip steps, thresholds or ramps where the change in level is less than 300mm. These should be assessed under the category of *Falls on the level*.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

21.03 The most vulnerable age group is all persons aged 60 years or over.

Falls on stairs
Average Likelihood and Health Outcomes for all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	218	2.2	7.7	22.1	68.0	169 (**F**)
	1920-45	226	2.1	7.4	20.5	70.1	155 (**F**)
	1946-79	256	1.6	6.6	21.6	70.3	115 (**F**)
	Post 1979	256	1.4	6.3	25.3	67.1	111 (**F**)
Flats	Pre 1920	214	3.9	8.0	19.3	68.8	249 (**E**)
	1920-45	263	1.6	2.8	20.1	75.5	96 (**G**)
	1946-79	410	2.8	5.3	17.7	74.2	97 (**G**)
	Post 1979	409	2.6	5.2	19.4	72.8	93 (**G**)
	All	**245**	**1.9**	**6.7**	**21.7**	**69.7**	**134** (F)

Basis of estimates

21.04 The figures in the above table relate to persons aged 60 years or over who were injured due to a fall associated with stairs or steps at their home, including communal homes, in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such fatal falls in the total population sample, as reported by Coroners. The Class II to IV estimates are based on the number of falls on or from stairs or steps, whether inside or outside including trip steps and common stairs, as reported by the Home Accident Surveillance System.

21.05 There is a strong evidence base for production of accident statistics in general, and a high confidence level for the statistical averages for *falls on stairs*. However, although unknown types of fall have been accounted for, there may still be under-representation of the proportion of Class I harms. This is because when an elderly person dies several weeks or months after a fall, not directly from the physical injury, but from ill-health, such as cardio-respiratory illness, precipitated by the fall, the cause of death may not be attributed to the fall.

21.06 While numerically more accidents involve younger people, proportionally the elderly are most at risk of a fall., Their falls result in worse injuries and they take longer to recover.

Health effects

21.07 Any fall can result in physical injury, such as bruising, fractures, head, brain and spinal injuries and may even be fatal. The nature of injury is dependent on the distance of a fall, and nature of the surface(s) collided with, as well as on the age and fragility of the person

21.08 Although typically the harm suffered from a fall is a physical impact type of injury, the health of an elderly person can deteriorate generally following a fall. Their

cause of death within weeks or months of the initial fall injury can be cardio-respiratory illness, including heart attack, stroke and pneumonia.

21.09 Falls on stairs account for around 25% of all home falls (fatal and non-fatal). Although fewer falls occur on stairs than on the level, stair falls are much more likely to lead to a death than falls on the level.

21.10 After the age of 40 men are much more likely to die of a fall on stairs or steps in the home than women. In the age bands 40 to 64, and 75+, a man is almost twice as likely to die from a fall on stairs/steps at home than a woman in the same age band (when the rate per million population of each sex is considered). In the age bands 65 to 74, a man is more likely to die from a fall than a woman, although the difference between the sexes is less marked.

THE IDEAL

21.11 The design and construction of stairs should satisfy Building Regulations *Approved Document Part K – Protection from falling collision and impact*, and British Standards, including *BS5395, 585, 6180,* and *5588*. Building Regulations *Approved Document Part N: Glazing – safety in relation to impact, opening and cleaning* deals with the location and specification of safety glass, as does British Standard *BS6262-4*.

21.12 The external access to a dwelling is dealt with under Building Regulations *Approved Document Part M*, where if possible access should be by a level path, ramp or drive. However, where topography prevents this, steps are permitted. Unlike most of the other Approved Documents, where the main purpose is to secure reasonable standards of health and safety in and about buildings, *Part M* addresses welfare and convenience for building users. Adoption of the requirements of *Part M*, would give a better standard of safety for all users in relation to the *Falls associated with stairs and steps*, than would application of *Part K*.

CAUSES AND PREVENTIVE MEASURES

Steepness

21.13 The likelihood of missteps is reduced where tread and rise dimensions are 280-360mm and 100-180mm respectively. Accidents are more likely where the pitch is more than 42°, and a steeper pitch can be expected to result in a worse outcome. It is estimated that the risk of an accident is decreased by 10% for every 10mm increase in going, at least between 180mm and 280mm.

21.14 Variations in dimensions of rise and going within a flight are likely to increase the possibility of missteps. However, where the variation is linked with an obvious change in direction of a stair, for example with the use of winders, this usually means the user takes greater care and increases concentration, reducing the likelihood of an occurrence.

21.15 For ramps, the steepness of the slope is relevant to the potential for accidents.

Nosings and stair surface

21.16 The shape and dimension of nosings affect the likelihood of an occurrence. In particular, nosings that project more than 18mm may increase missteps. Poor frictional quality of the surface of stair treads and particularly of nosings can increase slips and missteps.

21.17 An accident is three times more likely to occur on stairs without carpet covering, including those stairs intended to be left uncovered. Carpets generally reduce the severity of injury should a fall occur, both on stairs and at the foot of stairs.

21.18 Uncovered external steps which may become icy or wet, or are uneven and badly maintained, will increase the likelihood of a fall and the severity of the outcome.

Open risers, and alternating tread and spiral stairs

21.19 Openings to risers on stairs in a dwelling which may be occupied by children should not allow a 100mm diameter sphere to pass through. Alternating tread stairs may also present a greater hazard, particularly in emergencies.

21.20 Accidents are nearly twice as likely on stairs consisting of straight steps with no winders or intermediate landings. Accidents may also be more likely on small spiral stairs, particularly if there is no inner handrail and where the width is less than 800mm.

Width and length

21.21 Narrow stairs may cause problems in emergencies. Ideally, stair width should be a minimum of 900mm clear width to allow the stairs to be negotiated by a child and adult side-by-side. The length of flight of stairs or of slopes may increase the seriousness of the health outcome by increasing the possible distance of a fall.

Handrails and guarding

21.22 Handrails provide assistance in ascent and descent, and offer a hand-hold if there is a misstep and so can help prevent a fall. Handrails to both sides of the stairs provide the safest arrangement. Even if there are walls to both sides but no handrail, the risk of an accident is doubled.

21.23 Handrails should be sited between 900mm and 1,000mm measured from the top of the handrail to the pitch line or floor. They should be shaped so that they are easy to grasp and extend the full length of the flight.

21.22 Guarding (eg, balustrade) should be provided to prevent falls off the sides of stairs. Where the dwelling is suitable for occupation by children, the guarding should be designed and constructed so as to discourage climbing. It should have no openings through which a 100mm diameter sphere can pass. The risk of an accident is doubled if there is no wall or guarding to one side of the stair.

Headroom

21.23 The headroom to stairs themselves should be a minimum of 2,000mm. In some situations, such as loft conversions, where this is not possible the headroom should be 1,900mm at the centre reducing to a minimum of 1,800mm at the side.

Access to stairs

21.24 There should be reasonable space at the top and floor of any stairs to enable users to appraise the start and dimensions of the steps and stairs. Risks can be increased by doorways opening directly onto stairs.

Lighting

21.25 Good lighting at the top and bottom of stairs will enable users to identify the first step and the dimensions of the stairs, reducing the possibility of a misstep or slip. Artificial lights and windows should be sited to avoid shadows and dark corners where users cannot clearly see where they are going. There should be switches or controls for artificial lighting at both the top and foot of stairs. Glare from windows should be avoided.

Obstructions and projections

21.26 Architectural features (eg, doors) which create an obstruction on stairs or at the head of stairs can increase the likelihood of a fall. Projections and sharp edges on stairs and glass or radiators at the foot of stairs will increase the seriousness of the health outcome of a fall.

Temperature

21.27 Cold impairs movement and sensation, and a lowered body temperature affects mental functioning, such that falls are more likely in the cold. The thermal efficiency of the dwelling is therefore relevant. It may also be more hazardous using external steps in cold weather, irrespective of whether they are wet or icy.

Flats and other multi-occupied buildings

21.28 As well as the structural elements, for common stairs and steps in multi-occupied buildings other matters should be taken into account. These may include: furniture or other objects stored on stairs; worn, holed or loose stair carpet; poor frictional quality of the stair covering; and missing light bulbs to fittings above common stairs.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

21.29 Relevant matters contributing to the likelihood of a hazardous occurrence include –

a) Tread lengths:- of less than 280mm or greater than 360mm;
b) Riser heights:- of less than 100mm or greater than 180mm;
c) Variation in tread or riser:- dimensional variation producing an uneven pitch;
d) Nosing length:- projecting more than 18mm beyond any riser;
e) Poor friction:- of treads and nosings;
f) Openings in stairs:- or balustrades through which a 100mm diameter sphere can pass;
g) Alternating treads:- stairs so constructed, particularly those not conforming to current regulations;
h) Lack of handrails:- the absence of such to either side of the staircase;
i) Height of handrails:- set below 900mm or above 1,000mm;
j) Lack of guarding:- the absence of such where no wall to the side of the staircase;
k) Height of guarding:- not extending to at least 900mm above the treads;
l) Easily climbed guarding:- constructed so as to facilitate climbing;

m) Stair width:- of less than 1,000mm;
n) Length of flight:- long flights that increase the risk of a fall.
o) Inadequate natural lighting:- to the top and foot of the flight;
p) Inadequate artificial lighting:- to the top and foot of the flight;
q) Lighting controls:- inadequate or inconvenient means of controlling the artificial lighting;
r) Glare from lighting:- whether natural or artificial;
s) Door(s) onto stairs:- doors opening directly onto the stairs;
t) Inadequate landing:- inadequate floor space leading to the stairs;
u) Construction/disrepair:- inadequate construction or disrepair to any element of the stairs;
v) Thermal efficiency:- inadequate heating and insulation of the dwelling.

21.30 Relevant matters which may affect the severity of harm resulting from a hazardous occurrence include –

a) Length of flight:- long flights that increase the risk of harm;
b) Pitch of stairs:- stairs which are of above average steepness or shallowness
c) Projections etc:- the presence of sharp edges, heating installations, or glass, to the stairs or at the foot of the flight;
d) Hard surfaces:- unforgiving surfaces at the foot of the flight;
e) Construction/disrepair:- inadequate construction of, or disrepair to, any element of the stairs;
f) Thermal:- inadequate heating and insulation of the dwelling.

HAZARD ASSESSMENT

21.31 All stairs, steps, and ramps associated with the dwelling should be taken into account. This includes the internal stairs, stairs for exclusive use of the dwelling occupants, common stairs, external steps, fire escape stairs, and any ramps.

21.32 Where there are several flights of stairs or steps, then the overall risk of a fall on all the stairs and steps should be considered. This will involve assessing the risk of a fall on each of the different flights, taking into account the frequency with which each of the flights of stairs and steps might be expected to be used. So, stairs which are part of the only access to a dwelling might present a greater risk of a fall, even if of better design and better maintained, than another flight of stairs which is used less frequently.

22 Falls between Levels

DESCRIPTION OF THE HAZARD

22.01 This category includes falls between two levels within and outside a dwelling or building where the change in level is more than 300mm[54]. This includes falls from or out of dwellings. Thus it covers falls out of windows, falls from balconies, falls from accessible roofs, falls over landing balustrades above stairs, and falls from any other change in level not served by a stair or steps (for example over the guarding to galleried rooms, to a basement well, or to garden retaining walls).

22.02 It does not include falls from stairs, steps or ramps. Nor does it include falls from furniture such as chairs or tables, or falls from ladders.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

22.03 The most vulnerable age group is all persons aged under 5 years.

Falls between levels
Average Likelihood and Health Outcomes for all Persons aged 5 years and under, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	2,117	0.1	0.0	10.5	89.4	2 (J)
	1920-45	1,564	0.2	1.6	7.9	90.3	4 (J)
	1946-79	1,259	0.2	3.1	10.3	86.4	8 (J)
	Post 1979	2,132	0.0	0.0	16.7	83.3	3 (J)
Flats	Pre 1920	2,742	0.0	0.0	0.0	100.0	0 (J)
	1920-45	2,451	1.3	0.0	16.5	82.2	8 (J)
	1946-79	1,791	0.4	5.9	5.9	87.9	7 (J)
	Post 1979	1,235	0.0	0.0	0.0	100.0	1 (J)
All Dwellings		**1,693**	**0.2**	**1.8**	**9.9**	**88.2**	**4 (J)**

54 Guarding is not required by the current Building Regulations for a change of level of more 300mm and less than 600mm. However, such changes may present a hazard in some circumstances. Changes of levels of up to 300mm are covered by Falls on the Level.

Basis of estimates

22.04 The figures in the above table relate to persons aged under 5 years who were injured due to a fall from a window, landing, balcony etc or of their home in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such fatal falls in the total population sample, as reported by Coroners.

22.05 The Class II to IV estimates are based on the number of falls from building structures and from one level to another where the main article involved was a stair/landing element, roof, ceiling, window or balcony (but excluding falls on stairs or steps and falls from ladders), as reported by the Home Accident Surveillance System.

22.06 There is a strong evidence base for production of accident statistics generally, and a high confidence level for the statistical averages for falls between levels.

22.07 Children under the age of five are most likely to fall between levels, and boys are more likely to fall than girls. Falls from windows, landings and balconies is an important cause of death within the under 5 age group because the underlying rate of death for children is low. In other words, this is one of the more common causes of death for children (and, for that matter, young adults) - the low average hazard scores reflecting the fact that at this age people are unlikely to die, from whatever cause.

22.08 Within the adult age group of 16 to 59 years, young adults between 20 and 29 years old are the most likely to fall between levels. Adults 60+ years old are the least likely to fall between levels, but suffer much more severe health outcomes when they do.

22.09 There are around 50 fatal falls from windows in domestic buildings each year, and around 2,300 non-fatal cases treated in hospitals. There are around 8 fatal domestic balcony falls each year. The trend is that the number of non-fatal falls between levels are increasing while the number of fatal falls are decreasing year-on-year.

Health effects

22.10 Falls result in physical injury, including: bruising; puncture injuries; fractures; and head, brain and spinal injuries. The nature of injury is in part dependent on the distance of a fall, and in part dependent on the nature of the surface collided with.

THE IDEAL

Windows

22.11 Building Regulations *Approved Document L1: conservation of fuel and power* covers windows and energy conservation. *Approved Document K: protection from falling, collision and impact* deals with minimum sill height and the positioning of windows on stairs. *Approved Document N: Glazing – safety in relation to impact, opening and cleaning* deals with the location and specification of glass, and *Approved Document B: fire safety* also refers to window design.

22.12 Various British Standards cover windows, but of particular relevance is *BS 8213: Part 1* which deals with safety requirements, and *BS6262* which covers thickness of vertical glazing, particularly in areas where there is a risk of accidental impact.

Balconies, landings, roofs, basement wells, etc

22.13 Guarding for balconies and landings, and parapets to accessible roofs, etc, should be properly constructed to satisfy Building Regulations *Approved Document K: protection from falling, collision and impact.*

22.14 British standards *BS6180,* and *BS6399 Part 1,* give guidance on design of barriers and infill panels in and about buildings.

CAUSES AND PREVENTIVE MEASURES

Windows – general

22.15 The ease of opening windows, the distance they can be opened, the height of the sill and the design of the opening light will all have a bearing on the possibility of an occurrence. For windows above ground floor level, the ease of cleaning and maintenance will affect the likelihood of an occurrence. The distance above ground level and the nature of the ground will affect the severity of the outcome of any fall.

Windows – ease of opening and catches

22.16 Windows which are easy to open, may increase the likelihood of an occurrence for a child; whereas difficulty in opening a window requiring extra strength may increase the likelihood of an occurrence for an adult.

22.17 Safety catches will reduce the likelihood of children being able to open a window unsupervised.

Catches which restrict the distance a window can be opened to 100mm should be fitted to windows above ground floor level to reduce the possibility of an accident involving a child. Any opening limiter should be easy to over-ride by an adult in the event of fire.

22.18 Where window opening catches are inaccessible, this can increase the risk of a fall, although this may be more properly assessed in relation to *ergonomics*.

Windows – sill height and design, and opening lights, glazing and cleaning

22.19 Falls are least likely when internal sills are at least 1,100mm from the finished floor level. However, where a window serves the function of a means of escape in case of fire, then the Building Regulation requirement is for the bottom of the openable area to be not more than 1,100mm above floor level, except in the case of a window in a roof where the bottom of the opening may be 600mm above the floor. A trade-off is made between falls and fire safety.

22.20 The *Lifetime homes*[55] approach to dwelling design recommends that the height of glazing above floor level should not be more than 800mm, to enable views from a window from the seated position, and that there should be a catch to at least one window in a room accessible to wheelchair users. Further trade-offs in window design, between *Falls* and accessibility are therefore made. With other safety features, such as opening

55 Carroll, C, Cowans, J, Darton, D, *Meeting Part M and designing Lifetime Homes,* 1999, Joseph Rowntree Foundation,

limiters (discussed above), and the provision of safety glass, the risks from falling can be minimised.

Safety glass should be provided where window glazing extends to within 800mm of floor level (unless alternatively guarded).

Design of windows should facilitate safe cleaning of the outer surface (see British Standard *BS 8213*).

Windows – distance above, and nature of, ground and features

22.21 The distance of the window opening above the adjacent ground will affect the severity of the health outcome of a fall, as will the nature of the ground. The greater the distance and the less forgiving the ground finish, the more severe the health outcome is likely to be. Similarly any other features beneath the window will affect the severity of outcome; for example, railings and fences tend to increase the harm, whereas shrubs and flower beds tend to break the fall and reduce the severity of harm. Of the fatal falls from windows, 50% are from bedrooms, and 50% are from first floor windows. Clearly there is a large overlap between falls from bedrooms and falls from first floor windows.

22.22 In multi-storey buildings there is a need for increased safety precautions to upper storey windows, because of the increased risk posed by the more severe harms resulting from distance of fall.

In high rise blocks, and preferably from the second floor upwards, glazing below 1,100mm from floor level should be guarded with a safety rail. The design of the windows should be such that there is no reason to climb on a chair or stepladder when the main part of the window is open to clean it. Where there is a high level opening light above the main opening light, the high level light should be easily cleanable on both sides without opening the main light.

Balconies, landings, etc – guarding

22.23 The height, design and construction, and the maintenance of guarding affects the risk of a fall.

Balconies, landings, etc – height above, and nature of, ground or floor and any other features below

22.24 The height of the balcony or landing above the adjacent ground or floor below will affect the severity of the health outcome of a fall, as will the hardness of the ground or floor surface. The greater the distance fallen, and the less forgiving the ground or floor finish, the more severe the health outcome is likely to be. Falling onto railings or fences will tend to increase the severity of harm, and falling onto vegetation will tend to break the fall, and reduce the severity of harm.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

22.25 For windows, the matters contributing to the likelihood of a hazardous occurrence include –

a) Ease of window operation:- difficult to use window catches and opening lights;
b) Safety catches:- lack of such catches or features to catches;

c) Opening limiters:- no restriction preventing windows being opened more than 100mm;
d) Height of catch:- set more than 1,900mm above floor level, or more than 1,700mm where window is over a worktop or other fixture or fitting;
e) Sill heights:- less than 1,100mm above floor level and/or lack of safety glass above 800mm height;
f) Disrepair of window;- including catches, safety devices and opening lights; and
g) Ease of cleaning:- outer surfaces that are difficult to clean.

22.26 For balconies, landings, roof parapets, basement wells, etc, the matters which may affect the likelihood of a fall include –

a) Height of guarding:- extending less than 1,100mm above the balcony or landing floor;
b) Easily climbed guarding:- constructed so as to facilitate climbing by young children;
c) Openings in guarding:- the presence of openings greater than 100mm;
d) Strength of guarding:- of insufficient strength due to construction; and
e) Disrepair to guarding:- lack of protection due to disrepair.

22.27 For windows, balconies, landings, roof parapets, basement wells, etc , the matters which may affect the severity of harm resulting from a hazardous occurrence include –

a) Height above ground:- the height of the window, landing, balcony etc above the ground or the next lower level;
b) Nature of ground:- the nature of the ground or floor surface, and any features which may be collided with;
c) Non-safety glass:- the presence of non-safety glass in the window or guarding.

HAZARD ASSESSMENT

22.28 The assessment is of the overall risk at the dwelling from falling between levels. All deficiencies contributing to the hazard, including those associated with windows, balconies, landings, basement wells, etc, both internally and externally, are considered in the one assessment.

22.29 Risks associated with the use of step ladders etc for Do-It-Yourself activities are not considered in the assessment. (This is more properly attributable to occupier activity rather than the state of the dwelling.)

22.30 Where a roof is part of the recreational or amenity space associated with the dwelling, the risk of falls from that roof should be taken into account, although such falls are extremely rare.

Electric Shocks, Fires, Burns and Scalds

23 Electrical Hazards

DESCRIPTION OF THE HAZARD

23.01 This category includes hazards from shock and burns resulting from exposure to electricity. It does not include risks associated with fire caused by deficiencies to the electrical installations, such as ignition of material by a short-circuit.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

23.02 The most vulnerable age group is all persons under 5 years of age.

Electricity
Average Likelihood and Health Outcomes by Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	31506	0.0	25.0	50.0	25.0	1 (J)
	1920-45	19439	0.0	0.0	60.0	40.0	1 (J)
	1946-79	9694	0.4	5.9	35.2	58.6	2 (J)
	Post 1979	19577	0.0	0.0	75.0	25.0	1 (J)
Flats	Pre 1946	240179	100.0	0.0	0.0	0.0	4 (J)
	Post 1945	17284	0.2	0.0	15.0	84.9	23 (H)
All Dwellings		**16869**	**0.6**	**8.2**	**49.2**	**42.0**	**2 (J)**

Basis of estimates

23.03 The figures in the above table relate to persons aged under 5 years who were harmed by an electrical accident in their home, in England and Wales in the years 1997, 1998 and 1999. The statistics are based on the number of fatal injuries in the total population sample, reported in the mortality statistics, and the number of hospital treated cases, reported by the Home Accident Surveillance System, amongst children under 5 years of age who, between 1997 and 1999, suffered an electric shock, electrocution, burn, cardiac fibrillation, convulsion, puncture wound or respiratory paralysis caused by an electric current.

23.04 The relatively low sample sizes mean that there is less confidence in the statistical averages for *electrical hazards*, particularly for the spread of health outcomes, than for many of the other accident statistics. Because of the particularly low sample sizes for flats, these have been grouped into just two age bands..

Health effects

23.05 When electricity passes through the human body, it causes shock to the nervous system. The shock effect ranges from mild tingling sensations to disruption of the normal regular contractions of the heart or respiratory muscles, causing death.

23.06 As human tissue acts as a resistance to electricity, heat is generated which may result in burns. Such burns usually occur at the point of contact with the source of electricity. Injuries are primarily burns (53%) to the finger or thumb (58%). The mouth is the second most frequent injury site. About half of electrical accidents in the home result in burns as well as shock.

23.07 The majority of injuries are not severe. Of those attending hospital accident and emergency, 38% of victims are sent home, and 47% are referred to out-patients or a GP. Of those admitted to hospital, 71% stayed for less than 3 days.

23.08 Those under 40 have 80% of all accidents, and males have 59% of accidents. The most vulnerable group are young children, who are less likely to be aware of the risks posed by electricity. Boys between 5 and 14 are three times more likely to have accidents than girls of the same age.

THE IDEAL

23.09 Electrical wiring installation should satisfy the requirements of the current edition of Regulations of the Institution of Electrical Engineers (IEE). These Regulations have the status of a British Standard and are also known as *BS7671 Requirements for electrical installations*. The Regulations are supported by a separate series of Guidance Notes enlarging on particular requirements.

23.10 Where appropriate, residential buildings should be fitted with a Lightning Protection System (LPS). British Standard *BS6651* provides a procedure for calculating the overall lightning strike risk factor for a building.

CAUSES AND PREVENTIVE MEASURES

23.11 By touching metal or other conducting material which is "live" a person may receive an electric shock. The risk is dependent on a number of factors, the main one being the voltage across the body. An electric shock is experienced when current passes through the body to earth.

23.12 The potential danger of electrocution requires that there are adequate safety precautions, and, reflecting the high standard of electrical safety found in most UK homes, the incidence of electric shock in dwellings is relatively rare.

23.13 The majority of the electric current fatalities result from deficiencies in plugs, leads, and appliances. Less than 10% of fatalities result from a deficiency in the electrical wiring and other installations. Of the fatal accidents not associated with plugs, leads and appliances, 50% involve mains wire or cables, 24% sockets, 13% light fittings and 10% a fuse or fuse board.

23.14 Where a location is known (62% of cases) most accidents occur in the living or dining room (27%), kitchen (23%), or bedroom (18%). For adults the location is most likely to be the kitchen or the living/dining room, for children the living/dining room or bedroom.

Protection from electric shock is provided by isolation and/or insulation. Live parts must be covered with non-conducting material to reduce the risk of electric shock. All exposed metal parts of the installation must be earthed so that in the event of a deficiency any current will flow immediately to earth rendering the system safe from electric shock. Other exposed metalwork such as gas and water pipes should also be connected to the main earth terminal.

If equipment operating at 230 volts or higher is used, a Residual Current Device (RCD)[56] can provide additional safety. These can be incorporated in the consumer unit. An RCD is a device which detects some, but not all, deficiencies in the electrical system and rapidly switches off the supply.

23.15 As water is highly conductive, it increases the danger. This means that additional precautions are necessary in bathrooms, kitchens and other areas where individuals could be in contact with both water and a source of electricity (eg, electric showers).

There should be no socket outlets in bathrooms other than 12 volt AC (eg, shaver sockets).

23.16 A further potential source of electric shock is lightning striking the building.

[56] The term RCD covers a number of devices including Residual Current Circuit Breaker (RCCB), Residual Current Breaker with Overcurrent protection (RCBO), Socket-outlets with Combined RCD (SRCD), and Portable RCD (PRCD). It is not recommended to use RCD protection in circuits supplying security and emergency systems e.g. burglar alarms, fire alarms, security lighting.

A Lightning Protection System (LPS) may need to be present where there is an unacceptable risk of a lightning strike. This is particularly relevant to tall and isolated buildings, and is part dependent on geographical location.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

23.17 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of health outcome include:

a) IEE Regulations - non-compliance with the requirements of the 16th edition;
b) Number and siting of outlets - inadequate number of, and/or badly sited electrical socket outlets;
c) Fuses and meters:- inappropriately sited fuses and meters;
d) Earthing:- lack of or inadequately earthed electrical system;
e) Disrepair of installation: including to supply, meters, fuses, wiring, sockets, light fittings or switches;
f) Presence of Water:- electrical installations in close proximity to water, including areas of damp:
g) Lightning protection system: lack of, or defective system to buildings at significant risk of lightning.

HAZARD ASSESSMENT

23.18 A visual inspection of the electrical installation and fixed appliances may identify obvious hazards. Where there is an indication that there may be an above average risk, then a full inspection and test report by a qualified electrician or electrical engineer may be necessary to fully appraise this hazard.

23.19 Where portable appliances are provided as part of a rented dwelling, then their condition and that of associated leads and plugs, should also be taken into account in the assessment of *electrical hazards*. A Portable Appliance Test[57] may be necessary.

57 On which see: Institution of Electrical Engineers (IEE), Code of practice for in-service inspection and testing of electrical equipment, 2001, IEE

24 Fire

DESCRIPTION OF THE HAZARD

24.01 This category includes threats from exposure to uncontrolled fire and associated smoke at a dwelling.

24.02 It does not include injuries caused by clothing catching alight, not associated with an uncontrolled fire. For example, burns resulting from clothing catching alight as a result of reaching across a gas flame or across an open fire used for space heating are not included, as these would be considered under the *Hot surfaces and materials* hazard category. However, the *Fire* hazard category does include burns resulting from clothing catching alight on exposure to an uncontrolled fire, which appears to be common when people attempt to extinguish an uncontrolled fire.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating purposes

24.03 The most vulnerable age group is all persons aged 60 years or over.

Fire
Average Likelihood and Health Outcomes for all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores & band
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	4,496	8.7	3.2	35.4	52.7	23 (**H**)
	1920-45	6,248	10.2	5.1	15.6	69.1	18 (**I**)
	1946-79	6,341	5.4	4.3	31.8	58.5	11 (**I**)
	Post 1979	5,701	5.7	0.0	32.8	61.5	12 (**I**)
Flats	Pre 1920	1,681	7.3	0.0	51.5	41.2	53 (**G**)
	1920-45	3,372	11.0	0.0	14.8	74.2	34 (**H**)
	1946-79	2,729	6.0	0.0	26.5	67.5	25 (**H**)
	Post 1979	2,157	3.1	0.0	17.2	79.7	17 (**I**)
All Dwellings		**4,760**	**7.0**	**2.6**	**29.1**	**61.3**	**17** (**I**)

Basis of estimates

24.04 The figures in the above table relate to persons aged 60 years or over who died or were injured in a house or flat fire in England and Wales in the years 1997, 1998 and 1999. They are based on the number of such persons dying in fatal fires in the total population sample as reported by Coroners, on the number of casualties and persons rescued at all fires attended by the Fire Brigade and the number of additional persons injured from uncontrolled fire or flames, reported by the Home Accident Surveillance System.

24.05 There is a strong evidence base for production of accident statistics in general, and due to large sample sizes, a high confidence level for the statistical averages for *fire*.

Health effects

24.06 There are around 70,000 dwelling fires reported to Fire Brigades in the UK each year, of which the majority (around four fifths – 56,000) are accidental. As only one fifth of fires are reported to Fire Brigades, this represents an under-estimation of the total number of uncontrolled fires, which occur at approximately 3% of dwellings each year. It is estimated that nearly 90% of domestic fires do not result in any injury.

24.07 The most common cause of death from a fire is being overcome by gas or smoke, which accounts for around 38% of deaths. Around 26% of deaths are attributed jointly to both burns and being overcome by gas or smoke, and 25% of deaths are the result of burns alone. (The remaining 11% of deaths are either unspecified or from other causes.)

24.08 Burns resulting from exposure to the *fire* hazard, result in the majority of deaths from burns. (The majority of non-fatal burn injuries occur from the *hot surfaces and materials* hazard category.)

24.09 The elderly and the very young (aged four and under) are most at risk. Impairment of mobility will increase vulnerability as it affects the ability to, and speed of, escape. More children die from carbon monoxide poisoning (mainly as a result of fires) than from any other poisoning. A household with children is twice as likely to experience a fire as one without children. This increased risk cannot be attributed to children starting the fires, it is more common that adults are distracted by children whilst cooking.

24.10 Although children are more likely to be exposed to the *fire* hazard, the elderly are more than three times as likely to die from a fire, and therefore are more at risk. People over 80 years of age have the highest rate of deaths per million population, and 36% of fire deaths are to people over 65 years of age.

THE IDEAL

24.11 The requirements of Building Regulation *Approved Document B*, and British Standards *BS5588, Code of Practice 5839*, and *BS5446* should be complied with. Where appropriate, residential buildings should be fitted with a lightning protection system in accordance with *BS6651*.

24.12 Advice should be taken from the local fire authority on interpretation of requirements in Houses in Multiple Occupation.

CAUSES AND PREVENTIVE MEASURES

24.13 Occupier behaviour is a major factor in relation to fires. Over 80% of accidental fires in dwellings result from occupier carelessness or misuse of equipment or appliances, etc. Fires started by smokers' materials and matches account for about 40% of accidental deaths from dwelling fires, with a death rate of over 30 per 1,000 reported fires, the highest death rate resulting from any cause of fire ignition.

24.14 As well as being responsible for some fires starting, occupiers' reactions on discovering fire, influence escape and prevention of fire spread.

The dwelling design, construction and condition should limit the chances of carelessness causing a fire, limit the spread of a fire, howsoever caused, and provide safe and ready means of escape.

Sources of ignition

24.15 The main sources of ignition attributable to the dwelling, rather than occupiers, are cooking appliances, space heaters, and electrical distribution equipment.

All fitted appliances and equipment which present a possible source of ignition should be correctly and safely installed and maintained.

Cooking appliances

24.16 Around half of dwelling fires are related to cooking appliances, with over 30,000 reported fires each year. However, these fires have a relatively low injury rate, and result in 2 deaths per 1,000 reported fires associated with electric cookers, and 4 deaths per 1,000 reported fires associated with gas cookers, and around 200 non-fatal casualties per 1,000 fires for both gas and electric cookers. The majority of these fires are attributable to misuse or carelessness by the occupier, and include chip pan fires. The most common cause of fire is cooking left unattended. However, a small minority of cooking appliance fires, less than 10%, may be the result of equipment deficiencies or the siting of the cooker (eg close to flammable materials).

The space for siting cookers should be safe, with no flammable materials immediately adjacent, or close to windows where curtains may be hung.

Space heaters

24.17 Space heating appliances, including portable appliances and central heating systems, account for 12% of fatalities from dwelling fires, with around 25 deaths per 1,000 reported fires. There are around 240 non-fatal casualties per 1,000 fires caused by electric space heaters, and 315 non-fatal casualties per 1,000 fires caused by gas space heaters. Carelessness and placing articles too close to the heater are the cause of over 60% of the heating related fires. The use of solid fuel as the main fuel leads to a higher likelihood of a fire. However, there is a lower rate of fatal and non-fatal casualties from solid fuel fires than from those caused by gas or electric space heaters, around 20 deaths per 1,000 fires, and around 200 non-fatal casualties per 1,000 fires.

All fixed heating appliances and systems, whether central heating or not, should be properly designed, installed and regularly serviced and maintained. The adequate means for space heating of the whole of the dwelling will discourage the need for and use of supplementary portable heaters. The provision of means of drying clothes indoors during inclement weather will discourage placing clothing near to or on heaters. immediately adjacent, or close to windows where curtains may be hung.

Electrical distribution equipment

24.18 There are around 2,000 fires associated with electrical distribution (wiring and cabling) per annum, separate from those fires associated with appliances and leads to the appliances. These fires have a rate of 3 fatalities per 1,000 fires, and non-fatal casualties of 86 per 1,000 fires (2001 figures).

The provision of sufficient and appropriately sited electric socket outlets will help reduce the need for extension leads and overloaded sockets. The electrical installation (distribution board, wiring etc) should meet the relevant requirements of the Regulations of the Institution of Electrical Engineers (16th edition). It should be properly installed and maintained and be regularly checked and tested. There should be no defects to socket outlets or switches.

24.19 Residual Current Devices (RCDs) help prevent fires associated with electrical deficiencies where surface tracking across insulation is a cause of fire ignition.

Fire spread and room of origin

24.20 Of the 70,000 dwelling fires per year, around 90% are confined to the room where the fire originated, and a further 8% are confined to the building. Less than 0.5% of dwelling fires spread beyond the building where the fire started.

24.21 The design, construction and materials used may help contain and limit the spread of fire. The fabric of the building provides the initial fuel for the fire in very few cases.

The dwelling should be constructed of fire and smoke-permeable resistant materials. The design of the dwelling should incorporate fire stops to cavities including ventilation and heating systems. The design and construction should limit the spread of fire. Internal doors (including entrance doors to flats) should be made of appropriate materials and properly fitted, and, where appropriate fitted with self-closers.

Where furniture is provided in rented accommodation it must comply with current Furniture and Furnishings Regulations[1].

24.22 Over 65% of fires start in the kitchen, around 10% of fires start in bedrooms and bedsitting rooms, and 10% start in living and dining rooms. Around 2% of fires start in each of bathroom/wcs, circulation spaces, and store-rooms, and airing cupboards.

24.23 Over half of all fatalities occur in the room where the fire started. However, 65% of fatalities in fires starting in the bedroom or bedsitting room occurred in the room of origin. Only 32% of deaths in fires starting in the kitchen occurred in the room of origin.

24.24 There is a death rate of 23 per 1,000 fires starting in bedrooms or bedsitting rooms. Fires starting in the living room account for 40% of the accidental dwelling fire fatalities, and equate to a 32 deaths per 1,000 fires. The death rate from fires starting in the kitchen is 3 deaths per 1,000 fires.

Detectors and alarms

24.25 The level of harm suffered is influenced by the presence or absence of a fire detection and alarm system.

24.26 The proportion of households with smoke alarms had risen to around 80% in 2001, yet an alarm was absent in 59% of reported fires in dwellings. In 12% of reported fires the alarm had failed, most commonly as a result of a missing or flat battery.

24.27 Dwelling fires in which smoke alarms raise the alarm tend to shorten the discovery time of the fire, are associated with lower fatal casualty rates, and cause less property damage. Death rates from dwelling fires in which smoke alarms raise the alarm are 3-4 per 1,000 fires, compared to 7-9 per 1,000 for fires where there is no working smoke alarm.

24.28 The failure rate for smoke alarms generally is around 28%. However, there is a wide difference in performance between battery-operated and mains-powered alarms. The battery-operated alarms have a 45% failure rate, yet the mains-powered alarms have a failure rate of 13%.

There should be sufficient properly designed and appropriately sited smoke and/or heat detectors with alarms in every dwelling. These should be properly maintained and regularly tested.

Fire Fighting Equipment and Means of Escape

Unless vandalism is likely to be a problem, means of primary fire fighting should be provided, including fire blankets and extinguishers. Larger multi-occupied buildings should be provided with an automatic sprinkler system.

There should be means of escape from all parts of the dwelling. For one and two storey dwellings this should include an openable window or door which is capable of providing a safe means of escape from the building. For dwellings of three or more storeys there should be a protected staircase and, where the floor height is more than 3.5m above ground level, an alternative escape route.

Flats and other multi-occupied buildings

24.29 There is a greater risk of a fire occurring in flats than houses. Flats in buildings constructed before 1920 have the greatest likelihood of causing death and injury from fire, having an average HHSRS score well over four times greater than that for post 1979/80 houses, the latter having the lowest average score.

24.30 The risks of death or injury from fire vary by the way the building is occupied, and by the number of storeys. People living in shared accommodation, and households with lodgers, have similar risks to single household occupancies. However, people living in flats and bedsits have increased risk when compared with people in singly occupied houses, the extent of the increased risk being dependent on the number of storeys. The comparable risks for flat and bedsit occupiers escalate when they live in accommodation

of over two storeys in height, such that an adult living in either a self-contained flat or bedsit accommodation in a building of three storeys or more is roughly 10 times more likely to die in a fire than an adult living in a two storey house.

For any form of multi-occupied buildings, there should be adequate fire protection to the means of escape and between each unit of accommodation, appropriate fire detection and alarm system(s), and, as appropriate, emergency lighting, sprinkler systems or other fire fighting equipment.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

24.31 Relevant matters contributing to the likelihood of a hazardous occurrence include:

a) Heater/cooker position: - inappropriate siting and/or close proximity of flammable materials;
b) Space heating: - inadequate for the whole of the dwelling;
c) Defects to heating: - defects or disrepair to appliances or system;
d) Clothes drying facilities: - lack of indoor facilities;
e) Number/siting of sockets: - insufficient and/or inappropriately sited electric socket outlets;
f) Electrical installation:- defects to the supply, meters, fuses, wiring, sockets or switches;
g) Non-fire resistant fabric: - dwelling fabric allows spread of fire;
h) Smoke permeable fabric: - dwelling fabric allows spread of smoke;
i) Fire stops to cavities: - lack of ;
j) Disrepair to fabric: - walls, ceilings and/or floors may allow smoke, fumes and/or fire to spread;
k) Internal doors: - insufficient doors or doors of inappropriate materials or ill-fitting doors;
l) Self-closers: - lack of effective self-closers where appropriate;
m) Smoke/heat detectors: - lack of, or defective, smoke and/or heat detectors with alarms or of detection and alarm system;
n) Combustible furnishings:- including furniture and furnishings;
o) Fire fighting equipment:- lack of adequate and appropriate means of primary fire fighting;
p) Lightning protection system: - lack of a system where appropriate.

24.32 Matters affecting the severity of health outcome include:

a) Means of escape: - inadequate safe means of escape in case of fire.
b) Combustible furnishings: - including furniture and furnishings;
c) Smoke/heat detectors: - lack of or defective smoke and/or heat detectors with alarms or of a detection and alarm system;
d) Fire fighting equipment: - lack of adequate and appropriate means of primary fire fighting;
e) Lightning protection system: - lack of a system where appropriate.

HAZARD ASSESSMENT

24.33 The assessment should start with consideration of the likelihood of a fire starting, and, once started, how likely it is the fire will go undetected and spread.

24.34 The spread of harm suffered from a fire will depend on how quickly it can spread, and how soon it is detected and occupiers made aware of it. If a fire goes undetected, and spreads quickly, then the severity of harm will be worse. The majority of fires are detected and extinguished without injury being incurred.

24.35 The means of escape from fire is particularly relevant to the spread of harm. If the means of escape allows quick and easy exit from the accommodation, then there will probably be less severe harm, than if the escape from fire is more difficult. Travel distance from the accommodation to the final exit is relevant, as is the compartmentalisation of the means of escape to prevent ingress of smoke and flame. Emergency lighting will increase the speed of exit, whereas a steep and awkward staircase will impede it.

Multi-occupied buildings

24.36 Relevant to the assessment is the type and size of the multi-occupied building, and the number of people accommodated, assuming the designed occupancy.

24.37 The assessment is made for each individual unit of accommodation. This means that different hazard ratings can be expected for dwellings within the same building depending on the location of the dwelling unit within the building, and any deficiencies to the individual dwelling. For example, a bedsit on the ground floor close to the final exit from the building would not have the same risk as a bedsit on the third floor, where the means of escape is the internal staircase, and both bedsitting rooms are identical apart from location. This is largely because the spread of harms would be worse for the occupant of the third storey bedsit, resulting from the greater distance of travel from this bedsit to the final exit, than that of the ground floor bedsit.

24.38 Where there are deficiencies contributing to the *fire* hazard within the individual units of accommodation in a multi-occupied building, it must be borne in mind that 90% of fires do not spread beyond the room in which they start. Therefore there may be differing likelihoods of fire in different dwelling units. Relevant to the assessment of how deficiencies in a dwelling will affect the assessment of risk in other dwellings in the same building will be the degree of fire separation at the dwelling, the effectiveness of the detection and alarm system, and the presence of any primary fire fighting equipment.

24.39 Although an assessment is made for each individual unit of accommodation within a multi-occupied building, the condition of common and other parts are clearly relevant to that assessment. Therefore, an assessment of an individual unit of accommodation should include consideration of the common parts.

25 Hot Surfaces and Materials

DESCRIPTION OF THE HAZARD

25.01 This category includes threats of burns and scalds. Burns are injuries caused by contact with a hot flame or fire, and contact with hot objects or hot non-water based liquids. Scalds are injuries caused by contact with water-based liquids and vapours. The category includes burns and scalds resulting form spillage when cooking or preparing hot drinks, use of heating appliances, and use of hot water in baths and other appliances. It also includes burns caused by clothing catching alight, not associated with an uncontrolled fire at a dwelling, for example, when reaching across a gas flame.

25.02 The category does not includes burns resulting from an uncontrolled fire at a dwelling.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

25.03 The most vulnerable age group is all persons under 5 years of age.

Hot Surfaces and Materials
Average Likelihood and Health Outcomes by Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	178	0.0	0.8	17.2	82.0	39 (**H**)
	1920-45	191	0.0	2.5	16.4	81.1	44 (**H**)
	1946-79	156	0.0	1.2	16.4	82.5	44 (**H**)
	Post 1979	230	0.0	0.9	17.1	82.0	30 (**H**)
Flats	Pre 1920	246	0.1	2.6	20.5	76.9	42 (**H**)
	1920-45	306	0.2	0.0	15.0	84.9	23 (**H**)
	1946-79	161	0.0	1.9	24.3	73.9	64 (**G**)
	Post 1979	138	0.0	0.0	27.1	72.9	64 (**G**)

Basis of Estimates

25.04 The figures in the above table relate to persons aged under 5 years who were injured due to hot surfaces and materials in and around their home, in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such fatal accidents in the total population sample, as reported in the mortality statistics. The Class II to IV estimates are based on the number of such persons suffering burns or scalds from hot objects or appliances, hot liquid, steam or gas and burns from controlled fires and flames, as reported by the Home Accident Surveillance System.

25.05 There is a strong evidence base and, due to the large sample sizes involved, a high confidence level for the statistical averages for *hot surfaces and materials*. However, the greatest number of injuries to the vulnerable age group comprises scalds from hot liquids and the extent to which these relate solely to behaviour or, at least in part, to dwelling conditions, such as poor kitchens arrangements, is not clear.

Health effects

25.06 Around 112,000people visit hospital accident and emergency units each year suffering from burns or scalds incurred in the home or from leisure activities. At least a further 250,000 people visit GP surgeries for burns and scalds injuries. Burn or scald injuries result in the death of over 200 people each year. However, these accident numbers include injuries which may not be directly associated with dwelling conditions. For example, spilt tea and coffee may be an occupant, rather than dwelling, related accident, and this is the greatest cause of injury to small children.

25.07 Burns or scalds in this hazard category account for the great majority of non-fatal burn accidents, whereas burns in the *Fire* hazard category result in the most deaths.

25.08 Around half the injuries are to children under 5 years of age. Their risk level is 6 to 7 times greater than the average level for the population as a whole, with boys at slightly higher risk than girls.

25.09 The severity of the burn or scald is dependent on its depth and the area covered. The depth of burn is dependent on the temperature of the hot object or liquid, the length of time of exposure, the time taken before corrective action is taken, and the length of time that cold water is applied. How long a hot material can be touched without damage to human tissue also depends on the material, as well as the temperature.

25.10 The relatively small body area (especially when hot liquids are involved), the more sensitive nature of young children's skin, and their low position in relation to hot objects, means that young children are particularly at risk of suffering severe injuries. Many of these victims suffer extensive full thickness burns and require plastic surgery, often for many years following the accident.

25.11 Where the burn or scald is severe, it can result in permanent scarring. Apart from the obvious physical pain, many victims, and also parents of children that are burnt or scalded, suffer acute psychological distress for many years.

25.12 The incidence of burns and scalds is greater for those over 65 years of age than for other adults, but less than for children. The health outcome for the elderly is usually more serious than for all other age groups.

THE IDEAL

25.13 British Standard BS4086 gives surface temperatures for fixed heating radiators based on water temperatures of up to 100°C. Building Regulation *Approved Document J* requires where the surface temperature of any heating appliance is likely to exceed 100°C it should be shielded. Requirements for guarding of heating appliances are also found in various British Standards including *BS 1945* and *BS 8423*.

25.14 However, in high risk premises such as hostels and sheltered housing for the elderly, the mentally ill, and those with learning difficulties, the surface temperature of accessible heating appliances and associated pipework should be a maximum of 43°C[58], or appropriately guarded.

25.15 There is no mandatory model standard concerning temperature of hot water supplied to taps in all dwellings. However, the Housing Corporation, the regulatory body for all Registered Social Landlords (RSLs)[59], includes thermostatic control of supply to hot water taps over baths in its *Scheme Development Standards*[60]. The control measures applied to health and social care establishments, including care homes, social services premises and special schools, are, where risk assessment warrants it, that water is delivered to the bath/shower outlet at no more than 44° C by a thermostatic mixer valve.

25.16 The Housing Corporation's *Scheme Development Standards* also identify space and layout requirements in kitchens through the Unit Layout section of the *Housing Quality Indicator system (HQI)*[61].

CAUSES AND PREVENTIVE MEASURES

25.17 Around 50% of severe burn and scald injuries to young children happen in the kitchen[62]. The most common items involved in these accidents are cups and mugs of hot drinks, kettles, teapots, coffee pots, saucepans, cookers and chip pans and deep fryers. It is not known what proportion of these accidents result from dwelling deficiencies, and what proportion result from occupant behaviour. The most common cause of injury is a spilt mug of tea or coffee, which accounts for over a third of the severe burn and scald injuries, and most of these accidents involve a child reaching up and pulling over a mug of hot drink. The design and layout of the dwelling is a contributory factor to some of the occupier activity related accidents. For example, the design and layout of kitchens, and the relationship between the kitchen and living/dining areas. Other causes may be directly attributable to the dwelling, such as the cooker

58 Health and Safety Executive (HSE) Local authority circular 79/4 Burning risks from hot surfaces in health and social care, revised 2003, HSE, London

59 Registered Social Landlord (RSL) is the technical name for social landlords that are registered with the Housing Corporation — most are housing associations, but there are also trusts, co-operatives and companies.

60 Housing Corporation Scheme Development Standard, Fifth edition, 2003, Housing Corporation, London

61 HQI is a measurement and assessment tool developed by the Government and designed to allow housing schemes to be evaluated on the basis of quality rather than simply of cost. See: ODPM, Housing Quality Indicators form (Version 2), 2000, ODPM, London

62 Source: Department of Trade and Industry (DTI) Burns and Scald Accidents in the Home, 1999, DTI, London

location, the design or adjustment of fixed heating appliances, or the means of heating water.

25.18 Fires and heaters cause the most deaths from burns, about 30 per year, over all age groups (mainly the elderly). Burns from fires and heaters involve 10% of the severe injuries to small children and about 2 deaths a year[63]. Children under 5 years old tend to fall onto or touch a fire. Many adults and older children suffer burns when their clothes catch alight.

There should be adequate guarding of any open flame on space and water heating appliances.

The temperature of exposed surfaces of radiators, pipework between radiators and that serving hot water tanks and taps, storage heaters, boilers and tanks should be limited to a maximum of 43°C, or appropriately guarded, where a person (usually a child or elderly person) could become trapped against the hot surface. This is appropriate in rooms with limited space for furniture, or where there are long pipe runs at low level, where a typical accident involves a person falling and becoming trapped between furniture and the hot surface.

25.19 The elderly appear to be involved frequently with burns involving unfixed heating appliances, cookers and flammable liquids.

25.20 A sixth of the accidental burn and scald severe injuries (430 per year) and half of the deaths (over two per year) to children under five result from scalding in hot baths[64]. Most of these accidents involve the child being left unsupervised, and they fall or climb into a bath of very hot water. Many of the children under three years of age suffer 20-50% body burns, as they submerge in the hot water.

25.21 Water temperatures above 45°C present a risk of scalding, especially to young children. However, there is a balance to be struck between risks of scalding from hot water, and risks of *Legionella* from low storage temperatures of hot water (see *18 Water supply for domestic purposes)*.

The best way to address both risks from scalding and *Legionella* is to store hot water at 60°C or more, and then to limit the temperature delivered at taps, most importantly, bath taps. Thermostatic mixer valves can be fitted, when it advised that water should be delivered to baths at between 44°C and 46°C, bearing in mind that the water will cool as it fills the bath. There are few scalding accidents involving wash basins, and whereas a hot tap delivery temperature of 41°C is preferred, it is not as important in terms of health and safety risks to limit temperatures to basins as it is to baths. Higher temperatures are more appropriate for kitchens because a hot water temperature is necessary for washing up greasy cooking pans, etc. However, it is recommended that kitchen sink tap temperatures are limited to 60°C.

25.22 Cookers are involved in about 290 severe injuries a year, requiring admission as hospital in-patients, and 13 deaths a year (most involve the elderly). Annually, around

63 Source: Department of Trade and Industry (DTI) Burns and Scald Accidents in the Home, 1999, DTI, London
64 Ibid.

110 severe injuries involve children under 5 years old - usually a child touches a hot plate/ring or cooker grill. Adult injuries mostly involve items of clothing igniting when leaning over the cooker. Dwelling design and layout can contribute to these injuries when a cooker is sited adjacent or close to a doorway, or there are other deficiencies in the space or layout of the kitchen.

Kitchens should be of adequate size and of such a layout so as to ensure that cookers and worktops are safely sited away from doors, thoroughfares and other potentially hazardous areas.

Flats and other multi-occupied buildings

25.23 There can be increased risks of burns and scalds in multi-occupied buildings. For instance, where the kitchen is in shared use and there is potential for several people to be cooking and moving about in the kitchen at the same time, the risk of a burn or scald is increased.

Ideally, where there is more than one household sharing a kitchen, there should be separate worktop space and separate cooking facilities provided for each household.

25.24 Where cooking is carried out within a bedroom or living room, there can be an increased likelihood of an accident if the kitchen area is inadequately separated from the living or sleeping area. If there are insufficient numbers of electric socket outlets provided in the kitchen area, it can result in kettles, or other kitchen appliances, being used in non-kitchen areas, which may result in increased risk of scalds.

25.25 Where a kitchen is remote from the unit of accommodation, then there may be significantly increased risk of burns and scalds associated with carrying hot drinks and food from the kitchen to the accommodation.

Where a cooker is provided, it should be in good working order and stable and securely placed.

RELATED MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

25.26 Relevant matters contributing to the likelihood of a hazardous occurrence include:

a) Unprotected hot surfaces:- exposed surfaces to fixed appliances or pipework with surface temperatures of 43°C or more;
b) Unguarded open flames:- to space or water heating appliances;
c) Hot water to bath:- water from bath and basin taps supplied above 46°C;
d) Hot water to sink:- water from kitchen sink taps supplied above 60ºC;
e) Thermostatic taps:- no thermostatically controlled taps or incorrectly set thermostatically controlled mixer taps or anti scald devices;
f) Kitchen layout:- poor layout or inadequate space to kitchen, in particular where cooker or worktop is sited close to a door or thoroughfare; and
g) Inadequate separation:- of kitchen from living or sleeping areas;

25.27 Relevant matters affecting the severity of health outcome include:

a) Surface/liquid temperature:- the temperature of the hot liquid or surface;
b) Exposure:- the length of time exposure is expected;
c) The duration of time before rescuing action might be taken n[65].

HAZARD ASSESSMENT

25.28 The assessment includes consideration of the space and water heating provision at the dwelling, including the temperature of water at taps, and also the kitchen design and layout. Each of these features is considered in the one *hot surfaces and materials* hazard assessment.

25.29 It may be appropriate to measure the temperature of hot water as delivered, and to measure dimensions of rooms and other spaces in a dwelling. This is to ensure that there is adequate space around heating appliances given typical furniture and circulation space requirements.

25.30 Measuring the dimensions of kitchens may also be appropriate in assessment of the hazard, taking into account the number of people who might be expected to use the space.

Multi-occupied buildings

25.31 Relevant to the assessment is whether the people using facilities are expected to be part of the same household or not. Where people from different households share facilities, there may not be good communication or co-operation between them, increasing the risk from what would be expected from a similar kitchen in single household use by a similar number of people.

65 Of relevance to 25.25 (b) and (c), is whether or not the location is a room where adult supervision is expected.

Collisions, Cuts and Strains

26 Collision and Entrapment

DESCRIPTION OF THE HAZARD

26.01 This category includes threats of trapping body parts in architectural features, for example trapping limbs or fingers in doors or windows. It also includes striking (colliding with) objects such as architectural glazing, windows, doors, low ceilings and walls.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

26.02 The most vulnerable group is all persons aged under 5 years for most entrapment and collision hazards. However, for collision hazards due to low headroom, all persons aged 16 years or over is taken as the vulnerable age group.

Entrapment and Collision Hazards
Average Likelihood and Health Outcomes for Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	40	0.00	0.06	4.27	95.67	57 (**G**)
	1920-45	41	0.00	0.11	3.83	96.07	55 (**G**)
	1946-79	31	0.00	0.02	4.04	95.93	71 (**G**)
	Post 1979	42	0.00	0.05	4.16	95.79	54 (**G**)
Flats	Pre 1920	76	0.00	0.00	2.78	97.22	24 (**H**)
	1920-45	80	0.00	0.00	2.00	98.00	20 (**H**)
	1946-79	43	0.00	0.12	4.00	95.88	53 (**G**)
	Post 1979	32	0.00	0.00	7.60	92.40	100 (**F**)
All Dwellings		**39**	**0.00**	**0.06**	**4.06**	**95.89**	**57 (G)**

Collision Hazards from Low Headroom
Average Likelihood and Health Outcomes for Persons aged 16 years and over, 1997-1999

Dwelling type & age	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class 1 %	Class II %	Class III %	Class IV %	
All Dwellings	180	0.00	0.53	6.96	92.50	20 (**H**)

Basis of Estimates

26.03 The figures in the above two tables relate respectively to persons aged under 5 years and those aged 16 years or over who were injured due to collision or entrapment accidents in the home in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the small number of fatal collision and entrapment accidents in the total population sample, as reported by Coroners. The Class II to IV estimates are based on persons injured due to being stuck by or against or caught, crushed, trapped or pinched in or between moving or stationary building elements, fixtures and fittings, as reported by the Home Accident Surveillance System.

26.04 There is strong evidence and, due to large sample sizes, a high confidence level for the statistical averages for *entrapment and collision*.

Health effects

26.05 There are more than 200,000 injuries a year through collisions and entrapments involving doors in dwellings, and nearly 40,000 from collision and entrapment involving windows (1998 HASS data). However, the injuries sustained from window injuries tend

to be worse, particularly when the accidents result from cutting and piercing from architectural glass. Nearly 1,000 injuries each year are caused by entrapment and collision involving lifts in domestic accommodation.

26.06 The most common type of door accident involves a door shutting on, or trapping, part of a body (39% of door accidents). Collisions with doors is the next most common (37% of accidents).

26.07 Most door accidents occur to children aged 9 years and under, and these children are most vulnerable to a door shutting on part of the body. However, accidents involving door glazing (15% of door accidents) are most likely to occur to young adults (20 to 29 years).

26.08 Children and young adults (15 to 24 years) are most vulnerable to glazing and window accidents.

26.09 Children and the frail elderly are vulnerable to accidents involving lifts.

THE IDEAL

26.10 Building Regulations *Approved Document K* deals with the positioning of windows on stairs, and protection from collision with open windows, skylights and ventilators, and protection from impact from and trapping by doors.

26.11 Building Regulations *Approved Document N* deals with glazing and safety in relation to impact, opening and cleaning.

26.12 Various British Standards cover windows and doors, but of particular relevance is *BS 8213: Part 1* which deals with safety requirements of windows and doors. Also relevant is *BS6262: Part 4* which covers risks of accidental impact with glazing.

CAUSES AND PREVENTIVE MEASURES

Window opening lights should not project over pathways to obstruct the passage of those using the path.

Doors and window should be maintained in repair, with particular attention to items such as sash cords, to avoid increasing the risk of an occurrence.

Safety glazing should be provided in vulnerable locations.

Self-closers on doors should be adjusted so as not to cause over-vigorous closing.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

26.13 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Door design defects – difficult operation of doors and door catches;
b) Disrepair to doors – disrepair of door and/or door furniture;
c) Door closer defects – overly powerful mechanisms;
d) Door location – doors opening out into small circulation areas, corridors, landings or staircases;
e) Window design defects – difficult operation of opening lights and window catches;
f) Disrepair to windows – disrepair of windows, frames and/or window furniture;
g) Windows location – windows opening across pathways;
h) Non-safety glass – in a door, low window or other vulnerable location;
i) Unprotected gaps – gaps of over 10 cm in banisters in which young children could get trapped.
j) Low headroom to doors – well under 1.9 metres; and
k) Low beams and ceilings – well under 1.9 metres;

HAZARD ASSESSMENT

26.14 Following visual inspection, it may be necessary to take measurements to confirm and compare with the Ideal.

26.15 Where there are a number of deficiencies at a dwelling which could result in entrapment or collision then an overall assessment is made taking into account each deficiency and its location. This may possibly involve a range of architectural features, such as doors and glazing.

27 Explosions

DESCRIPTION OF THE HAZARD

27.01 This category includes threats from debris generated by the blast, or partial or total collapse of a building, as the result of an explosion.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

27.02 While no particular age group appears to be more vulnerable than others, the low incidence rate for explosions in dwellings means that it would be unwise to draw firm conclusions about vulnerable groups.

Explosions
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	139,439	11.8	0.0	14.7	73.5	1 (J)
	1920-45	295,326	22.2	0.0	0.0	77.8	1 (J)
	1946-79	123,913	5.6	0.0	4.5	89.9	1 (J)
	Post 1979	134,544	3.8	0.0	0.0	96.2	0 (J)
Flats	Pre 1920	116,270	16.5	0.0	0.0	83.6	1 (J)
	1920-45	561,344	100.0	0.0	0.0	0.0	2 (J)
	1946-79	187,231	16.5	0.0	0.0	83.6	1 (J)
	Post 1979	482,054	100.0	0.0	0.0	0.0	2 (J)
All Dwellings		**156,528**	**11.2**	**0.0**	**5.4**	**83.4**	**1 (J)**

Basis of estimates

27.03 The figures in the above table relate to persons of all ages who were killed or injured due to an explosion at their home, in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of persons killed by the explosion of pressure vessels and gases in the total population sample, as recorded by the mortality statistics. The Class II to IV estimates are based on the number of persons

non-fatally injured by blast or objects from an explosion, as reported by the Home Accident Surveillance System.

27.04 The low incidence rate of explosions in dwellings means that the figures must be considered with caution. However, it can be concluded that the average likelihood of an explosion is very small, but explosions can result in extreme harm.

27.05 There are around 10 deaths per year in dwellings as a result of explosions. It is estimated that there were 508 non-fatal "struck – explosion" accidents in 1998.

Health effects

27.06 Typical injuries include crushing, bruising, puncture injuries, fractures, and head, brain and spinal injuries. If the explosion involves a hot water appliance, there may also be scalding.

THE IDEAL

27.07 Gas supplied to dwellings should satisfy the requirements of the current Gas Quality Regulations. The gas installation should be properly installed by a competent person (ie, registered with the Council for Registered Gas Installers (CORGI)) and in accordance with the current Gas Safety (Installation and Use) Regulations. Gas appliances should satisfy the relevant Gas Appliances (Safety) Regulations.

27.08 Hot water systems should be correctly installed to meet the requirements of relevant Water Byelaws, the Building Regulations *Approved Document G*.

27.09 Building Regulation *Approved Document J* includes requirements for safe storage of liquid fuel, as well as other requirements relating to combustion appliances.

27.10 Relevant British Standards include *BS 5258 Safety of domestic gas appliances Part I Specification for central heating boilers and circulators, BS6700 Specification for Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages,* and *BS 5482 Domestic butane- and propane-gas-burning installations - Part 1:Specification for installations at permanent dwellings.*

CAUSES AND PREVENTIVE MEASURES

27.11 A study for the Building Research Establishment (BRE) between 1985 and 1991 showed that the most frequent causes of explosions were mains gas (42%) and stored gas (17%). Water vapour explosions accounted for 5%, and fire for 4%, of the total recorded explosions.

Gas

Gas supplied to dwellings should be supplied by an authorised supplier at a standard pressure and of a standard composition.

There should be appropriate properly designed and installed pressure regulators, meters and pipework. The installation should be regularly tested to ensure there are no leaks or other defects, and in particular where there have been any alterations to the dwelling or to the gas installations.

Appliances should be properly designed and installed. The appliances and associated flue should be regularly serviced and maintained by a competent person.

Liquid Petroleum Gas (LPG) is heavier than air, while natural gas is lighter. Where LPG is used, there should be adequate low level ventilation or means of ensuring any gas escaping can drain safely away. This is particularly important where the floor level is below the adjacent ground level. Liquid Petroleum Gas (LPG) containers and storage tanks should be secure and sited well away from possible sources of ignition.

Water

No hot water storage tank of more than 3 gallon (15 litre) capacity should be connected directly to the mains water supply.

For ventilated systems, there should be an adequately sized vent pipe sufficient to allow steam to escape in case of thermostat failure.

Unvented systems should be provided with both a non self-resetting thermal cut-out and one or more temperature relief valves. These safety devices should be regularly tested.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

27.12 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Unauthorised gas supply:- the supply of gas from a non-authorised supplier;
b) Siting of gas tanks:- inappropriate siting of LPG containers or tanks;
c) Gas installations:- defects to the gas installation (pressure regulators, meters and pipework);
d) Gas appliances:- defects to the gas appliances;
e) Maintenance defects:- lack of evidence of regular testing and servicing of the gas installation and/or appliances;
f) Ventilation:- lack of appropriate means of ventilation, taking account of the type of gas used;
g) Gas storage:- inadequate or defective storage equipment for other than mains gas;
h) Hot water storage tank:- tank of greater than 3 gallons (15 litres) connected directly to the mains water supply;
i) Vented hot water system:- inadequately sized and/or blocked vent to system;
j) Unvented hot water system:- lack of or defective non self-resetting thermal cut-out and/or temperature relief valve to unvented system.

HAZARD ASSESSMENT

27.13 Following a visual inspection, if there are indications that there may be an above average risk, further investigation and a safety report from an appropriate engineer may be necessary to fully appraise the hazard.

28 Ergonomics

DESCRIPTION OF THE HAZARD

28.01 This category includes threats of physical strain associated with functional space and other features at dwellings. It also includes physical strain which may result from avoidance of other hazards, such as *26 Collision and entrapment* and *19-22Falls* hazard categories.

POTENTIAL FOR HARM

Most vulnerable group and statistical averages used for rating

28.02 The most vulnerable age group is all persons aged 60 years or over.

Ergonomics
Average Likelihood and Health Outcomes for all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	11,495	0.0	2.6	28.2	69.2	1 (J)
	1920-45	11,106	0.0	2.7	10.8	86.5	1 (J)
	1946-79	12,859	0.0	1.5	10.6	87.9	0 (J)
	Post 1979	17,679	0.0	0.0	55.6	44.4	1 (J)
Flats	Pre 1920	9,074	0.0	0.0	0.0	100.0	0 (J)
	1920-45	8,443	0.0	0.0	33.3	66.7	1 (J)
	1946-79	22,883	0.0	0.0	11.1	88.9	0 (J)
	Post 1979	22,421	0.0	0.0	25.0	75.0	0 (J)
All Dwellings		**12,925**	**0.0**	**1.7**	**16.9**	**81.4**	**1 (J)**

Basis of estimates

28.03 The figures in the above table relate to persons aged 60 years or over who were harmed by ergonomic factors in their home, in England and Wales in the years 1997, 1998 and 1999. The statistics are based on the number of fatal injuries in the total population sample, reported in the mortality statistics, and the number of hospital treated

cases, reported by the Home Accident Surveillance System. They are all for persons aged 60 years or over who, between 1997 and 1999, suffered an accident caused by acute over exertion, where the main article involved was a fixed building element or a fixture or fitting, such as a fixed kitchen wall unit.

28.04 The sample sizes for this hazard category are small, resulting in weak data, and low confidence in averages given. In such cases, the averages for all dwelling will be significantly more accurate than those for individual dwelling types and the likelihood figure more accurate than those for the spread of health outcomes. However, it is clear that the likelihood of injury is small.

Health effects

28.05 Strain and sprain injuries are the obvious injuries resulting from poor ergonomics. However, this hazard can lead to other injuries where a person is forced to stretch or lean awkwardly to reach a handle, catch or switch. This may include fall injuries.

THE IDEAL

28.06 Dimensions to facilitate safe use and cleaning of windows, doors and roof lights are given in British Standard *BS 8213*.

28.07 Space requirements for both appliances and their activity spaces are given in British Standard *BS6465 Sanitary Installations Part 2: Code of practice for space requirements for sanitary appliances*. This includes space requirements for baths, showers, basins, water closets, and sinks.

28.08 British Standard *BS 4467 Dimensions in designing for elderly people,* covers the anthropometric and ergonomic requirements of the elderly.

28.09 Activity space requirements for kitchens and other areas are given in the *BRE housing design handbook*[66].

28.10 Building Regulations *Approved Document M* gives details of convenient locations for electric sockets and switches. Unlike most of the other Approved Documents, where the main purpose is to secure reasonable standards of health and safety in and about buildings, *Part M* addresses welfare and convenience for building users. The standard therefore goes beyond the minimum required for health and safety.

CAUSES AND PREVENTIVE MEASURES

28.11 The positioning and location of amenities, fittings and equipment and the design and layout of dwellings has an effect on convenience of use. Inappropriate positioning of amenities and equipment may cause physical strain. For example, strain can result from awkward positioning of windows, difficult to operate window catches, inadequate functional space such as low headroom, inadequate space around bathroom or kitchen facilities, or inappropriate siting of facilities.

66 BRE, BRE Housing Design Handbook, 1993, CRC, London

The layout of the dwelling and in particular the kitchen and bathroom should be such as to make use convenient and easy, as well as safe, and should facilitate cleaning.

Wash hand basins, sinks, worktops, sanitary basins, baths and showers should be located at an appropriate height, and with sufficient free user space to facilitate use without strain. Light switches should be sited convenient to door openings and at each end of staircases and corridors and at a reasonable height. Socket outlets should be conveniently sited. Door handles should be at a reasonable height and window catches should be readily accessible without strain. Cupboards and shelves should be sited where they can be easily reached, but without posing collision hazards.

MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

28.12 Relevant matters contributing to the likelihood of a hazardous occurrence and affecting the severity of the health outcome include:

a) Position of amenity:- inappropriate positioning of a wash hand basin, bath, shower, bidet and/or sanitary basin;
b) Space for amenity:- inadequate activity space for the use of a wash hand basin, bath, shower, bidet and/or sanitary basin;
c) Kitchen worktops:- inappropriate positioning of a worktop and/or sink;
d) Kitchen space:- inadequate activity space for the use of cooking facilities, worktops and/or sinks;
e) High level storage:- inappropriate siting of a shelf or wall cupboard.
f) Window controls:- inappropriate positioning of window controls;
g) Electric switch/sockets:- inappropriate siting of electric switch and/or socket outlet;
h) Operation of windows etc:- stiff or otherwise difficult operation of window, door, or tap handles and catches.

HAZARD ASSESSMENT

28.13 Following visual inspection, it may be necessary to take measurements where ergonomics are considered an issue.

29 Structural Collapse and Failing Elements

DESCRIPTION OF THE HAZARD

29.01 This category includes threats of whole dwelling collapse, or threat of an element or a part of the fabric being displaced or failing because of inadequate fixing, disrepair, or as a result of adverse weather conditions. Structural failure may occur internally or externally within the curtilage threatening occupants, or externally outside the curtilage putting at risk members of the public.

POTENTIAL FOR HARM

Most vulnerable age group and statistical averages used for rating

29.02 There is no particular age group more vulnerable than others.

Structural failure
Average Likelihood and Health Outcomes for Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class 1 %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	10825	0.2	0.6	9.3	90.0	1 (J)
	1920-45	9010	0.2	0.00	9.6	90.1	1 (J)
	1946-79	10440	0.3	0.00	7.5	92.3	1 (J)
	Post 1979	14701	0.3	0.00	4.5	95.2	0 (J)
Flats	Pre 1920	24098	0.6	0.00	22.1	77.3	1 (J)
	1920-45	21126	0.0	0.00	0.0	100.0	0 (J)
	1946-79	14561	0.7	0.00	4.7	94.5	1 (J)
	Post 1979	14762	1.0	0.00	16.5	82.5	1 (J)
	All	**11170**	**0.3**	**0.1**	**8.2**	**91.4**	**1 (J)**

Basis of estimates

29.03 The figures in the above table relate to persons of all ages who were injured due to structure collapse or falling elements at their home, in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such persons fatally struck by falling objects, including collapse except where due to fire, in the total population sample, as reported by Coroners. The Class II to IV estimates are based on the number non fatal strikes by moving objects, where the article involved is an otherwise fixed building element or structure, as reported by the Home Accident Surveillance System.

29.04 There is strong evidence for the likelihood of the risk for the *structural failure* hazard category, due to the large population sampled, but weaker evidence for the spread of health outcomes as such accidents are relatively rare. Consequently there is moderate confidence in the averages overall.

Health effects

29.05 Objects falling from the fabric of a building and as a result causing injury are extremely rare. Potential injuries range from minor bruising to death.

THE IDEAL

29.06 Dwelling construction should comply with the requirements of Building Regulations Part A and Approved Documents A and F2.

CAUSES AND PREVENTIVE MEASURES

29.07 Externally, the hazard ranges from falling slates, eaves gutters, bricks or windows, to collapse of walls. Internally, it includes floor, ceiling and staircase collapse. The most common incident is for a fixture, such as a light fitting or kitchen cabinet, to fall from the ceiling or wall, because of a combination of poor fixings and vibration. However, the most common part of the fabric of buildings to fall and injure someone is ceiling plaster. Being hit by chimney pots and roof slates/tiles is much more rare.

29.08 All elements of the structure of dwellings should be properly maintained to ensure they remain safe and stable.

Foundations and external walls

The foundations and load bearing external walls should be designed, constructed and maintained to be of sufficient strength to support the weight of the building, fittings, furnishings and its users. Any disrepair should not interfere with structural integrity. Any external cladding, rendering or similar finishing and any coping should be securely fixed and in repair.

Windows, doors and other openings in walls

All openings to external walls should be properly constructed and maintained to provide for proper distribution of the load above. Lintels should be of sufficient strength and be maintained in repair. Frames to openings and doors and windows should be securely fixed and maintained in repair.

Balconies and external walkways

All external balconies and walkways should be designed, constructed and maintained so as to be capable of supporting their own weight and the imposed loads (such as plant pots) and persons.

Roofs

The roof structure should be designed, constructed and maintained so as to be strong enough to support the weight of the covering, be securely fixed and to cope with wind and weather imposed loads. Roof coverings should be securely fixed and maintained in repair. Chimney stacks should be properly constructed and maintained and pots securely fixed.

Rainwater goods and external pipework

All external pipework and eaves gutters should be securely fixed and properly maintained. Eavesgutters should be capable of coping with the weight imposed by typical snowfalls.

Floors and staircases

Floors should be designed, constructed and maintained to be of sufficient strength to support their own weight and that of imposed loads including furniture, fixtures, fittings (including facilities such as baths and wc basins) and occupants. Staircases should be designed, constructed and maintained to be of sufficient strength to support their own weight and that of imposed loads including occupants and furniture likely to be carried up and down.

Ceilings

Ceilings should be designed, constructed, fixed and maintained to be strong enough to remain intact.

Internal walls and wall openings

Internal walls should be designed, constructed and maintained to be strong enough to support their own weight and any loads reasonably expected. Such loads could include upper floors and ceilings, shelves, pictures, light fittings, equipment, facilities and fixtures. Door frames and openings should be properly fixed and maintained and capable of supporting the doors.

Fittings

Fittings and fixtures (such as electric lights, kitchen wall-cupboards and showers) should be properly and securely fixed.

RELEVANT MATTERS AFFECTING LIKELIHOOD AND HARM OUTCOME

29.09 Relevant matters contributing to the likelihood of a hazardous occurrence include:

a) Structural movement: - evidence of continuing movement;
b) Structural cracks etc: – cracks and/or bulges to external walls;
c) Open joints: – to brick, stone or block work to external walls or chimney stacks;
d) Cladding defects:– loose render or other insecure external finish to external walls;

e) Loose coping/s: - to parapet or balcony walls or to chimney stacks;
f) Loose guarding: - to balconies, roof terraces etc;
g) Structural damage: - to balconies etc;
h) Disrepair to lintels/sills:- cracked lintels and/or sills or other disrepair around openings to external and internal walls;
i) Insecure frames or hinges: – to either windows or doors;
j) Roof movement: - sagging, distorted or spreading to the roof structure;
k) Loose roof covering: – loose or slipped roof slates, tiles etc;
l) Loose pots - to chimney stacks;
m) Insecure rainwater goods: – including eaves gutters and/or external pipework;
n) Staircase failure: - springy, distorted or other indications of failure of staircase structure;
o) Insecure guarding: - to staircases and/or landings;
p) Defective ceilings etc: - cracked, damp and/or bulging ceilings;
q) Defective internal walls: - cracked and/or bulging internal walls;
r) Insecure internal frames: – loose door frames or hinges;
s) Loose fittings or fixtures.

29.10 Matters affecting the severity of health outcome include:
a) Height above ground:- the height of the building or of the element above the ground or floor;
b) Size/weight of element:- the size, weight and nature of the object or element likely to fall.

HAZARD ASSESSMENT

29.11 Visual inspection can be used to assess some hazards. However, further investigation, sometimes involving opening up of the structure, may be necessary to establish the extent or seriousness of some structural hazards. For example, wall-tie condition, or the extent of fungal or insect attack to timber, will only usually be determined following destructive examination. In some instances it may be necessary to seek expert advice from a structural engineer.