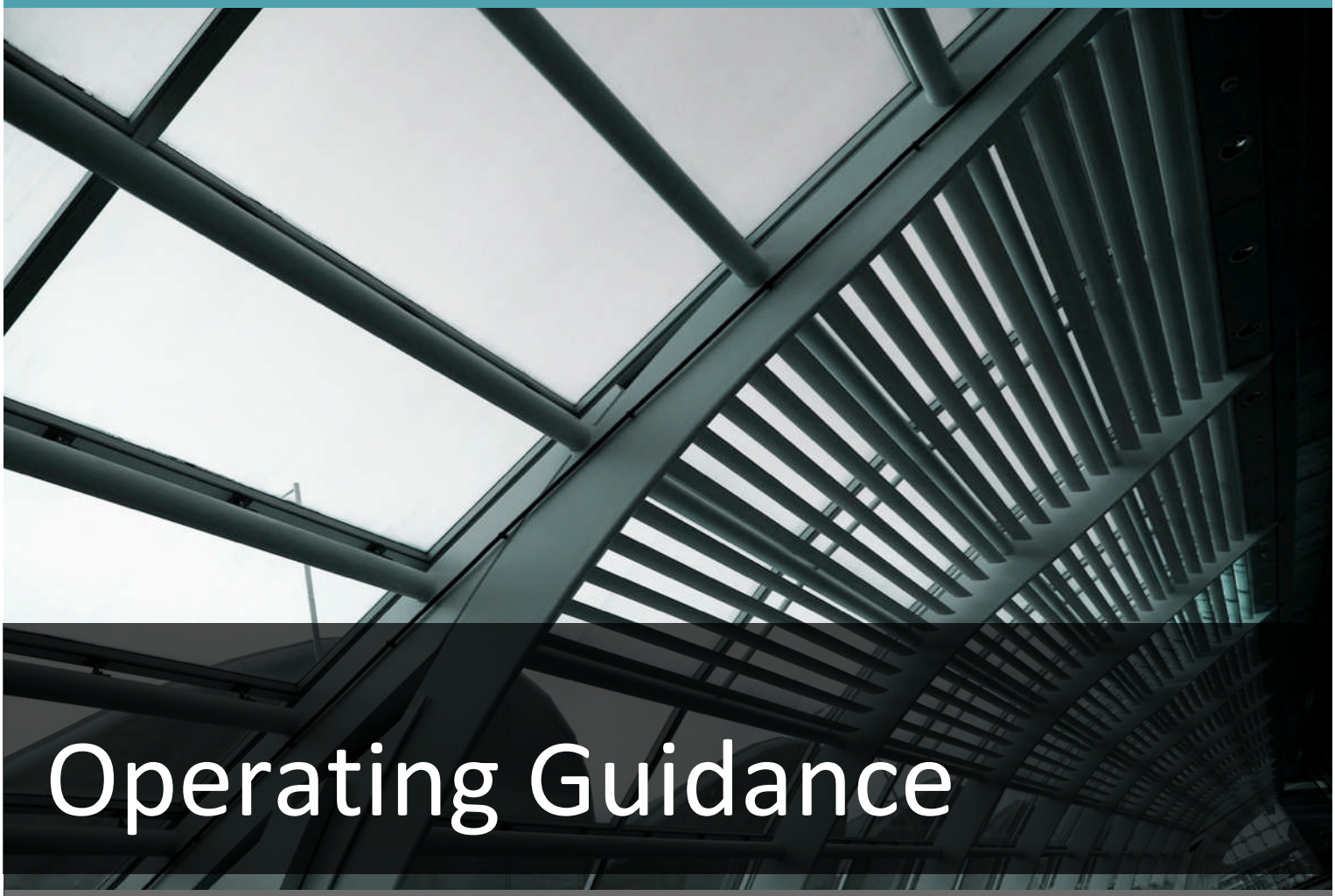

Operating Guidance

Healthy Home Rating System – Operating Guidance

Department of Housing and Urban Development
Office of Healthy Homes and Lead Hazard Control

Department of Housing and Urban Development

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Operating Guidance – Healthy Home Rating System

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[1] Appendix C and D are incorporated from the UK's HHSRS Operating Guidance (originally as Appendix D and Appendix E) – original page numbering is retained.

CHAPTER 1
Introduction and Background

1.01. The Healthy Home Rating System (HHRS) is not in itself a standard; rather, it is a system of assessment. This document provides guidance on the technical aspects of the HHRS assessment in this context.

1.02. The HHRS is founded on the logical evaluation of both the likelihood of an occurrence that could cause harm, and the probable severity of the outcomes of such an occurrence. It relies on the informed professional judgments of both of these to provide a simple means of representing the severity of any dangers present in a dwelling.

1.03. The Rating System is concerned with the assessment of hazards and the potential effect of conditions. While the HHRS can be used to judge the effectiveness of remedial action, it cannot determine or suggest that action – that is a matter for judgment depending on the particular circumstances, including the design and construction of the dwelling.

1.04. The HHRS 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 summarized in the Hazard Profiles section of this Guidance and these are intended to inform professional judgment.

1.05. The assessment using the HHRS is made based on the condition of the whole dwelling. This means that, before such an assessment can be made, a thorough inspection of the dwelling must be carried out to collect the evidence of the condition.

1.06. While this does not involve a new approach to the inspection of dwellings, it does require an understanding and appreciation of the potential effects that could result from conditions and deficiencies that should have been identified during the inspection.

1.07. The HHRS concentrates on threats to health and safety. It is generally not concerned with matters of quality, comfort and convenience. However, in some cases, such matters could also have an impact on a person's physical or mental health or safety and so can be considered. 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.

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

The Background to the Healthy Home Rating System

The Theory Behind the HHRS

1.09. The HHRS (HHRS) is an American adaptation of the British Housing Health and Safety Rating System. The HHRSR was developed to allow assessment of all the main potential housing related health and safety hazards. By focusing on potential hazards, it places the emphasis directly on the risk to health or safety, rather than cosmetic or physical conditions alone. As such, there is significant overlap between the two approaches and the HHRS utilizes the vast housing and health data that forms the basis for the HHSRS in the United Kingdom. The rationale for this "borrowing" is due to the fact that the United States lacks key data connecting housing and health outcomes. Until such a time as the United States develops a comprehensive data set, the HHSRS provides reliable "point-of reference" data for our use.

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

1.11. Development of the British HHSRS was carried out over several years. As well as those directly involved with the development, there was considerable input, advice and evaluation of the underlying principles of the Rating System from a wide range of experts, including experts in risk assessment, housing, environmental health, and risks in buildings. This development involved wide ranging testing of both the theory and the practical application.

1.12. The concept was originally proposed in 1998. Over the following years several options for the approach to assessment and scoring were tried and tested, and the most consistent and robust was finalized and released in July 2000.

1.13. During this time, the underlying principles and the assessment formula were shown to be sound. Between July 2000 and January 2003, the statistical evidence that supports the HHSRS and informs judgments, was refined and updated, the reaction of practitioners to the most recent version was evaluated, and the application of the system in dwellings in multi-occupied buildings reviewed. The HHRS follows the same principles and judgments and relies upon the same statistical data.

1.14. The principles and approach developed remain unchanged. However, this guidance uses the refined and updated statistical evidence, and takes account of the findings from the evaluation and multi-occupied buildings studies. It also incorporates information unique to the United States context.

The Principle Underlying the HHRS

1.15. The underlying principle of the HHRS is that – **Any residential premises should provide a safe and healthy environment for any potential occupant or visitor.**

1.16. 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.

1.17. Some hazards, however, are necessary or unavoidable, and others are considered 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 an occurrence that could result in harm and of the potential harm that could result.

1.18. 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 normal local weather conditions, ground conditions and pollution (including noise, air and radiation).

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

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

1.21. For the purposes of the HHRS, 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.

1.22. **Note** – While the Rating System focuses on the existing potential effect of any deficiencies on health and safety, any inspection should not overlook any other deficiencies that do not currently contribute to hazards. Such deficiencies may have other implications, such as interference with the aesthetic or general 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.

CHAPTER 2
Terminology, and Extent and Purpose of the Guidance

Glossary

Certain words and phrases have particular meanings when used in connection with the HHRS. To assist in the correct understanding and application of the HHRS the definitions of these words and phrases for the purpose of this Guidance are given below.

Deficiency

2.01 This is a failure of an element to meet the Ideal, as defined below. 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 lack of repair or maintenance.

Dwelling

2.02 For the purposes of an assessment, a **dwelling** is any form of accommodation that 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 an "apartment", "flat", or "efficiency" that is a self-contained dwelling on one or more floors in a building containing other dwellings or other types of accommodation (e.g. shops or offices); and
(c) what may be known as an "efficiency", "dormitory", or other type unit that 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.

2.03 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.

2.04 Where the dwelling is an apartment, secondary suite (e.g., in-law suite) or other self-contained living accommodation occupying two floors of a larger house and having its own outside entrance, or a single room occupancy (SRO) or rooming house, as well as including those means of access, amenities and services mentioned 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. This applies whether or not the flat/apartment or SRO is self-contained.

Element

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

Harm and Class of Harm

2.06 Harm is an adverse physical or mental effect on the health of a person. It includes, for example, physical injury, and illness, condition, or symptom whether physical or mental. It also includes both permanent and temporary harm.

2.07 For the purposes of the HHRS, the possible Harms that may result from an occurrence are categorized according to their perceived severity into four Classes of 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 medical records. (Examples for each Class of Harm are given in Appendix B).

Hazard

2.08 Any risk of harm to the health or safety of an actual or potential occupant that arises from a deficiency. In some cases, as well as being a hazard in its own right, a hazard may increase the likelihood of an occurrence of, or the severity of harm likely to result from another hazard.

Hazard Score and Rating

2.09 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 of the probable spread of harms that could result.

2.10 Note –The application of the HHRS 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 that are part of a larger building (i.e. flats/apartments etc – above);
ii. those which are not self-contained (i.e. SROs etc – above); and
iii. premises such as halls of residence, hostels and so-called “bed and breakfast” accommodation.

2.11 The Hazard Rating is the Band into which the Hazard Score falls[5].

Health

2.12 This is an individual’s state of physical, mental and social wellbeing. It is not limited to the presence or absence of disease, infirmity or physical injury, but includes psychological injuries and distress.

HHRS Formula

2.13 This is the Formula used to calculate the Hazard Score using representative scale points to denote likelihood and spread of outcomes judgments.

Ideal

2.14 The perceived optimum standard, at the time of the assessment, intended to prevent, avoid or minimize the hazard.

Likelihood

2.15 The probability of an occurrence that could cause harm. For the purposes of the Healthy Home

Rating System, this is the probability of an occurrence during the twelve months following the assessment.

Location

2.16 This is a site or several sites in or associated with a dwelling where the presence of a particular hazard would threaten the health or safety of an occupant or potential occupant. For the assessment following an inspection, 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 Falling on Stairs etc[7].

Occurrence

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

Representative Scale Points

2.18 These are used in the HHRS Formula to denote the judgments made of the likelihood and the spread of outcomes.

2.19 Note – As it is the perceived optimum prevailing at the time of assessment, this will change, and it is the responsibility of those using the HHRS to keep up-to-date on what it the Ideal. For a discussion on assessing hazards existing in more than one location, see paras 3.16 and 3.22.

2.20 A set of standard ranges of ratios is given for the likelihood and standard ranges of percentages for the spread of outcomes. For each of these ranges a representative scale point is used in the Formula.

2.21 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 HHRS calculation.

2.22 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 HHRS 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.

Risk

2.23 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 HHRS this is expressed as the Hazard Score or Hazard Rating.

Single Room Occupancy (SRO)

2.24 Generally refers to a building, whether purpose-built or converted, comprising two or more dwellings, each dwelling being occupied by one individual or household, and where two or more of the dwellings share some or all amenities (e.g., a shared bathroom, kitchen).

Spread of Harms

2.25 The range of possible harm outcomes (i.e. Classes of Harm) that could result from an occurrence.

For the HHRS, this is expressed numerically as a set of percentages indicating the relative possibility of each Class of Harm as assessed from data sources.

Vulnerable Group

2.26 A range of people for whom the risk arising from a hazard is greater than for any other age group in the population. Where there is no vulnerable group for a specific hazard, the population is taken as a whole.

2.27 Vulnerability to particular hazards is restricted to age groups. It does not extend to vulnerability for other reasons.

Responsibility for Deficiencies and Hazards

2.28 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 behavior of the occupants or neighbors; and
(c) deficiencies which are attributable to both the dwelling and the occupants or neighbors.

An occupant in a vulnerable group, where applicable, is referred to as a “relevant occupant”.

2.29 The HHRS provides 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, and takes into consideration occupant use as appropriate. This assessment is of the dwelling disregarding the current occupants (if any), and based on the potential effect of any hazards on a member of the relevant vulnerable age group. This is important and means that the assessment will not be affected by a change of occupant, and that an unoccupied dwelling can be assessed.

CHAPTER 3
Overview of Rating Hazards

3.01 The HHRS uses judgments made by the inspector, based on an inspection of the whole dwelling, to generate a numerical score. The information observed during the inspection should be properly and accurately recorded as this will provide evidence to justify and support the judgments that form the basis of the numerical Hazard Score.

3.02 The Rating System assessment procedure requires for each hazard, two judgments from the inspector. 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 group; and
(b) the range of potential outcomes from such an occurrence.

3.03 This approach is more logical than merely attempting to judge the severity of the hazard on a linear scale[14]. 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).

BOX 1 - Similar Hazards, with Differing Outcomes

Example –
There is a window with a low internal sill (about 10 inches/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 an apartment 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 an apartment 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

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

Note - The term “inspector” used in this Guidance includes an environmental health practitioner or other local authority officer.

3.04 Using these two judgments, the HHRS Formula is used to generate the numerical Hazard Score for each of the hazards. The Formula and the use of numbers to represent the inspector’s judgments

provide the means to compare very different hazards. It is this approach which enables hazards that have a slow and insidious effect to be compared with ones where the effect is relatively instantaneous; and enable hazards which may result in physical injury to be compared with ones which could cause illnesses or affect mental health.

The HHRS Formula

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

(a) a weighting for each Class of Harm[2] reflecting the degree of incapacity to the victim resulting from the occurrence;

(b) the likelihood of an occurrence involving a member of a vulnerable group, expressed as a ratio; and

(c) the spread of possible harms resulting from an occurrence, expressed by percentage for each of the four Classes of Harm.

3.06 The first of these, the weighting given to each Class of Harms, remains fixed and is shown in Table 1.[3] This built-in fixed weighting means that, given the same likelihood, those hazards that cannot result in death (e.g. risks from the position and operability of amenities etc) will not produce a Score as high as those that may cause death (e.g. risks from carbon monoxide).

Table 1. Weighting for Classes of Harm

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

3.07 The other two sets of figures represent the informed professional judgments made by the inspector of the likelihood and of the potential spread of harms.

3.08 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.)

[2] See paras 2.09-2.11 above, for the interpretation of these terms, and Appendix B for Examples for each Class.

[3] The Classes of harm and the weightings are based on those proposed in *A Risk Assessment Procedure for Health and Safety in Buildings* (2000) CRC, London.

Figure 1. The HHRS Scoring Formula

Class of Harm Weighting				Likelihood		Spread of Harm (%)
SI	=	10,000	X	1/L	X	O1
SII	=	1,000	X	1/L	X	O2
SIII	=	300	X	1/L	X	O3
SIV	=	10	X	1/L	X	O4
					Hazard Score = (S1+S2+S3+S4)	

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

3.09 General advice and guidance on assessing the likelihood and outcomes is given in the following paragraphs. More specific guidance on assessments for each individual hazard is given in the Hazard Profiles.

Judging the Likelihood

3.10 The inspector judges the likelihood of an occurrence over the next twelve months that could result in harm to a member of the relevant vulnerable group. For the HHRS, the judgment is limited to the likelihood of an occurrence resulting in outcomes that would or should require some medical attention – a visit to a doctor or a hospital. This is because the Rating System deals only with those hazards that could cause significant harm outcomes (and so carry a significant Class of Harm weighting). It is only these outcomes for which there are recorded data to inform the judgment.[4]

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

3.12 Thus, the inspector 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 inspection, 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

For *falls on stairs*, the inspector determines the likelihood of a fall occurring over the following twelve months that 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, variations in tread or riser dimensions, and the available lighting.

*The **going** of a step is measured from the edge of the nosing to the edge of nosing in plan view. A person using the stairs would move this distance forward with each step they take.

[4] It is this data that has been used to calculate the statistical evidence for each Hazard.

Box 2. Continued.

For *dampness and mould growth etc*, the inspector 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.

3.13 To inform the inspector's judgment, national UK average likelihoods of an occurrence involving a person in the vulnerable age group are given in the Hazard Profiles (see Appendix C).[5] Where data is available, these are given for different age groups and types of dwellings. 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 that may affect the likelihood of an occurrence.

3.14 Assessing likelihood is not determining or predicting that there definitely will be an occurrence. 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.

3.15 The inspector is not expected to give an exact likelihood ratio, but to select one of the standard HHRS likelihood ranges – e.g., the range of 1 in 24 to 1 in 42; or the range of 1 in 420 to 1 in 750. For each of the standard ranges a representative scale point is used in the Hazard Rating Formula to calculate the Hazard Score. See Box 3 for the standard HHRS ranges of likelihoods, and the Representative Scale Points of those ranges that is used in the Hazard Rating Formula.[6]

Box 3. HHRS Standard Range of Likelihoods –

			Representative Scale Point
Less likely than		1 in 4,200	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	6
4	to	2.5	3
2.5	to	1.5	2
More likely than		1 in 1.5	1

[5] Note that these are national averages for the UK, which may differ from local US averages.

[6] An explanation of the calculation of the standard ranges and the Representation Scale Points is given in paras. 2.24-2.27.

3.16 Some hazards may be present in several locations. However, the inspector judges the likelihood range for the dwelling as a whole. Falls on the level, for example, will include reviewing the condition of all the floors within the dwelling and all the paths and yards associated with the dwelling. Damp and mould growth will involve reviewing the extent and severity of the dampness and any mould growth in all rooms within the dwelling. For these, the inspector should assess the collective likelihood of an occurrence at the dwelling as a whole. This should take into account all the factors associated with the 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 (i.e. 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 in 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

3.17 After judging the likelihood of an occurrence, the inspector makes the second judgment, that of the possible harm outcomes for the vulnerable age group that could result from such an occurrence. This is done by assessing the range of outcomes, under the four classes of harm. The most likely outcome would be decided upon first, and then other possible outcomes using the representative scale points for those other outcomes. This would mean that the percentage for the most likely outcome would be 100% minus the percentage sum of the representative scale points for any other outcomes.

3.18 National average spreads of harm outcomes for each hazard, although from the UK, are given in the Hazard Profiles (see Appendix C). The choice to include UK averages was made owing to the similar outcomes that would be anticipated in the US for similar types of conditions. Where data is available, these are given for different age groups and types of dwellings. The electronic tool simplifies this data for the inspector. 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. Local conditions may reveal different averages, which the inspector will take into account when scoring the hazard(s). Also given in the Hazard Profiles is guidance on dwelling characteristics that may affect the outcomes.

3.19 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 inspection 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.

3.20 As for likelihood, the inspector is not expected to give an exact spread of outcomes, but select one of the standard HHRS outcome ranges. For each of the standard ranges there is a representative scale point that is used in the Hazard Rating Formula. See Box 5 for the standard HHRS ranges of outcomes and for the Representative Scale Points used in the Formula to generate the Hazard Score.

BOX 5. HHRT Standard Range of Class of Harm Outcomes –

			Representative Scale Point
Below		0.05%	0%
0.05%	to	0.15%	0.1%
0.15%	to	0.3%	0.2%
0.3%	to	0.7%	0.5%
0.7%	to	1.5%	1%
1.5%	to	3%	2.2%
3%	to	7%	4.6%
7%	to	15%	10%
15%	to	26%	21.5%
26%	to	38%	31.6%
Above		38%	46.4%

3.21 As the spread of outcomes is given as percentages, the total must, obviously, equal 100. For example, using the Paper Scoring Form (see Appendix B), the inspector should select the representative scale points for three of the Classes of Harm, and the fourth Class, the most likely Class to occur, should be 100 minus the sum of the other three Classes. (This calculation is made automatically by the HHRS scoring programs.)

3.22 For those hazards which may be present in several locations, the inspector should take account of the state, condition and other factors related to each location and how that might affect the likelihood of an occurrence and so increase or lessen the overall possible 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 (i.e. 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

3.23 Using the same falls associated with stairs example as given in Box 6 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 HHRS Formula to generate a Hazard Score of 3,505 (See Box 7).

BOX 7. Generating a Hazard Score

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

3.24 Average Hazard Scores for each hazard are given in the Hazard Profiles (see Appendix C), and, where data is available, for different age groups and types of dwellings. These have been calculated using the Hazard Rating Formula and the average likelihoods and outcomes.

The Hazard Bands

3.25 The numerical Hazard Score can appear too specific. It can also falsely imply that the score is a precise statement of the risk, rather than a representation of the inspector's judgment.

3.26 Hazard Bands have been devised to avoid emphasis being placed on what may appear to be a precise numerical Hazard Score. These also provide a simple means for handling the potentially wide range of Scores – from under 0.2 to 1,000,000[7]. There are ten Hazard Bands (see Box 8), with Band J being the safest, and Band A being the most dangerous.

3.27 The Hazard Band is the first factor to be taken into account in determining the appropriate enforcement action – for guidance on which, see the Enforcement Guidance.

BOX 8. HHRT Bands – Band Hazard Score Range

Band	Score
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

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

CHAPTER 4
The Assessment of Conditions Using the HHRS

4.01. Once the inspection has been completed, the inspector 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 which is obviously worse than average for that type and age of property, the inspector assesses:
  - i) the likelihood of an occurrence over the next twelve months; and
  - ii) the probable spread of harms which could result from such an occurrence.

The Inspection Procedure

4.02. An inspection is, of course, a means of gathering information on which to base decisions. As those decisions could result in enforcement action, the inspection should be thorough and comprehensive. The observations and findings from the survey should be accurately recorded and stored for future reference, particularly as they may be needed to substantiate the judgments made and justify decisions taken which may affect someone's home and someone's property.

4.03. For the purposes of assessment using the Rating System, the inspection should be detailed enough to gather all the necessary information on the state and condition of a dwelling, and particularly on any deficiencies. As with all inspections, a simple logical approach should be adopted to ensure all internal and external parts of the dwelling are inspected. For local authority officers, such inspections generally will be restricted to visual and surface inspection, without any destructive investigations and limited by furniture and furnishings.

Assessing the Condition

Linking Deficiencies and Hazards

4.04. The first stage in assessing the condition of a dwelling is a review of the deficiencies identified during the inspection.

4.05. As defined above (paras 2.02-2-03) for the purposes of the HHRS, 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 lack of maintenance. While a deficiency may have implications in building and aesthetic terms, for the purposes of the HHRS its prime importance is whether the effect from that deficiency has the potential to cause harm – i.e. when the deficiency results in a hazard (see paras 2.12-2.13).

4.06. A single deficiency may contribute, to differing degrees, to more than one hazard. For example, the single deficiency of disrepair to a ceiling could, dependent upon the nature and extent of that disrepair, 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 harborage 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.

4.07. Similarly, several deficiencies may contribute to the same hazard. Disrepair to a ceiling, an ill-fitting door, and the lack of a smoke detector may all contribute to the hazard of fire, as each could lead to smoke and flames spreading to other parts of the dwelling without means of detection and warning.

4.08. 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 and areas within the dwelling. It is the cumulative contribution of those deficiencies to the hazard of damp and mould growth that 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 doorsteps. It is the cumulative contribution of these deficiencies to the hazard of falls associated with stairs/steps that is assessed.

4.09. 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 the *Preventive Measures* and the *Ideal* sections of the Hazard Profiles in Appendix C. However over time research may be published that will overtake the evidence used in the profiles.

Note – 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 (Appendix C) and which may influence their judgment as to likelihood and/or spread of harms.

Identifying Hazards

4.10. 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.

4.11. 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 and individuals who could normally be expected to occupy a dwelling of that size and type.

4.12. As well as satisfying the general principle behind the Rating System (see paras 1.12- 1.18), the dwelling should not contain any deficiencies and consequential hazards that interfere with the household establishing a home or which might endanger the occupants and any potential occupants.

4.13. Determining whether a deficiency contributes to one or more hazards also requires an understanding on the part of the inspector of the function(s) of each element and facility, and

competence in assessing how 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

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 unauthorized 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 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 – Eaves/gutters are intended to collect rainwater draining off roofs and carry it safely to rainwater pipes, which in turn should carry it safely to a drainage inlet.

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 toilet 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.

Assessing Hazards

4.14. Using details of the deficiencies identified which contribute to hazards, the inspector should at least score each hazard which is obviously worse than the average for that age and type of dwelling. 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 for that hazard. This process can be repeated for each hazard obviously worse than average.

Hazards from Cold, however, should be scored where they are average or below average.

4.15. To fully assess some hazards, destructive investigations may be necessary, but the inspector may not be in a position to carry these out. In other cases, such as for Excess Cold, Noise, and Radiation, 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.

4.16. First, after reviewing the deficiencies identified during the inspection that contribute to a hazard, the inspector should assess the likelihood of a member of the vulnerable age group suffering a potentially harmful occurrence in the next twelve months.

Second, the inspector should judge the possible harm outcomes that could result from such an occurrence. (These two stages are described in paras 3.10-3.16 and paras 3.17-3.22 above respectively.)

4.17. The Representative Scale Points are used to reflect the inspector's judgments and a single numerical Hazard Score is generated by the HHRS Formula for that hazard.

4.18. This scoring procedure should be repeated for all hazards that are considered to be worse than average – i.e. where the Hazard Scores are likely to be significantly above the average for the housing stock.

4.19. Finally, the Hazard Band for all the scored 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.

Supplemental Stage for Crowding

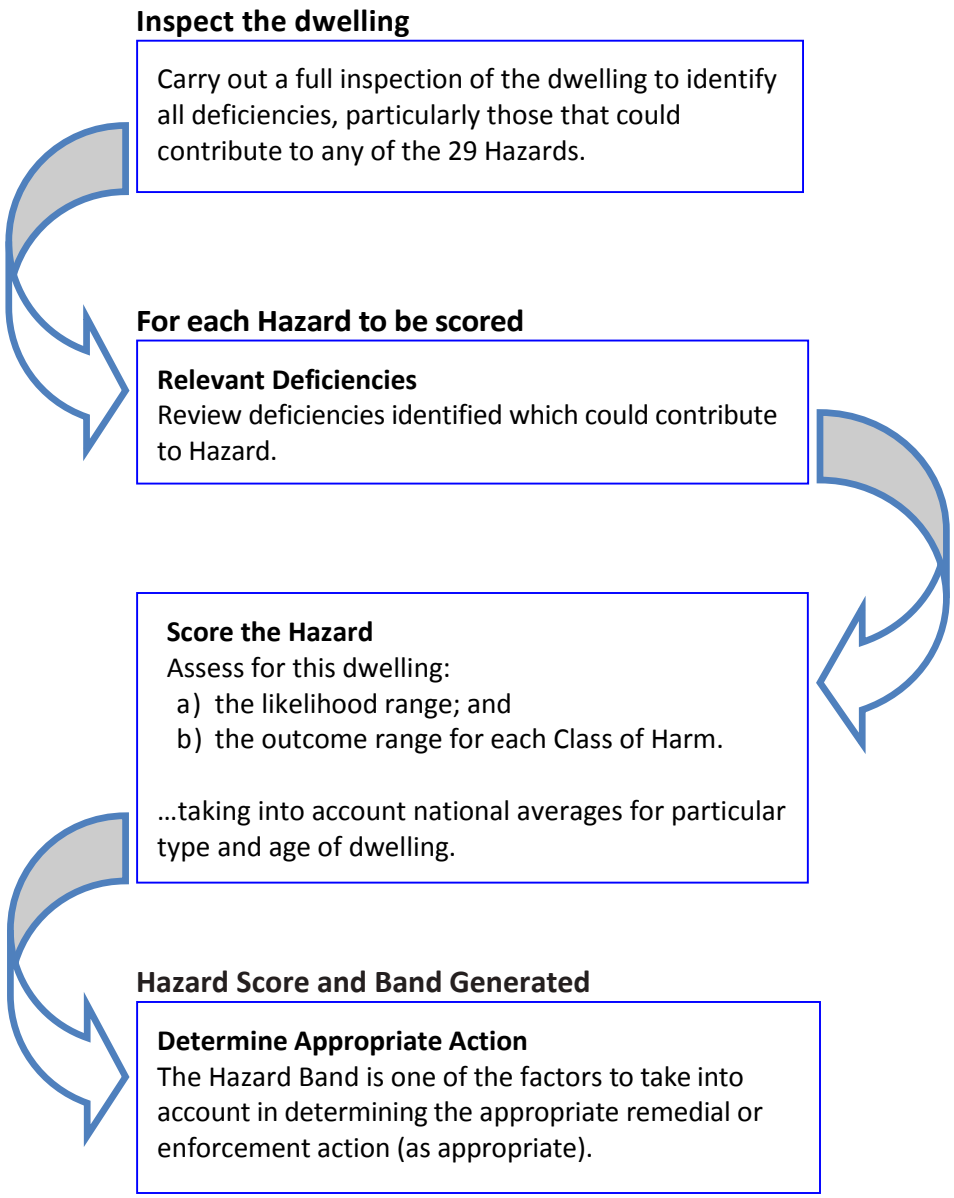
4.20. For all Hazards, the Hazard Score and Band are based on the assessment of the dwelling without taking account of the current occupants (if any). This means that the Scores and Bands relate to the dwelling and so does not vary with a change of occupancy.

4.21. 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.

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

4.22. For example, disregarding the current occupants, a two storey house may be assessed as average, having adequate space for sleeping, living and recreation for up to four persons (irrespective of age). This gives a Hazard Score of 22 (Band H). However, if this dwelling is currently occupied by five persons – two parents and their three children – then there is mismatch 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 potential enforcement decision-making processes.

Scoring Hazards Process Schematic



CHAPTER 5
Apartments and Other Dwellings in Multi-Occupied Buildings

Application of HHRS in Multi-Occupied Buildings

5.01. This additional guidance is for the use and application of the HHRS 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; and/or
(d) 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.

5.02. The HHRS 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 form of 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 inspect and assess the dwelling and those parts and areas (whether shared or not) that are associated with that unit.

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

5.03. Assessments using the Rating System, therefore, include:

(a) those rooms and areas of the dwelling which are in exclusive occupation (i.e. 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 that are not shared with others, the assessment is as described above (see paras 4.14-4.19).

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

(i.e. 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 Appendix C. Where data is available, statistical averages are given in the Hazard Profiles for multi-occupied buildings, and these 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 occupant from the relevant age group in the dwelling being rated.

5.07. Where more than one dwelling in a multi-occupied building is being inspected 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-inspect those parts.

Dormitory Style Accommodation

5.08. For residential premises providing dormitory style sleeping accommodation, it is the whole of the premises that 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 are no national averages available for the individual hazards, and the assessment must rely on professional judgment.

APPENDIXES

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Selected References and Sources of Further Information

APPENDIX A
Inspections for an HHRS Assessment

Introduction

A.1 The purpose for which any inspection or inspection is carried out will have an influence on the detail and information collected. It is therefore, important that the inspector fully understands the HHRS and the information required before undertaking an inspection and ensures that sufficient details are collected both to enable any hazards to be rated and to substantiate the judgments involved in that rating.

A.2 Any decision on enforcement based on the findings from an inspection may affect someone's home and may have financial implications for both the owner and the occupant. As such decisions may be challenged and could be the subject of scrutiny by the courts, any inspection should ensure that sufficient clear information is recorded to substantiate the findings and provide the evidence to support the judgments and decisions. That information should be recorded in a form that is logical and readily understandable, in particular by occupants and owners.

A.3 Assessments using the HHRS should be based on a full inspection of the dwelling, collecting sufficient information on each deficiency and on the dwelling as a whole should be recorded to inform the hazard assessments. In practice, the inspection should ensure that all deficiencies are identified and recorded, whether or not those deficiencies could contribute to a hazard[28].

Conventions

A.4 To promote consistency in the carrying out of inspections and in record keeping, it is recommended that conventions be adopted to ensure no misunderstandings on orientation and room and element locations. To avoid confusion, particularly for those following any requirements based on the inspection or carrying out subsequent inspections, it is good practice to include in any report a statement on the conventions followed to describe rooms and aspects of the dwelling.

Note – A Hazard Scoring Form which can be used for the HHRS assessment on completion of an inspection is provided at the end of this Appendix. HUD will develop a HHRS Hazard Scoring program, available for use with handheld computers, tablets, and desktop PCs (MS Windows OS).

Practical Considerations

A.5 Where an inspection is carried out in cooperation with 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.

A.6 Inspections carried out by local authority officers or on the instruction of tenants may not have such benefits. These inspections 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 inspections 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.

A.7 An inspection 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 inspection, 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.

A.8 It is important to remember that, for the purposes of the HHRS, assessment of the likelihood is judging whether there is likely to be an occurrence during the twelve months following the inspection.

A.9 Although it may not be necessarily relevant for the HHRS assessment, it is suggested that all deficiencies identified are recorded, including those that do not currently, nor could not in the next twelve months, contribute to a hazard. Some deficiencies if left un-remedied could deteriorate to the extent that they would contribute to a hazard.

A.10 The assessment of all hazards is made once the inspection has been completed and details collected of any deficiencies. Also, there are some deficiencies that can only be determined after inspecting the whole of the dwelling. These are matters that 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.

Inspecting a dwelling in a multi-occupied building

A.11 As well as inspecting the dwelling – i.e. those rooms and areas in exclusive occupation – the number and relative position of other units within the building should be collected and recorded. This should include whether each is residential or nonresidential. General details should also be collected and recorded on the rooms and areas (not yet inspected) 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, toilet compartments, living rooms, and dining rooms.

A.12 Where the dwelling is not self-contained (i.e. some facilities such as kitchen, sanitary accommodation or personal washing facilities, or living or dining rooms, are shared with others), as well as inspecting for deficiencies, 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.

A.13 The inspection 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 inspector should indicate whether remedial action, further investigation or no action is appropriate.

A.14 The inspection should also include the internal shared areas. For example:

(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 firefighting equipment; and

(d) any refuse storage or disposal system, such as refuse chutes. It may also include other areas that, although not commonly used by the occupants of the dwelling, are accessible and could be used.

A.15 Where meals are provided – e.g. 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.

Inspecting the Exterior, Means of Access, Amenity Space etc.

A.16 As the HHRS relates to the assessment of individual dwellings, it is suggested that the inspection of the exterior of the building containing the dwelling should concentrate first on those parts of the exterior directly associated with the dwelling, including the walls, windows, and where appropriate, the roof. This stage should also include the external means of access, refuse storage and amenity space associated with the dwelling.

A.17 The second stage should be an inspection of the exterior of the remainder of the building containing the dwelling.

A.18 As noted above (para B.10) there are some deficiencies that can only be assessed once the whole of the dwelling and the building containing the dwelling have been inspected. These are matters that 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.

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

Inspecting premises with dormitory accommodation

A.19 For residential premises where accommodation is of a non-exclusive basis – i.e. occupants are not granted exclusive occupation of a room or rooms, and sleeping accommodation is provided in dormitories – the whole of the premises should be inspected as for a single household occupied house.

A.20 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 (Side 1)

HHSRS V2 SCORING SHEET

ADDRESS

Survey date | | | | | | **Surveyor**

DWELLING **House or flat** hse | flat **HMO** Non | HMO **Age of dwelling** Pre 1920 | 20-45 | 46-79 | 80+

HAZARDS

Physiological		Psychological		Safety	
Cold	01	Crowding & space	11	Falls in baths etc	19
Damp & mould etc	02	Entry by intruders	12	Falling on level surfaces	20
Heat	03	Lighting	13	Falling on stairs etc	21
Asbestos (& MMFs)	04	Noise	14	Falling between levels	22
Biocides	05	**Infection**		Electrical hazards	23
Carbon monoxide etc	06	Domestic hygiene etc	15	Fire hazards	24
Lead	07	Food safety	16	Hot surfaces etc	25
Radiation	08	Personal hygiene etc	17	Collision/entrapment	26
Uncombusted fuel	09	Water supply	18	Position and operability of amenities etc	27
VOCs	10			Explosions	28
				Structural collapse	29

HAZARD & No. | **Item/s**

LIKELIHOOD

5600	3200	1800	1000	560	320	180	100	56	32	18	10	6	3	2	1
< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4	2.5	1.5 >	

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	

Class IV 100-(I+II+III)

Justification

RATING

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

Score (if calculated)

HAZARD & No. | **Item/s**

LIKELIHOOD

5600	3200	1800	1000	560	320	180	100	56	32	18	10	6	3	2	1
< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4	2.5	1.5 >	

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	

Class IV 100-(I+II+III)

Justification

RATING

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

Score (if calculated)

Example Paper Scoring Form (Side 2)

HAZARD & No. ☐ **Item/s**

LIKELIHOOD

5600	3200	1800	1000	560	320	180	100	56	32	18	10	6	3	2	1
< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4	2.5	1.5 >	

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	

Class IV
100-(I+II+III)

Justification

RATING

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

Score (if calculated)

HAZARD & No. ☐ **Item/s**

LIKELIHOOD

5600	3200	1800	1000	560	320	180	100	56	32	18	10	6	3	2	1
< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4	2.5	1.5 >	

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	

Class IV
100-(I+II+III)

Justification

RATING

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

Score (if calculated)

HAZARD & No. ☐ **Item/s**

LIKELIHOOD

5600	3200	1800	1000	560	320	180	100	56	32	18	10	6	3	2	1
< 4200	2400	1300	750	420	240	130	75	42	24	13	7.5	4	2.5	1.5 >	

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	

Class IV
100-(I+II+III)

Justification

RATING

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

Score (if calculated)

APPENDIX B
Examples for the Four HHRS Classes of Harm

B.1 The Classes of Harm used for the HHRS are based on the top four Classes of Harm as identified in *A Risk Assessment Procedure for Health and Safety in Buildings, UK* (2000) Building Research Establishment (BRE). While this work identified seven Classes of Harm, only the top four are used for the purposes of the HHRS 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 physician records.

B.2 Work on developing and refining the Statistical Evidence supporting the Rating System involved classifying a more comprehensive list of harm outcomes.

B.3 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 Class covers the most extreme harm outcomes including: Death from any cause; Lung cancer; Mesothelioma and other malignant lung tumors; Permanent paralysis below the neck; Regular severe pneumonia; Permanent loss of consciousness; 80% burn injuries.

Class II
This Class covers severe harm outcomes, 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 covers serious harm outcomes, including: Eye disorders; Rhinitis; Hypertension; Sleep disturbance; Neuro-pyschological impairment; Sick building syndrome; Regular and persistent dermatitis, including contact dermatitis; Allergy; Gastro-enteritis; Diarrhea; Vomiting; Chronic severe stress; Mild heart attack; Malignant but treatable skin cancer; Loss of a finger; Fractured skull and severe 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 that are still significant enough to warrant medical attention. Examples are: Pleural plaques; Occasional severe discomfort; Benign tumors; Occasional mild pneumonia; Broken finger; Slight concussion; Moderate cuts to face or body; Severe bruising to body; Regular serious coughs or colds.

APPENDIX C[8]

Profiles of potential health and safety hazards in dwellings

Introduction

There are 29 hazards. These are arranged in four main groups reflecting the basic health requirements. The four groups are sub-divided according to the nature of the hazards. The profiles provide a summary of information to assist in the assessment of hazards. It is assumed that practitioners using the HHRS 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. Practitioners 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 hazard is profiled under the following headings:

- *Description of the hazard* – This defines the hazard, specifying what is included and what is excluded.
- *Potential for harm* – This sets out how the hazard can affect health, outlining typical illnesses or injuries that may result from exposure to the hazard. The prevalence of the hazard, and typical numbers of people affected nationally each year, are identified.

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 national statistical averages for the likelihood and spread of harms are given in a table, together with the average hazard scores. For all hazards these are the national averages for a specified age group of the population living in all dwellings of a stated age and type. Although theses averages are derived from UK statistics, they may prove useful in establishing a starting point for the American assessor. As always, local housing conditions vary and will not be entirely consistent from one region to the next. Assessors are encouraged to share their experience in local peer-to-peer networks.

The statistical averages have been calculated for the age range of the population most vulnerable to that particular hazard. This age group is identified, and it is this vulnerable age group that is to be considered when assessing the hazard. For some hazards no age group is more vulnerable than others, and for these the statistics relate to the total population of the United States.

The averages are given for up to eight different ages and types of dwellings, and for all dwellings.

[8] Appendix C and D are incorporated in full from the HHSRS Operating Guidance (originally as Annex D and Annex E) – original page numbering is retained.

Generally, the average likelihood is statistically significant for each of the eight dwelling ages and types, being based on a large sample of the vulnerable population in such dwellings. However, where the likelihood is low the sample of occurrences is sometimes too small to provide an accurate spread of harms. In these cases, the average outcomes are given for all flats/apartments or, where samples are particularly small, for all dwellings.

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

- *Causes:* – This section discusses potential sources of the hazard. Where multi-occupation could have an impact on the causes and possible severity of the hazard this is also identified. It also discusses the contribution to a hazard that could be attributed to dwelling features and to human behavior. This should assist in assessing whether the deficiencies identified could mean that the likelihood or spread of harms deviates from the averages for the particular age and type of dwelling.
- *Preventive measures and the Ideal:* – This gives an indication of measures and the optimum standard intended to avoid or minimize the hazard. This is usually based on British Standards or relevant UK Building Regulation Approved Documents. Where there is no appropriate UK guidance, reference is made to international standards.
- *Relevant matters affecting likelihood and harm outcome:* – A check-list of dwelling features which may affect the likelihood and the severity of the outcome is given. In many cases the same features can affect both the likelihood and the severity of the outcome. Where different dwelling features affect the likelihood and spread of harm outcomes, the lists are given separately.
- *Hazard assessment:* – Where appropriate, this gives advice to supplement the relevant matters. Any differences in the assessment relevant to multi-occupied buildings are identified.

Pages 36-50 left blank. Pages 51 and beyond are taken from the Housing Health and Safety Rating System (HHSRS) Operating Guidance.

APPENDIX C
THE HAZARD PROFILES

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A PHYSIOLOGICAL REQUIREMENTS

Hygrothermal Conditions

1 Damp and mould growth

Description of the hazard

1.01 This category covers threats to health associated with increased prevalence of house dust mites and mould or fungal growths resulting from 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

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

Basis of estimates

1.03 The averages for Class I 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 outcomes were taken from GP consultation rates for coughs and wheeze.

1.04 Recent research has shown that low levels of background ventilation, without visible mould or dampness, can result in high indoor humidity levels and in greatly increased house dust mite populations. In consequence the average likelihoods given may be an underestimate, and should be considered as conservative.

Damp and Mould Growth
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 SROs	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)
SROs	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)**

Health effects

Physiological health effects

1.05 Both the detritus from house dust mites and mould spores are potent airborne allergens. Exposure to high concentrations of these allergens over a prolonged period will cause sensitisation of atopic individuals (those with a predetermined genetic tendency to sensitisation), and may sensitise non-atopic individuals. Once a person is sensitised relatively low concentrations of the airborne allergen can trigger allergic symptoms such as rhinitis, conjunctivitis, eczema, cough and wheeze. For a sensitised person, repeated exposure can lead to asthma, and it appears that the severity of the asthma intensifies with increasing humidity, house dust mite and mould levels.

1.06 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 sensitised to mould spores. One in eight children suffer with asthma in the UK, compared with one in thirteen adults.

Dust mites

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

Mould growth

1.08 Although less significant statistically in health terms, spores of many moulds and fungi (including timber attacking fungi) can be allergenic. The 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. Although uncommon, these are serious if they occur.

Social and mental health effects

1.09 The mental and social health effects of dampness and mould should not be underestimated. Damage to decoration from mould or damp staining and the smells associated with damp and mould can cause depression and anxiety. Feelings of shame and embarrassment can lead to social isolation.

Causes

1.10 The indications are that house dust mite populations and indoor mould growth have increased over the last century. This is probably because of 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.

1.11 Both house dust mites and moulds flourish in damp or humid conditions, and their growth is also influenced by temperature. Where relative humidities are within the optimum range, 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%.

1.12 Moisture production is influenced by the design, construction and repair of the dwelling, and on occupant density and activity. 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). Vapour pressure will equalize humidities throughout a dwelling, so that damp in one part will have an impact on relative humidities in other parts.

1.13 There should be 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. Increasing the rate to above 0.7 air changes per hour can also lead to an increase in the mite population in a dwelling which is not adequately heated. Use of mechanical heat recovery ventilation (MHRV) systems can allow an increased air change rate (around 0.9 per hour) without the same heat loss. Dwellings which can be expected to have high occupant density and small room sizes may require increased ventilation and heating/insulation to prevent problems.

1.14 Hygrothermal conditions are considered the most important limiting factor in house dust mite population growth. However, furnishing, especially the age and type of mattresses, and mode of housekeeping, can also have some influence.

Preventive measures and the ideal

1.15 Dwellings should be warm, dry and well-ventilated. Indoor relative humidity should be between 40% and 60%, except for short periods of fluctuation. This range is the optimum to limit the growth of house dust mite populations and mould growth. It is also the recognized comfort zone.

1.16 The structure and finishes of a dwelling should be maintained free from rising, penetrating and traumatic dampness, or persistent condensation.

1.17 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.

1.18 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.

1.19 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.

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

1.21 The dwelling should be able to cope with normal occupant moisture producing activities without persistently high relative humidities. 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.

1.22 There should be sufficient and appropriate means of ventilation to deal with moisture generated by normal domestic activities without the need to open windows. Opening windows can result in heat loss, noise, and may be a security risk. There may be no need for additional background ventilation where windows are ill-fitting, no draught-stripping, and/or where there are open chimney flues. Where there is draught-stripping, or tight fitting 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.

1.23 If moisture levels are controlled, through adequate ventilation, dust mite populations can be significantly reduced by raising indoor temperatures. To achieve this, there should be adequate structural thermal insulation, and appropriate means of space heating.

1.24 For further information see in particular – British Standards *BS 5250 Code of practice for control of condensation in buildings, BS 8102: Code of Practice for protection of structures against water from the ground,* Building Regulation *Approved Documents: C (site preparation and resistance to moisture), F (Ventilation of Buildings), and L (Conservation of Fuel and Power).*

Relevant matters affecting likelihood and harm outcome

1.25 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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.

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.

k) Roof and sub-floor spaces – inadequate ventilation.

l) Small rooms sizes – may result in high occupant density.

Hazard assessment

1.26 The many variables mean that, perhaps more so than for other hazards, the assessment is one of professional judgement rather than measurement. Consideration should be given to the design, condition and state of repair of the dwelling. The location, extent and duration 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.

1.27 The immediate local climate and exposure should also be taken into account. Areas of high rainfall will influence penetrating dampness. Altitude and wind exposure will affect the thermal efficiency and associated condensation/high relative humidities.

1.28 Prevailing weather conditions should be taken into account. While a temporary spell of good weather may result in dry conditions when an inspection is undertaken, the assessment is for a twelve month period. Penetrating and rising dampness may be less prevalent during dry weather. Condensation is less likely outside cold and winter months. Damage to decoration, mould growth, and/or structural deficiencies are indicative of potential problems.

1.29 Dwelling size is a relevant factor, a small dwelling can cope with less moisture than a larger dwelling. The location of the damp and/or mould is also relevant, the threat to health being influenced by the number and intended use of the affected room(s). Damp affected bedrooms are probably more important since mattresses tend to support larger dust mite populations than other furniture and furnishings. Also the most vulnerable age group normally spend a large proportion of the day in their bedrooms, both because that group typically require 9 to 14 hours sleep per day and because bedrooms are often also used for homework.

1.30 The cause of the dampness is also relevant to the assessment. Condensation is a symptom of high humidities, while other types of dampness are potential causes of high humidities, rather than being a symptom.

1.31 Measurement of background ventilation rates and of thermal efficiency may be appropriate in some circumstances. Thermal efficiency is usually assessed using the Government's Standard Assessment Procedure[33].

1.32 For dwellings where rooms are occupied for both living and sleeping, such as bedsits and small flats in multi-occupied buildings, then the presence of dampness may be more significant as occupants can be expected to spend a greater proportion of time exposed. This can be compounded if the room is also used for cooking.

33 DEFRA/BRE, *The Government's Standard Assessment Procedure for Energy Rating of Dwellings*, 2001, BRE, Watford

2 Excess cold

Description of the hazard

2.01 This category covers the threats to health from sub-optimal indoor temperatures.

Potential for harm

Most vulnerable age group and statistical averages

2.02 The most vulnerable age group is all persons 65 years or over.

Excess Cold
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 1 %	Class II %	Class III %	Class IV %	
Non SROs	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)
SROs	Pre 1920	340	34.0	6.0	18.0	42.0	1,035 (C)
	1920-45	290	34.0	6.0	18.0	42.0	1,213 (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 averages relate to persons aged 65 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 were derived from data for cold/winter related mortality . The estimates for Class II and Class III include cardiovascular and respiratory illness serious enough to lead to hospital admission and are calculated from Hospital Episode Statistics. Class IV estimates are based on new GP consultations from the General Practice Research Database and the Fourth Morbidity Survey of General Practice.

2.04 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 19°C 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.

Health effects

2.05 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. 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.

2.06 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.

2.07 Cardiovascular conditions (e.g. heart attacks and stroke) account for half the excess winter deaths, and respiratory diseases (e.g. 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.

2.08 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.

2.09 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.

2.10 The 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. There is less evidence on the relationship between housing characteristics and health other than mortality. However, 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.

2.11 Low temperatures can impair the thermoregulatory system of the elderly, and the very young whose thermoregulatory system is immature. Both these groups may spend a greater time indoors in cold weather and both will not move about as much as other groups in the cold.

2.12 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.

2.13 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.

Causes

2.14 The percentage rise in deaths in winter is greater in dwellings with low energy efficiency ratings. 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 in part determined by the characteristics of the dwelling and in part by occupation factors. For example, under-occupation can mean either excessive heating costs or low indoor temperatures.

2.16 The energy efficiency of a dwelling depends on the thermal insulation of the structure, on the fuel type, and the size and design of the means of heating and ventilation. Any disrepair or dampness to the dwelling and any disrepair to the heating system may affect their efficiency. The exposure and orientation of the dwelling are also relevant.

2.17 Some forms of insulating material, such as glass fibre, will settle over a period and become less effective as a result. As water readily conducts heat, 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. Dampness will also affect the thermal insulation of bedding, increasing the risk.

2.18 Excess ventilation wastes heat and reduces air temperatures. It also causes draughts and discomfort. Excess ventilation may be caused by too large or inappropriately sited permanent openings, or large openable windows. Draughts can also be caused by ill-fitting butt-jointed floor boarding or ill-fitting doors or windows.

Preventive measures and the ideal

2.19 Structural thermal insulation should be provided to minimise heat loss. The level of insulation necessary is in part dependent on geographical location and exposure, position in relation to other dwellings and buildings, and orientation. South facing glazing can be used to increase solar heat gain and so save energy.

2.20 Heating should be controllable by the occupants, and safely and properly installed and maintained. It should be appropriate to the design, layout and construction, such that the whole of the dwelling can be adequately and efficiently heated.

2.21 There should be means for ensuring low level background ventilation without excessive heat loss or draughts. It should be controllable, properly installed and maintained, and appropriate to the particular part of the dwelling. There should be means for rapid ventilation at times of high moisture production in kitchens and bathrooms.

2.22 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 and should be provided with controls to allow the occupants to regulate the temperature within their dwelling.

2.23 For further information see in particular – Building Regulation *Approved Document L1: Conservation of fuel and power in dwellings,* and *Approved Document F: Ventilation of buildings.*

Relevant matters affecting likelihood and harm outcome

2.24 Matters relevant to the likelihood of an occurrence and the severity of the outcomes include:

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 reducing 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) Installation and maintenance of heating system – inadequately installed or maintained systems.

g) Controls to heating system – inadequate or inappropriate controls to the system or appliance.

h) Amount of ventilation – inadequate, excessive, or inappropriate provision for thorough ventilation.

i) Ventilation controls – inadequate means of controlling the ventilation.

j) Disrepair to ventilation – to the system or controls.

k) Draughts – uncontrollable draughts and those situated to cause discomfort.

Hazard assessment

2.25 Indoor temperature is a function both of dwelling characteristics and of the occupying household. For the HHSRS assessment it is the dwelling characteristics, energy efficiency and the effectiveness of the heating system, which are considered, assuming occupation by the vulnerable age group. Simple measurement of indoor temperature is inappropriate.

2.26 The assessment should take account of the adequacy of the heating, insulation and ventilation. This may involve assessing the dwelling energy rating (using SAP[34]), and any other factors which might affect the indoor temperature, such as dampness, or disrepair to the structure or to the space or water heating system.

2.27 The energy efficiency of cooking facilities, lighting, and other energy using installations and appliances, should not be included in the HHSRS assessment.

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34 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

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

Excess 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	–	31.0	8.0	25.0	36.0	0 (J)
Apts	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)
	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 averages relate to persons aged 65 years or over who suffered illness, including fatal illness, as a result of excess heat in their dwelling. The statistics for Class I were derived from data for heat related mortality. The estimates for Class II and Class III include emergency hospital admissions for cardiovascular illness and are derived from the Hospital Episode Statistics. The figures for Class IV are from data on new GP consultations 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. It has also been assumed that there is no risk from heat associated with houses in the UK. Consequently, there is a weak evidence base for these statistics.

3.05 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.

Health effects

3.06 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. Dehydration is a problem primarily for the elderly and the very young.

3.07 Evidence from investigations into heat waves and morbidity in other countries shows that there is an increase in genitourinary diseases, and, as ozone levels rise during heat waves, an increase in respiratory conditions. Also, heat waves have been linked with excess mortality due to mental disorders.

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

Causes

3.09 While in the UK it has been unusual for risks from over-heating of a dwelling, heat waves are forecast to become more common. It is possible, therefore, that there will be an increase in mortality and morbidity rates from excess heat associated with the inability to maintain a healthy temperature within dwellings.

3.10 The major dwelling factors are solar heat gain, ventilation rates, and thermal capacity and insulation of the structure. Smaller, more compact dwellings, and particularly attic flats, are more prone to overheating than are large dwellings.

3.11 Solar heat gain is influenced by the area and orientation of glazing, the amount of external shading, and the thermal capacity and insulation of the structure. Ventilation and/or the provision of air-conditioning influence the ability to control the indoor air temperature.

3.12 Of particular importance to the risk to health of occupants is the ability to dissipate heat at night. This is influenced by the thermal mass of the structure, the position of insulation in the structure (i.e. whether the insulation is external, in the cavity, or internal, and the night time ventilation rate).

3.13 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.

3.14 Dwellings in multi-occupied buildings are more likely to be affected by excessively high indoor temperatures. Particularly those located immediately beneath an uninsulated roof, those with only a south facing elevation, and those with district heating systems not controllable by the occupier.

Preventive measures and the ideal

3.15 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.

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

3.17 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. While openable windows can provide ventilation, occupiers may be reluctant to use them for security reasons, or because of external noise levels, especially at night.

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

3.19 There is little relevant information in the UK on protection from excess high indoor temperatures. However, see in particular – Building Regulation *Approved Document L1: Conservation of fuel and power in dwellings, Approved Document F: Ventilation of buildings* and the Chartered Institution of Building Services Engineers (CIBSE) *Guide A: Environmental design, and Guide B2: Ventilation and air conditioning*.

Relevant matters affecting likelihood and harm outcome

3.20 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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

3.21 The assessment should take account of the provision for ventilation, particularly night-time ventilation, and the provision and condition of any mechanical ventilation or air conditioning system. Also relevant will be the thermal capacity of the structure and the amount and position of thermal insulation, the extent and orientation of glazing, and the condition of and controls for the heating system.

Pollutants (non-microbial)

4 Asbestos (and MMF)

Description of the hazard

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

Potential for harm

Most vulnerable age group and statistical averages

4.02 No age group appears more vulnerable than others.

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

4.03 The averages are based on extrapolations from studies of high exposure to asbestos – mainly 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.

4.04 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

4.05 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).

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

4.07 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 not found in the domestic situation, and is therefore not considered here.) Lung cancer has very poor survival rates, and there is no known cure for mesothelioma. While pleural plaques are not in themselves harmful, if discovered, they may cause significant anxiety about the risk of more serious asbestos-related conditions.

4.08 The risk to health from inhalation of asbestos fibres depends on 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 so tends not to persist in the lung as long. For this reason amphibole asbestos is considered the most hazardous form, especially with regard to mesothelioma. It appears that mesothelioma may occur following relatively low levels of exposure to amphibole asbestos.

4.09 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. Those at greatest risk include children and adults with long-term exposure to asbestos levels significantly increased above the ambient background level. 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.

MMF

4.10 MMF include rockwool and glass fibre blanket, which provide thermal and acoustic insulation. MMF are skin, eye and respiratory irritants, and there have been isolated reports of respiratory problems and dermatitis associated with exposure to MMF in the home.

4.11 There is conflicting data on risks of lung cancer from inhaled MMF, and the risks have been largely assessed on the basis of occupational exposure. In the domestic situation, the balance of evidence suggests that there is only a small clinical risk of Class I to IV harms following domestic exposure.

Causes

4.12 Asbestos has been incorporated in a wide range of building products. 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. As well as not having been extensively used, the asbestos is not usually in locations that are likely to be disturbed.

4.13 However, as well as chrysotile, non-traditionally built dwellings constructed between 1945 and 1980 may contain large amounts of amphibole asbestos products in positions vulnerable to damage and disturbance. Peak use of asbestos was during the 1960s. After the health effects began to be recognised, there was a dramatic decline in the use of asbestos. Only chrysotile is still used in the UK, mostly in asbestos-cement products.

4.14 The indoor air concentrations of asbestos in most dwellings, including those where asbestos is present but in good condition, present minimal risk to health. 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.

4.15 Activities such as plumbing and rewiring which involve disturbance of asbestos materials can generate much elevated airborne fibre levels. So far as occupants are concerned, exposure from such activities is likely to be episodic, infrequent and short; such that the risk is likely to equate to less than the equivalent of 2 years of exposure at ambient levels. However, in the case of amphibole asbestos there is some uncertainty over the associated risk of mesothelioma following low levels of exposure.

4.16 Loft and cavity wall insulation are the most common uses of MMF in dwellings. Most MMF products do not readily release airborne fibres, and few if 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.

Preventive measures and the ideal

4.17 Asbestos should not be present in dwellings. However, where it is, as removal 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; and/or
- not likely to be worked on or disturbed.

4.18 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; and
- keeping a record of the location of asbestos in the building.

4.19 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 it.

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

4.21 Where MMF based materials are present, the material should be in good condition, sealed, inaccessible, labelled and the location recorded. 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 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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.

f) Presence of MMF – in accessible positions.

Hazard assessment

4.23 Assessment should include identifying any asbestos, its vulnerability to damage, and the extent of any current damage and possible fibre release. If present, the type of asbestos should also be identified. Sampling may be necessary to confirm the presence of asbestos and the type.

4.24 Assessment for MMF should involve visual examination for disturbance of material.

5 Biocides

Description of the hazard

5.01 This category covers threats to health from those chemicals used to treat timber and mould growth in dwellings.

5.02 While biocides include insecticides and rodenticides to control pest infestations (e.g. cockroaches or rats and mice), these are not considered for the purposes of the HHSRS.

Potential for harm

Most vulnerable age group and statistical averages

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

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	513,333	0.0	0.0	9.1	90.9	0 (J)

Basis of Estimates

5.04 There is a weak quantitative evidence base. The averages given use a base of all dwellings. They have been calculated from those used in Version 1 of the HHSRS which used a base population of people living in dwellings which have been recently built or refurbished (those most likely to be exposed to biocides).

Health effects

5.05 Biocides are intended to prevent growth or development of insects, fungi, moulds and bacteria, or kill those already present. The potential for harm to human health varies depending on the particular biocide.

5.06 The main health risk is from inhalation, although skin contact and ingestion may also be an issue, particularly for small children.

Causes

5.07 Problems only arise where biocides are used incorrectly, or where the dwelling is occupied before the fumes have been allowed to disperse adequately.

Preventive measures and the ideal

5.08 Where possible the use of biocides should be avoided. Often, treatment of the underlying and 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 instructions, and provided proper precautions are observed during use and afterwards to allow for fume dispersal, risks should be minimised. Use of biocides for treating mould growth and timber should also be in accordance with the various statutory controls. Wood preservatives (fungicides and insecticides) and surface biocides (mould growth treatments), are subject to approval under both UK and EC regulations and directives.

Relevant matters affecting likelihood and harm outcome

5.10 Matters relevant to the likelihood of an occurrence and the severity of the outcomes include:

a) Use of biocides – use particularly in living areas.

b) Misuse – failure to follow the instructions for use and other proper precautions.

Hazard assessment

5.11 In order to properly assess the hazard it will be necessary to identify the biocide(s) used, and determine whether the 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 for heating and cooking. The health effects of carbon monoxide, oxides of nitrogen, and sulphur dioxide and smoke vary. However, 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 The most vulnerable age group is all persons aged 65 years or over.

Basis of estimates

6.1.02 For the Class I averages, 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 is probable that all these fatalities were concentrated in the 4 or 5% of dwellings which have defective 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 defective appliances or 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.

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 1 %	Class II %	Class III %	Class IV %	
Non-SROs	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	–
SROs	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)**

6.1.03 The averages given are almost certainly under-estimates as 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 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, odorless and extremely toxic gas. 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. All 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. 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.

6.1.08 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.

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

6.2 Nitrogen dioxide

Potential for harm

Most vulnerable age group and statistical averages

6.2.01 There is no age group more vulnerable than others.

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 %	
All Dwellings	513	0.0	0.1	9.1	90.8	7 (J)

6.2.02 There is a weak quantitative evidence base. The averages given use a base of all dwellings. They have been calculated from those used in Version 1 of the HHSRS which used 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 also 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.

6.3 Sulphur dioxide and Smoke

Potential for harm

Most vulnerable age group and statistical averages

6.3.01 There is no specific age vulnerable group.

Sulphur dioxide and smoke 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	5,126	0.0	0.1	9.1	90.8	0 (J)

6.3.02 There is a weak quantitative evidence base. The averages given use a base of all dwellings. They have been calculated from those used in Version 1 of the HHSRS which used 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.

Carbon monoxide, oxides of nitrogen, and sulphur dioxide

6.3.04 The Causes, and Preventive Measures and the Ideal, and features relevant to hazard assessment, for each of these indoor air pollutants overlap, and they are therefore discussed together.

Causes

6.3.05 The main source of carbon monoxide within dwellings is the incomplete combustion of all fuels containing carbon, including gas, oil, and solid fuels. Gas and oil burning appliances are the main sources of nitrogen dioxide. Sulphur dioxide, which has a noticeable smell, is produced by oil and solid fuel.

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

6.3.07 A possible source of carbon monoxide is from vehicle exhausts, particularly where there is an integral garage to the dwelling.

6.3.08 Gas cookers discharge combustion gases into the dwelling and, without appropriately sited extract ventilation, safe 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 safe levels while the appliances are in use.

Preventive measures and the ideal

6.3.09 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, be appropriately sited, and be 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.

6.3.10 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. Balanced flues, which take in air for combustion from outside and discharge combustion gases outside, avoid the likelihood of combustion gases spilling back.

6.3.11 There should be a ventilated lobby between an integral garage and living accommodation.

6.3.12 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.

6.3.13 Recommended maximum exposure levels are given by the World Health Organization. Gas, oil and solid fuel burning appliances and associated flues should be properly installed and maintained by a competent person. For gas appliances, installation should be by a CORGI registered gas installer.

6.3.14 For further information see in particular – Building Regulations *Approved Document J Combustion appliances and fuel storage systems, 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, 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.*

Relevant matters affecting likelihood and harm outcome

6.3.15 Matters relevant to the likelihood of an occurrence and the severity of the outcomes include:

a) Flueless appliances – gas or oil burning appliances, including cookers.

b) Disrepair to appliance – to gas, oil or solid fuel burning appliances resulting in incomplete combustion.

c) Inadequate ventilation – particularly of rooms with gas, oil or solid fuel burning appliances.

d) Disrepair to ventilation – disrepair to the means of ventilation.

e) State of flues – lack of proper and regular cleaning of flues serving gas, oil or solid fuel burning appliances.

f) Disrepair to flues – serving gas, oil or solid fuel burning appliances.

g) Flue outlet siting – sited adjacent to openable window.

h) Extractor fans – in rooms with open flued appliances.

i) Ventilation lobby – no lobby between a garage and living accommodation.

j) Carbon monoxide detectors – lack of, or defects to, detectors.

Hazard assessment

6.3.16 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.

7 Lead

Description of the hazard

7.01 This covers the threats to health from the ingestion of lead.

Potential for harm

Most vulnerable age group and statistical averages

7.02 The most vulnerable age group is 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 SROs	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)
SROs	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 averages are based upon the best available evidence. However, mainly US studies or high exposure area studies were used to generalise current background rates of lead exposure for children in the U.K. 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.

Health effects

7.05 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.

7.06 Lead is a heavy metal, which, when ingested accumulates in the body, and 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.

7.07 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.

7.08 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.

Causes

7.09 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.

7.10 For the purposes of the HHSRS, lead contamination of water is limited to that which may occur after water has been delivered to the premises where it becomes the responsibility of the owner. Lead does not normally occur in natural water supplies but is the result of the use of lead pipework or lead-based solder (in copper or lead pipework) in the water distribution systems and domestic pipework. 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.

Preventive measures and the ideal

7.11 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.

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

7.13 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).

7.14 There are statutory controls limiting the levels of lead in drinking water and guidelines for lead levels in soil. There is no UK guideline level for lead in house dust.

Relevant matters affecting likelihood and harm outcome

7.15 Matters relevant to the likelihood of an occurrence and the severity of the outcomes include:

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

7.16 There should be a visual examination of the condition of paintwork. Where old flaking paint is found in pre-1970 dwellings sampling and analysis may be necessary to confirm the presence or otherwise of lead.

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

Lead in water

7.18 Visual inspection should identify any lead pipework. However, to determine the lead content of water, sampling and analysis will be necessary.

8 Radiation

Description of the hazard

8.01 This category covers the threats to health from radon gas and its daughters, primarily airborne, but also radon dissolved in water.

8.02 Concern has been expressed about the possible health effects of electromagnetic fields (EMFs). 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. High frequency fields are produced by mobile telephones and their masts, television and radio transmitters, microwave ovens and radar. 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

8.04 The most vulnerable age group is all persons aged between 60 and 64 years who have had lifetime exposure to radon.

Basis of Estimates

8.05 Calculations of excess annual risk of lung cancer are based on the models presented in the (BEIR) VI Report[35]. This gives tabulations of lifetime relative risks of lung cancer against lifetime indoor exposure to radon. In the table, the likelihood is for the average annual risk, but only refers to persons aged 60 to 64 years 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.

8.06 There is a relatively strong basis of evidence for the attributable risk of radon in homes. This means that there is a high confidence level for the statistical averages given.

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

Radiation
Average likelihood and health outcomes for all persons aged 60-64 years, following lifetime exposure to radon gas

Measured Radon Level pCi/L	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class 1 %	Class II %	Class III %	Class IV %	
20	28	90.0	10.0	0.0	0.0	14,826 (A)
10	56	90.0	10.0	0.0	0.0	8,472 (A)
8	67	90.0	10.0	0.0	0.0	8,472 (A)
4	143	90.0	10.0	0.0	0.0	2,635 (B)
2	250	90.0	10.0	0.0	0.0	1,482 (C)
1.3	500	90.0	10.0	0.0	0.0	847 (D)
0.4	---	90.0	10.0	0.0	0.0	

Note: If you are a former smoker, your risk may be higher.* Lifetime risk of lung cancer deaths from EPA Assessment of Risks from Radon in Homes (EPA 402-R-03-003).** Comparison data calculated using the Centers for Disease Control and Prevention's 1999-2001 National Center for Injury Prevention and Control Reports.

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.

The Environmental Protection Agency has detailed information on its "Citizen's Guide to Radon" website, www.epa.gov/radon/pubs/citguide.html#risk%20charts.

8.08 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. 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

8.09 Radiation is the process of energy emission as waves or particles. There are two forms – ionising and non-ionising. Ionising radiation, which includes alpha (a) particles resulting from the decay of radon, can pass through the tissues of the body and has sufficient energy to damage DNA and cause genetic mutation. Non-ionising radiation, such as ultraviolet radiation, microwave, and radio-frequency radiation, does not have sufficient energy to damage DNA directly.

Radon

8.10 EPA estimates that about 21,000 lung cancer deaths each year in the U.S. are radon-related. Exposure to radon is the second leading cause of lung cancer after smoking. Radon is an odorless, tasteless and invisible gas produced by the decay of naturally occurring uranium in soil and water. Radon is a form of ionizing radiation and a proven carcinogen.

8.11 The risk of lung cancer is attributable to the radon gas decay products, which are themselves radioactive. Radon decays rapidly and the resulting products can very quickly attach themselves to particles in the air. If these particles are inhaled, they can be deposited in the lungs where the process of radioactive decay continues. The **a** particles emitted 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.

8.12 There is strong epidemiological evidence that radon gas is a cause of lung cancer. Although weaker, indications that other organs may be targeted by radon through ingestion there are and skin contact. Malignancies resulting from these exposures may nclude leukaemia (acute lymphatic leukaemia in children) and skin cancer.

8.13 As radon is soluble in water, it can be ingested resulting in the organs of the gastrointestinal tract receiving the largest dose.

8.14 Call your state radon office for state and local information on radon. You can also call the national radon hotlines at 1-800-S0S-RADON (1-800-767-7236) or 1-866-730-GREEN (1-866-730-4733). For more information on radon, read "A Citizen's Guide to Radon: The Guide to Protecting Yourself and Your Family from Radon".

EMFs

8.15 The levels of non-ionising radiation, or EMFs, usually found within dwellings are insufficient to cause significant harm to health.

Causes

8.16 Radon from soil gas is the main cause of radon problems. Sometimes radon enters the home through well water. In a small number of homes, the building materials can give off radon, too.

8.17 The average radon concentration in the indoor air of America's homes is about 1.3 pCi/L. It is upon this level that EPA based its estimate of 21,000 radon-related lung cancers a year. It is for this simple reason that EPA recommends that Americans consider fixing their homes when the radon level is between 2 pCi/L and 4 pCi/L. The average concentration of radon in outdoor air is .4 pCi/L or 1/10th of EPA's 4 pCi/L action level.

8.18 Radon gas is naturally occurring in the US, but the amount varies from place to place. Concentrations tend to be highest in areas where the underlying rock is granite, but can occur in other areas. In the open air radon is diluted to very low concentrations, but in confined spaces, such as within a building, it can accumulate and reach concentrations hazardous to health.

8.19 Indoor 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.

8.20 The gentle suction created by the normally lower atmospheric pressure within buildings draws radon gas in through holes, cracks and gaps in the floor. This will occur most readily with suspended timber floor, but any breaches of solId floors or damp proof membranes will allow the gas to penetrate into the dwelling.

8.21 Upper floor ventilation, particularly with 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.

8.22 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.

8.23 Radon is not found in major public water supplies in concentrations which pose a threat to health. 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 (typically Action Areas). However, less is known about the risks from radon in drinking water than that in air.

Preventive measures and the ideal

8.24 For existing dwellings one 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. Other, but less effective options include increased air flow under a timber floor, and installing a whole house positive pressurisation system.

8.25 All new dwellings should be constructed to achieve radon gas levels as low as is practicable. For existing dwellings in Affected Areas (ie, identified areas where radon emissions are likely to be above the Action Level) remedial measures should be adopted.

8.26 For further information see EPA's "Radon-Resistant New Construction (RRNC)" website www.epa.gov/radon/rrnc/index.html.

Relevant matters affecting likelihood and harm outcome

8.27 The primary relevant matter is whether the dwelling contains a level of radon above 4 pCi/L. If it does, then the following matters may increase the likelihood of an occurrence:

a) Timber ground floor – ground floor of suspended timber construction particularly if without adequate sub-floor ventilation.

b) Disrepair to solid floor – holed, cracked or other disrepair to a solid ground floor.

c) Lack of DPM – lack of or defective damp proof membrane to solid floor.

d) Sealing around services – inadequate sealing around service entry points, and similar disrepair.

e) Ventilation rates – high upper-level ventilation rates.

f) Open fires – use of open fires and solid-fuel-effect open fires, without additional through the wall ventilation.

g) Remedial measures – disrepair to any remedial measures, such as a radon sump or associated fan.

h) Extractor fans – continuous use of extractor fans in kitchens, bathrooms or wcs.

i) Private water supply – particularly if from a borehole or well.

Hazard assessment

Radon in the air

8.28 Radon levels less than 4 pCi/L still pose a risk, and in many cases may be reduced.

8.29 Testing is the only way to know if occupants are at risk from radon. EPA and the Surgeon General recommend testing all homes below the third floor for radon. EPA also recommends testing in schools. If present, the state of any remediation measures should be checked. However, the condition of these will only indicate that there could be a problem. And, as radon levels can vary widely between apparently identical dwellings, the only way to determine whether or not there is a threat to health is by measurement.

Radon in the water supply

8.30 As for radon gas, the only way to determine whether or not there is a high level in a particular water supply is by measurement.

9 Uncombusted fuel gas

Description of the hazard

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

9.02 Poisonings associated with incomplete combustion of gas and the spilling back of combustion products into a dwelling are covered by Carbon Monoxide, and explosions from gas leakages are covered by Explosions.

Potential for harm

Most vulnerable age group and statistical averages

9.03 There appears to be no age group more vulnerable than others.

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	51.3	0 (J)
	1920-45	117,830	1.2	2.3	41.4	55.1	0 (J)
	1946-79	103,618	0.5	0.0	38.9	60.6	0 (J)
	Post 1979	181,609	1.2	2.3	41.4	55.1	0 (J)
Apts	Pre 1920	83,784	1.2	2.3	41.4	55.1	0 (J)
	1920-45	83,784	1.2	2.3	41.4	55.1	0 (J)
	1946-79	83,784	1.2	2.3	41.4	55.1	0 (J)
	Post 1979	83,784	1.2	2.3	41.4	55.1	0 (J)
All Dwellings		**83,784**	**1.2**	**2.3**	**41.4**	**55.1**	**0 (J)**

Basis of estimates

9.04 The averages relate to persons of all ages who were harmed, including fatally, by uncombusted fuel gas in their dwelling, 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 is relatively weak and should be treated with caution. This means that 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.

Causes

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

9.10 The most probable cause of uncombusted fuel gas escaping into a dwelling is defects to the gas installation or appliance(s).

Preventive measures and the ideal

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

9.12 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.

9.13 For LPG, which is 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.

9.14 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.

9.15 For further information see – Building Regulation *Approved Document J,* and *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.*

Relevant matters affecting likelihood and harm outcome

9.16 Matters relevant to the likelihood of an 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.

9.17 Matters relevant to the severity of the outcomes include:

a) Gas detector provision – the lack of correctly sited detectors.

b) Defects to detectors.

Hazard assessment

9.18 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 gas is detected (or smelt), further investigation and a safety report from an appropriate engineer may be necessary.

10 Volatile Organic Compounds

Description of the hazard

10.01 Volatile organic compounds (VOCs) are a diverse group of organic chemicals which includes formaldehyde, that are gaseous at room temperature, and are found in a wide variety of materials in the home.

Most vulnerable age group and statistical averages

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

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 %	
All dwellings	5,580	0.1	0.1	1.0	98.8	0 (J)

Basis of estimates

10.03 There is a weak quantitative evidence base. The averages given use a base of all dwellings. They have been calculated from those used in Version 1 of the HHSRS which used 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.

Health effects

10.04 The majority of individual VOCs that may be found in dwellings 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. Formaldehyde can be a particular problem, although sensitivity varies.

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

Causes

10.06 VOCs, including formaldehyde, produce vapours at room temperatures. Sources typically within the control of building owners include:

a) Urea formaldehyde foam insulation (UFFI).

b) Particle board, chipboard, plywood.

c) Paints, glues, solvents.

d) Combustion of fuel.

10.07 There are many other (non-building) sources of VOCs, such as cleaning products, tobacco smoke, furnishings and wall and floor coverings.

10.08 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.

10.09 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 VOCs (or may have been pre-treated) and will release them later.

Preventive measures and the ideal

10.10 Emissions of VOCs 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.

10.11 For further information see in particular – Building Regulation *Approved Document F: Ventilation, and BS 5618* on urea-formaldehyde foam insulation (UFFI).

Relevant matters affecting likelihood and harm outcome

10.12 Matters relevant to the likelihood of an occurrence and to the severity of the outcomes 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

10.13 Care should be taken not to confuse the source of the odour with other problems, such as faulty gas appliances, and to eliminate sources which may have been introduced by the occupier.

B PSYCHOLOGICAL REQUIREMENTS

Space, Security, Light and Noise

11 Crowding and Space

Description of the hazard

11.01 This category covers hazards associated with lack of space within the dwelling for living, sleeping and normal family/household life.

Potential for harm

Most vulnerable age group and statistical averages

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

Basis of Estimates

11.03 The averages 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.

11.04 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. This means that there is a relatively weak evidence base for the production of these averages.

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)
Apts	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)**

11.05 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

11.06 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 in heart rate, increased perspiration, reduction of tolerance, and a reduction of the ability to concentrate. Crowded conditions are also linked with increased hygiene risks, an increased risk of accidents, and spread of contagious disease.

11.07 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.

11.08 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.

11.09 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.

Causes

11.10 Deficiencies with space and crowding can increase the risks associated with a number of other hazards. The risk of domestic accidents is greater where there is insufficient space for the occupants. Small kitchens also increase the risk of accidents. 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.

11.11 Space and crowding deficiencies can result in beds being placed too close to fixed heating appliances. 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.

11.12 In multi-occupied accommodation, most of these issues may be compounded by sharing of some spaces. 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.

Preventive measures and the ideal

11.13 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.

11.14 Open-plan arrangements may be acceptable for dwellings for a single person or for a couple, but not for dwellings intended for larger households.

11.15 For larger households, physical separation of living, cooking, dining and even sleeping areas is more necessary. For such household, bedrooms should lead off a circulation space, and should be large enough to be useable for sleeping and for study or relaxing away from the other members of the household.

11.16 There should be sufficient provision for sleeping having regard to the numbers likely to be accommodated in the dwelling. As a guide, and 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.

11.17 As well as sufficient sleeping space, there should be a living area of sufficient size for the household. 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.

11.18 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.

11.19 For further information and guidance see – Unit Size and Layout sections of the *Housing Quality Indicator system* (ODPM), and publications such as *Metric Handbook – Planning and Design Data.*

Relevant matters affecting likelihood and harm outcome

11.20 Matters relevant to the likelihood of an occurrence and the severity of the outcomes include:

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

11.21 As with all hazards, the initial assessment should be of the dwelling disregarding the current occupants. This should take into account the size and layout of rooms based on the occupancy level that typically might be expected to use the dwelling.

11.22 Unlike other hazards, a second stage is involved for Crowding[36]. This involves determining whether the dwelling is over-occupied by the current household, 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.

36 See Chapter 4, paras 4.29-4.31

12 Entry by intruders

Description of the hazard

12.01 This covers 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

12.02 There is no age group more vulnerable than others.

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	
All Dwellings	140	0.0	0.1	9.1	90.8	22 (H)

Basis of estimates

12.03 The FBI's Uniform Crime Reporting (UCR) Program defines burglary as the unlawful entry of a structure to commit a felony or theft. To classify an offense as a burglary, the use of force to gain entry need not have occurred. The UCR Program has three subclassifications for burglary: forcible entry, unlawful entry where no force is used, and attempted forcible entry. The UCR definition of "structure" includes apartment, barn, house trailer or houseboat when used as a permanent dwelling, office, railroad car (but not automobile), stable, and vessel (i.e., ship). The average dollar value of property taken during burglaries was $2,137. The spread of health outcomes 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.

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 The basis for likelihood estimates is derived from research conducted in 2000 by Temple University, the City College of the City University of New York and the University of Pennsylvania.[37]

37 *Knowing Your Odds: Home Burglary and the Odds Ratio*, September 2000, Hakim, Rengert, and Shachamurove.

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" (Crime in England and Wales 2002/2003, Home Office, London). The emotional impact is greater for burglaries where there is successful entry to the dwelling.

Causes

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, than with physical attributes, such as estate design and home security.

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.

12.13 In the majority of successful burglaries, some force is used to effect entry. The risk of entry increases with declining levels of security.

Preventive measures and the ideal

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, the surrounding area, including both the estate design and the level of crime, affect the level of security appropriate at a dwelling.

12.15 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.

12.16 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.

12.17 However, creating fortress-like dwellings may have a negative effect on the health of occupiers. In addition, there is a balance to be made between security features and any associated increased risks from other hazards. For example, security measures can hamper or obstruct means of escape in case of fire, and may result in windows not being readily openable interfering with ventilation.

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

12.19 For further information see – British Standard *BS 82200 Guide for security of buildings against crime – Part 1: Dwellings.*

Relevant matters affecting likelihood and harm outcome

12.20 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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.

j) Burglar alarms – lack of or defective alarm system.

Hazard assessment

12.21 The level of physical security features at a dwelling should reflect the overall crime rate in the neighbourhood, and the assessment should take both into account. Both fear of crime as well as the risk of any actual burglary (whether aggravated or not) should be considered.

12.22 There appears to be elevated risks of burglary associated with multi-occupied buildings. Not only is security of the building important (i.e. restricting unauthorised 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.

13 Lighting

Description of the hazard

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

Potential for harm

Most vulnerable age group and statistical averages

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 %	
All Dwellings	50,825	0.1	0.9	9.0	90.0	0 (J)

Basis of estimates

13.03 There is a weak quantitative evidence base. The averages given use a base of all dwellings and have been calculated from those used in Version 1 of the HHSRS (which used a base population of people living in dwellings with defective lighting).

13.04 There is little quantitative information on the numbers of people suffering from Class I to III harms. However, in excess of 100,000 people annually suffer Class IV harms.

Health effects

13.05 The health conditions which can be caused by inadequate light include:

a) Depression and psychological effects caused by a lack of natural light or the lack of a window with a view.

b) Disturbance by intrusive artificial external lighting at night.

c) Eye strain from glare and a lack of adequate light (natural or artificial).

d) 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.

Causes

13.07 The shape, position and size of windows and the layout of rooms all affect the amount of daylight. Windows, adequate in themselves, can be obstructed externally by other buildings or by trees.

13.08 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.

13.09 The siting of external lighting (street lights and security lighting) can be annoying and cause sleep disturbance to adjacent occupiers.

13.10 Inappropriately positioned artificial lighting within the dwelling can cause glare and shadows which interfere with occupiers identifying other hazards.

Preventive measures and the ideal

13.11 The layout of the dwelling, particularly living rooms and kitchens, and of recreation space, should allow access for sunlight. There should be sufficient natural light during daylight hours to enable normal domestic tasks to be carried out without eyestrain. 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, and there should be sufficient adequate open space outside the window to allow for adequate light penetration.

13.12 Artificial lighting should be 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.

13.13 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. (Safety glass should be provided in vulnerable locations.) Window heads should be above the eye level of someone standing. Ideally, the views should be of open space through windows of all rooms other than those where privacy is required such as bathrooms and wc compartments. The view should also provide for supervision of outside recreation space and, for security purposes, of the means of access to the dwelling.

13.14 For further information see – British Standard *BS8206 Code of Practice Parts 1 and 2* and guides on lighting and windows published by the Chartered Institution of Building Services Engineers (CIBSE).

Relevant matters affecting likelihood and harm outcome

13.15 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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

13.16 The assessment should include the views from windows and the adequacy of both artificial and natural lighting for the dwelling as a whole.

14 Noise

Description of the hazard

14.01 This category covers threats to physical and mental health resulting from exposure to noise inside the dwelling or within its curtilage.

Potential for harm

Most vulnerable age group and statistical averages

14.02 There is no age group more vulnerable than others.

Noise
Average likelihood and health outcomes by 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 SROs	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)
SROs	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**	**5 (J)**

Basis of estimates

14.03 For Class I to III 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 provide information on 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. In addition, 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.

Health effects

14.05 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.

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. 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. There is some evidence of correlation between noise and stress induced raised blood pressure and altered blood constituents.

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.

Causes

14.11 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.

14.12 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 unusually 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.

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

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

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

Preventive measures and the ideal

14.16 To prevent problems from traffic and other outside noise, the level of insulation should be appropriate 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. However, where double or triple glazing is provided to protect occupiers from noise there must be adequate alternative provision for ventilation.

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

14.18 Minimum requirements for new dwellings is Building Regulations *Approved Document E*. However, in some circumstance, the minimum may not be adequate to prevent indoor noise pollution. Other sources of information include the World Health Organization.

Relevant matters affecting likelihood and harm outcome

14.19 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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

14.20 The assessment should concentrate on the ability of the dwelling to protect the occupants from noise penetrating from outside the dwelling. The design and construction of the dwelling should protect the occupants from ordinary domestic noise from one dwelling entering another, and from traffic or other ambient external noise.

14.21 It is more appropriate to assess the noise levels within the dwelling than to measure the performance of the building as this will take into account the noise conditions of the immediate environment. (In some situations the minimum required by the Building Regulations will be insufficient.) Measurement of noise levels using properly calibrated noise meters can be helpful to confirm the subjective assessment.

14.22 Noise from unreasonable behaviour of neighbours (whether domestic or commercial) should not be included in the assessment, although this could be the subject of other action.

C 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 Note that hazards associated with sanitation and drainage, domestic water, personal washing facilities and food safety are each dealt with as separate hazards.

Potential for harm

Most vulnerable age group and statistical averages

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

Basis of estimates

15.04 There is a weak quantitative evidence base. The averages given use a base of all dwellings. They have been calculated from those used in Version 1 of the HHSRS which used a base population of people living in dwellings with defective cleanability in the kitchen or bathroom, or where pests are present.

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 %	
All Dwellings	5,585	0	0.1	1	98.9	0 (J)

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. 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* (Cryptosporidiosis), *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.

Causes

15.12 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 dwelling. There are also instances where rats have gnawed through plastic covers to wall ventilators. Urban rat infestations show an association with poor environments and areas of poor quality or multi-occupied housing.

15.13 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.

15.14 Damaged or ill fitting doors and windows can provide means of access for rats and mice.

15.15 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. 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.

15.16 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 (e.g. *Monomorium pharaonis*). Treatment of infestations requires a coordinated approach to ensure pockets of infestation do not re-infest treated parts of a building.

15.17 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.

Preventive measures and the ideal

15.18 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.

15.19 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 that 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.

15.20 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.

15.21 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.

15.22 The design and construction should reduce, so far as is possible, any means of access by pests from the outside into the dwelling. 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. To prevent mice entering there should be no holes or gaps in excess of 6.25mm. 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.

15.23 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.

15.24 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.

15.25 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.

15.26 For further information see – Building Regulations *Approved Document H* and British Standard *BS5906 Code of Practice for storage and on-site treatment of solid waste from buildings.*

Relevant matters affecting likelihood and harm outcome

15.27 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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

15.28 It is the overall risk at the dwelling from potential infestations and any problems associated with refuse disposal and domestic hygiene generally which is to be assessed.

16 Food Safety

Description of the hazard

16.01 This category covers 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

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

Food Safety
Average likelihood and health outcomes by 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 SROs	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)
SROs	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 Class I outcomes are derived from the mortality statistics, and Class II and III from the Hospital Episode Statistics. Class IV are derived 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 human behaviour and ignorance of the risks involved in food preparation. It has been estimated that 40% is associated with human 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 so are not included in the statistical evidence).

16.06 It is estimated that in the general UK population there are 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.

Causes

16.08 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. Cracks, chips or other damage to the internal surface may prevent thorough cleansing and provide for harbourage of pathogenic and food spoiling organisms.

16.09 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.

Preventive measures and the ideal

16.10 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, so reducing the risk of food poisoning and promoting safe practice.

16.11 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. 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.

16.12 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, and there should be appropriate means of ventilation of the whole of the kitchen area and in particular the cooking area.

16.13 The food storage facilities should enable cooked and uncooked food to be kept separate to prevent cross contamination. These facilities should be of adequate size for the size of dwelling and should be finished internally and externally with smooth impervious surfaces capable of being readily cleansed and maintained in a hygienic condition.

16.14 The sink should be of an adequate size, and have a drainer which drains into the sink, or, as an alternative, a dual sink. It should be strong enough to safely take the weight of the water and equipment and utensils. The surface of the drainer and the internal surface of the sink should be smooth, impervious and capable of being readily cleansed and maintained in a hygienic condition.

16.15 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.

16.16 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 sufficient appropriate power sockets associated with the worktop(s) (as well as those provided for equipment such as refrigerators and washing machines).

16.17 There should be space for the installation of cooking facilities sufficient to take facilities of adequate size for the household, with appropriate connections for fuel.

16.18 In multi-occupied premises where facilities are shared, a degree of lack of communication between individuals from different households is likely. This can lead to conditions where there is an increased risk of food poisoning, particularly where there is confusion over responsibility for cleaning. Separate food storage, preparation and cooking facilities for different households can help reduce the risk of food poisoning and also reduce stress and anxiety associated with shared use.

16.19 For further information see – the Unit Layout section of the *Housing Quality Indicator system* (ODPM), and British Standard *BS 6465 Parts I and II.*

Relevant matters affecting likelihood and harm outcome

16.20 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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.

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.

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

16.21 The design, layout and state of repair of the kitchen and of the facilities provided can make it relatively easy to maintain clean and hygienic conditions and can promote safe food practice. Deficiencies can be a major disincentive.

16.22 The 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.

16.23 In multi-occupied premises, the degree of sharing of facilities by other household/ individuals should be taken into account and its potential impact on food safety.

17 Personal Hygiene, Sanitation and Drainage

Description of the hazard

17.01 This category covers threats of infection and threats to mental health associated with personal hygiene, including personal washing and clothes washing facilities, sanitation and drainage. It does not include problems with pests associated with defective drainage facilities.

Potential for harm

Most vulnerable age group and statistical averages

17.02 The most vulnerable age group is all persons under 5 years of age.

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)
Apts	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

17.03 The statistics were 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.

17.04 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. While the confidence levels for the averages are low, the fact that no mental ill-health has been include, suggests that the average likelihoods may represent an under-estimation of the risk.

Health effects

17.05 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.

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.

17.07 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.

17.08 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.

17.09 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.

Causes

17.10 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. However, where there are deficiencies with the facilities themselves, this clearly can increase the risk from this hazard.

17.11 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. A water closet includes the basin, a flushing mechanism and a connection to the drainage system. Other means include composting closets and chemical closets.

17.12 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, the wash-out) are considered insanitary.

17.13 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.

17.14 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.

17.15 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.

17.16 Waste water discharged onto paths or gardens, if allowed to accumulate and stagnate, will be a source of offensive smells, and may attract pests.

Preventive measures and the ideal

17.17 Water closet basins should have a smooth and impervious surface (such as vitreous china) and be self-cleansing. They 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. 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).

17.18 Where a macerator is installed, the safe operation of the water closet relies on a supply of electricity as well as water for flushing.

17.19 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).

17.20 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 adequately ventilated. 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).

17.21 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.

17.22 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.

17.23 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.

17.24 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.

17.25 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.

17.26 Sinks will be used for hand washing of clothes as well as for food preparation and for washing up kitchen and eating equipment. 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.

17.27 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.

17.28 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.

17.29 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.

17.30 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 or directly in vertical drains connected to the main sewerage system. 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.

17.31 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. 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.

17.32 All connections between sanitary closets 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.

17.33 In multi-occupied premises where facilities are shared, a degree of lack of communication between individuals from different households is likely. This can lead to conditions where there is an increased risk of infection, particularly when one household has an infectious illness of which other households are unaware. There may also be confusion over responsibility for cleaning, or poor management of cleaning, which can lead to a poor standards of hygiene.

17.34 For further information see – Building Regulations *Approved Document G: Hygiene, Approved Document H: Drainage and waste disposal*, and British Standards *BS 6465 Sanitary installations Parts I and II*, and *BS 8000 Part 13: Workmanship on building sites. Code of practice for above ground drainage and sanitary appliances.*

Relevant matters affecting likelihood and harm outcome

17.35 Matters relevant to the likelihood of an occurrence and the severity of the outcomes include:

Personal hygiene

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

i) Sewage system – none or an obsolete means for the sanitary collection and removal of human excreta from the dwelling.

j) Sanitary provision – insufficient numbers of sanitary closets (whether water, composting or chemical) for the numbers in occupation.

k) Sanitary closet siting – inappropriate or inconvenient location of a sanitary closet.

l) Disrepair of sanitary closet – cracked or otherwise non-impervious bowl to a water closet or other sanitary appliance.

m) Water to wc – inadequate supply of water to the flushing cistern serving a water closet.

n) Effective flush – defective mechanism to a flushing cistern serving a water closet.

o) Macerator defects – defective mechanism to a water closet.

p) Earth closet defects – ineffective means of supplying deodorising earth or similar material to an earth closet.

q) Seat/lid to sanitary closet – missing or non-impervious seat and/or lid to a sanitary closet basin.

r) Ventilation to compartment – inadequate ventilation to the compartment or room housing a sanitary closet.

s) 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.

t) Inadequate lighting – to the compartment or room containing a sanitary closet.

u) Door to compartment – missing or defective door to the compartment.

v) Adjacent wash hand basin – lack of a wash hand basin in the room, compartment or immediately adjacent room.

Drainage

w) 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.

x) Pipe defects – defects to a soil or waste pipe serving a water using facility.

y) Traps and water seals – the lack or disrepair of a trap and water seal.

z) Ventilation of pipes – inadequate ventilation to a soil or waste pipe.

aa) Disrepair to system – defects to the foul or waste water drainage systems.

bb) Private sewage system – missing or defective private foul sewage treatment system or private foul sewage storage cistern.

cc) Soakaway – missing, defective or badly located soakaway for surface water.

dd) Surface water drainage – inadequate or defective drainage.

ee) Recycling system – defects to greywater or rainwater recycling system.

Hazard Assessment

17.36 It is the overall threat to health at the dwelling from provision and state of the facilities for personal hygiene, sanitation, and drainage, which is to be assessed.

17.37 It should be noted that the statistical averages for likelihood reflect the generally good level of provision for drainage, sanitary and personal hygiene facilities in UK homes. This means that, where there are problems, the risks will be elevated well above the average.

17.38 The assessment of a dwelling in a multi-occupied building should reflect the increased risk having regard to the number of individuals and households that might be expected to share facilities.

18 Water Supply

Description of the hazard

18.01 This category covers the quality and adequacy of the supply of water within the dwelling for drinking and for domestic purposes such as cooking, washing, cleaning and sanitation. As well as the adequacy, it includes threats to health from contamination by bacteria, protozoa, parasites, viruses, and chemical pollutants. (Contamination by radon and lead are dealt with separately.)

18.02 The quality of water supplied from public mains is outside the HHSRS assessment and is subject to separate controls.

Potential for harm

Most vulnerable group and statistical averages used for rating

18.03 There is no particular age group more vulnerable than others.

Basis of estimates

18.04 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 as a result of infection from domestic water systems, of which less than 2 proved fatal.

18.05 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.

Water supply
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 SROs	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)
SROs	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)**

Health effects

18.06 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.

18.07 In the UK, the main threats to health from water result from contamination. 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.

18.08 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*.

18.09 Private water supplies may be untreated and can become contaminated more readily, although there is a lower rate of reported illness. While this may be due to the occupiers developing some acquired immunity, visitors may be at risk.

18.10 In 2000 there were 173 reported cases of Legionnaires' disease, of which 76 (44%) were community acquired. It is estimated that 1 in 6 community acquired cases is due to domestic water systems. Most infections with *Legionellas* are respiratory infections, acute pneumonia – Legionnaires disease – of which 10 to 15% of cases are fatal. *Legionella* can also cause wound infections from contact with contaminated water.

Causes

18.11 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.

18.12 *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.

18.13 There is potential for pathogens to proliferate in filters attached to taps, or in a plumbed in filter.

18.14 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 greywater (bathroom waste water).

Preventive measures and the ideal

18.15 Drinking water should be wholesome, and the supply to and within the dwelling should not be interrupted, except in emergencies.

18.16 The entire installation (taps, pipes, any storage tanks) should not adversely affect the quality of the water:

a) by allowing ingress of contamination (e.g. tanks should be covered to prevent access to mice, birds and insects);

b) by stagnation, particularly at high temperatures (e.g. 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 (e.g. 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; and/or

e) by cross-connection between pipes conveying water supplied for drinking water with pipes conveying water from some other source.

18.17 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. 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. There should be regular sampling and analysis of drinking water stored and supplied from a tank (such as from a private supply).

18.18 The water should be supplied at a pressure adequate for appliances at a dwelling, if necessary, with the use of a booster pump.

18.19 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.) 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*.

18.20 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, therefore should be stored and held in pipework at a temperature as low as possible, and at least below 20ºC.

18.21 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. 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.

18.22 Any filters attached to taps, or plumbed in, should be fitted properly and the filter cartridge changed regularly according to the manufacturer's instructions.

18.23 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.

18.24 In multi-occupied buildings, where there is inadequate pressure from mains water to supply all dwellings, 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. *Legionella* are more likely to be found in the water systems of multi-occupied buildings than in other domestic accommodation. Drinking water to such buildings should be sampled and analysed regularly, particularly for new installations, and where extensive repairs or alterations have been carried.

18.25 For further information see – British Standards BS6700 *Specification for design, installation, testing and maintenance of services*, Building Regulation *Approved Document H* on reuse of grey-water and rainwater, and the Water Regulations Advisory Scheme Information and Guidance Note: *Reclaimed Water Systems – Information about installing, modifying or maintaining reclaimed water systems.*

Relevant matters affecting likelihood and harm outcome

18.26 Matters relevant to the likelihood of an occurrence and the severity of the outcomes 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. Where there is justification for further investigation, sampling and analysis of water will be necessary.

18.28 In multi-occupied buildings, where there are greater risks from Legionella, it may be considered appropriate to check the temperature of water in pipes, cold water cisterns, hot water storage vessels, and the discharge from taps. Water sampling and analysis may also be considered necessary.

D 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.

Potential for harm

Most vulnerable age group and statistical averages

19.02 The most vulnerable age group is all persons 60 or more years of age.

Basis of estimates

19.03 The averages 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 the accident statistics in general, and a high confidence level for these averages. However, there may be under-representation of the proportion of Class I as 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. While precipitated by the fall, the cause of death may not be reported as linked to the fall.

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	4 (J)
Apts	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	68.6	12 (I)
	Post 1979	4,448	0.0	9.1	0.0	90.9	2 (J)
All Dwellings		**4,026**	**1.9**	**3.6**	**10.3**	84.2	7 (J)

Health effects

19.05 The most common injuries that result from falls associated with a bath, shower or similar facility are cuts or lacerations (27%), swelling or bruising (26%), or fractures (11%). Because of the many hard projections and surfaces found in bathrooms, and that the user may be unprotected by clothing, outcomes from a fall are likely to be more severe than in other areas.

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, the elderly are most at risk because of the more severe health outcomes.

Causes

19.08 The main cause of falls in bathrooms is slipping when getting into or out of the bath. Thus the slip resistance of the internal surfaces of baths and showers when wet will affect the likelihood of an incidence occurring.

19.09 The position of taps, waste controls and other bathroom 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, increasing the risk of a fall. The position and direction of opening of the door may also affect the likelihood of a fall.

19.10 Inadequate functional space (the space necessary for using the facility) immediately adjacent to the appliance may make it more difficult to use, increasing the likelihood of a fall. Inadequate lighting or glare can also increase the likelihood of a fall, as can a light switch remote from the doorway.

19.11 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.

Preventive measures and the ideal

19.12 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. The layout of a bathroom and of the appliances should allow for ease of use of each appliance, including sufficient functional 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.

19.13 For further information see – British Standard *BS6465 Sanitary installations – Part 1 Code of Practice for space requirements for sanitary appliances, and BS 6340 Shower units.*

Relevant matters affecting likelihood and harm outcome

19.14 Matters relevant to the likelihood of an occurrence include:

a) Poor friction – of the internal surface of a bath or shower.

b) Siting of taps, wastes, light switches and other controls– inappropriate sitings increasing the risk of falls.

c) Handles and grab rails – lack of, or insecurely fitted.

d) Unstable appliance – unstable fitting of bath, shower, wc basin, or wash hand basin.

e) Inadequate space – for the functional area immediately adjacent to the appliance.

f) Inadequate lighting – lack of adequate natural or artificial lighting.

g) Glare – from natural or artificial lighting.

h) Space heating – inadequate means of heating the bathroom.

19.15 Matters relevant to the severity of the outcomes include:

a) Projections – the presence of sharp edges, heating installations, or glass.

b) Inadequate space – functional space and space between appliances.

c) Space heating – inadequate means of heating the bathroom.

Hazard Assessment

19.16 As well as the condition of the facilities and appliances, the layout and functional space is important. The space should be sufficient for more than one person, to allow for a parent to help a child, or a carer to help an elderly person. The more individuals or households using a bathroom, the greater the wear and tear which may lead to appliances and handles becoming loose and unstable.

20 Falling on Level Surfaces etc

Description of the hazard

20.01 This category covers falling 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

20.02 The most vulnerable age group is all persons aged 60 years or over.

Falling on level surfaces 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	124	0.2	13.8	27.3	58.7	198 (F)
	1920-45	139	0.2	12.8	26.2	60.8	167 (F)
	1946-79	152	0.2	13.3	28.7	57.8	161 (F)
	Post 1979	126	0.1	13.8	33.9	52.2	202 (E)
Apts	Pre 1920	87	0.1	14.3	18.6	67.0	248 (E)
	1920-45	101	0.2	14.4	24.4	61.0	241 (E)
	1946-79	132	0.3	15.3	22.6	61.8	195 (F)
	Post 1979	112	0.1	17.5	24.9	57.5	237 (E)
	All	**135**	**0.2**	**13.8**	**27.3**	**58.7**	**182 (F)**

Basis of estimates

20.03 The averages relate to persons aged 60 years or over who were injured due to a fall on the level in or around their dwelling (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 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 the dwelling (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 these averages. 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, 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, because of the more severe health outcomes, are considered the most vulnerable age group.

Health effects

20.06 Falls can 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 onto which the victim falls. While falls on the level tend to result in relatively minor injuries than other falls, they 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.

Causes

20.08 The construction, evenness, inherent slip resistance, drainage (for outdoor path surfaces), and maintenance of the floor or path surface, all affect the likelihood of an occurrence and the severity of the outcome. Other factors such as lighting, temperature and distracting noise also have an affect.

20.09 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 increase the likelihood of a trip, an even surface will help prevent falls.

20.10 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.

20.11 A lack of sufficient space to carry out tasks or manoeuvres may also increase the likelihood of an occurrence and the severity of the outcome.

20.12 The nature of the surface will influence the outcome. Hard surfaces such as uncovered stone, concrete, or ceramic tiled floors being more unforgiving than carpeted floors.

20.13 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 Excess Cold hazard category. It may also therefore be more hazardous using external paths in cold weather, irrespective of whether they are wet or icy.

Preventive measures and the ideal

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.

20.15 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.

20.16 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.

20.17 In common parts in multi-occupied buildings, the owner or manager is responsible for floor coverings as well as the other factors discussed.

20.18 For further information see – Building Regulations *Approved Document A: Structure*, and British Standards *BS 5385* and *6431*.

Relevant matters affecting likelihood and harm outcome

20.19 Matters relevant to the likelihood of an occurrence include:

a) Lack of floor surface – 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 – both artificial and natural.

j) Thermal efficiency – inadequate heating and insulation at the dwelling.

20.20 Matters relevant to the severity of the outcome 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 a fall might occur.

c) Nature of area – and of the activities which will be undertaken in the area where a fall might occur.

d) Thermal efficiency – inadequate heating and insulation at for the dwelling.

Hazard Assessment

20.21 Account should be taken of the floors to all rooms, passages and areas within the dwelling and all paths and yards giving access to and associated with the dwelling and the hazard assessed for the dwelling as a whole.

20.22 As well as uneven boarding or loose paving, the friction quality can be affected by moisture, or, in the case of paths and yards, ice or leaves. The expected frequency of use should also be considered.

20.23 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 Falling on Stairs etc

Description of the hazard

21.01 This category covers any fall associated with a stairs, steps and ramps where the change in level is greater than 300mm. It includes falls associated with:

a) internal stairs or ramps within the dwelling;

b) external steps or ramps within the curtilage of the dwelling;

c) internal common stairs or ramps within the building containing the dwelling and giving access to the dwelling, and those to shared facilities or means of escape in case of fire associated with the dwelling; and

d) external steps or ramps within the curtilage of the building containing the dwelling and giving access to the dwelling, and those to shared facilities or means of escape in case of fire associated with the dwelling.

21.02 It includes falls over guarding (balustrading) associated with the stairs, steps or ramps. However, it does not include falls over guarding to balconies or landings, nor does it include 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

21.03 The most vulnerable age group is all persons aged 60 years or over.

Basis of estimates

21.04 The averages relate to persons aged 60 years or over who were injured due to a fall associated with stairs or steps at their dwelling (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 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, as reported by the Home Accident Surveillance System.

Falling on stairs
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 %	
Houses	Pre 1920	218	2.2	7.7	22.1	68.0	170 (F)
	1920-45	226	2.1	7.4	20.5	70.0	156 (F)
	1946-79	256	1.6	6.6	21.6	70.2	116 (F)
	Post 1979	256	1.4	6.3	25.3	67.0	112 (F)
Apts	Pre 1920	214	3.9	8.0	19.3	68.8	249 (E)
	1920-45	263	1.6	2.8	20.1	75.5	97 (G)
	1946-79	410	2.8	5.3	17.7	74.2	96 (G)
	Post 1979	409	2.6	5.2	19.4	72.8	92 (G)
	All	**245**	**1.9**	**6.7**	**21.7**	**69.7**	**134 (F)**

21.05 There is a high confidence level for these averages. 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 as they usually suffer worse injuries from which they take longer to recover.

Health effects

21.07 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 Class I outcome.

21.08 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.

21.09 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.

21.10 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.

Causes

21.11 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 may mean that the user takes greater care and increases concentration, reducing the likelihood of an occurrence.

21.12 Accidents are nearly twice as likely on stairs consisting of straight steps with no winders or intermediate landings. The length of flight of stairs or of slopes may increase the seriousness of the outcome by increasing the possible distance of a fall.

21.13 On small spiral stairs, the likelihood of a fall may be increased where there is no inner handrail and where the width is less than 800mm. Alternating tread stairs may also be hazardous, particularly in emergencies.

21.14 Accidents are more likely where the pitch of stairs is more than 42º, and a steeper pitch can be expected to result in a worse outcome. For ramps, the steepness of the slope is relevant to the potential for accidents.

21.15 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.

21.16 An accident is three times more likely to occur on stairs without carpet covering, including those stairs intended to be left uncovered. 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.

21.17 The likelihood of a fall is doubled if there is no wall or guarding to one side of the stair. Similarly, the lack of any handrail doubles the likelihood of a fall, even if there is a wall to both sides of the stairs.

Preventive measures and the ideal

21.18 The likelihood of missteps is reduced where tread and rise dimensions are 280-360mm and 100-180mm respectively. It is estimated that the risk of an accident is decreased by 10% for every 10mm increase in going between 180mm and 280mm.

21.19 Carpets generally reduce the severity of injury should a fall occur, both on stairs and at the foot of stairs.

21.20 To prevent small children falling (or becoming trapped), there should not be any openings on stairs, either to the stairs themselves or to the guarding, which allow a 100mm diameter sphere to pass through.

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.

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. 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.

21.23 Where the is no wall to one or both sides of the stairs, guarding (e.g. balustrade) should be provided to prevent falls off the sides of stairs. It should be designed and constructed so as to discourage children climbing.

21.24 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.

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.

21.26 There should be reasonable space at the top and bottom of any stairs to enable users to appraise the start and dimensions of the steps and stairs. Architectural features (e.g. 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.

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.

21.28 In multi-occupied buildings, the owner or manager is also responsible for the stair covering (e.g. carpet) and for ensuring that stairs are kept free from obstructions.

21.29 For further information see – Building Regulations *Approved Document Part Kt*, *Approved Document Part N*, and British Standards *BS5395, 585, 6180, 5588*, and *6262-4*. Also, see Building Regulations *Approved Document Part M* which deals with the welfare and convenience for building users.

Relevant matters affecting likelihood and harm outcome

21.30 Matters relevant to the likelihood of an 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 quality – of treads and nosings.

f) Openings – in stairs or guarding 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 to both sides of the staircase.

i) Height of handrails – set below 900mm or above 1,000mm.

j) Lack of guarding – the absence where there is no wall to both sides 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 – less than 1,000mm.

n) Length of flight – long flights may increase the likelihood of a fall.

o) Inadequate lighting – natural and/or artificial, particularly to the top and foot of a flight.

p) Lighting controls – inadequate or inconvenient means of controlling the artificial lighting.

q) Glare from lighting – whether natural or artificial.

r) Door(s) onto stairs – doors opening directly onto the stairs.

s) Inadequate landing – inadequate floor space leading to the stairs.

t) Construction/disrepair – inadequate construction or disrepair to any element of the stairs.

u) Thermal efficiency – inadequate heating and insulation of the dwelling.

21.31 Matters relevant to the severity of the outcome include:

a) Length of flight – long flights increase the severity of the outcome.

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 efficiency –inadequate heating and insulation of the dwelling.

Hazard Assessment

21.32 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. It is the overall likelihood of a fall that is to assessed. This should take account of the frequency with which each might be expected to be used.

22 Falling between Levels

Description of the hazard

22.01 This category covers falls from one level to another, inside or outside a dwelling, where the difference in levels is more than 300mm. It includes, for example, falls out of windows, falls from balconies or landings, falls from accessible roofs, into basement wells, and over garden retaining walls.

22.02 It does not include falls associated with stairs, steps or ramps. Nor does it include falls from furniture or from ladders.

Potential for harm

Most vulnerable age group and statistical averages

22.03 The most vulnerable age group is all persons aged under 5 years of age.

Falling between levels
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	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	7 (J)
	Post 1979	2,132	0.0	0.0	16.7	83.3	3 (J)
Apts	Pre 1920	2,742	0.4	3.2	5.9	90.5	4 (J)
	1920-45	2,451	0.4	3.2	5.9	90.5	4 (J)
	1946-79	1,791	0.4	3.2	5.9	90.5	6 (J)
	Post 1979	1,235	0.4	3.2	5.9	90.5	8 (J)
All Dwellings		**1,693**	**0.2**	**1.8**	**9.9**	**88.1**	**5 (J)**

Basis of estimates

22.04 The averages relate to persons aged under 5 years injured due to a fall from a window, landing, balcony etc. 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 reported by Coroners. The Class II to IV estimates are based on the number of falls from residential 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.

22.05 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.

Health effects

22.06 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.

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 five 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.

Causes

22.10 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 from inside will affect the likelihood of an occurrence.

22.11 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. Difficult to reach catches can increase the likelihood of a fall (although this may be more properly assessed in relation to ergonomics).

22.12 The distance of a window opening or balcony 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 these falls).

Preventive measures and the ideal

22.13 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. While, ideally, there should be a catch to at least one window in a room accessible to wheelchair users, such a window should still be fitted with a restrictor.

22.14 Falls are least likely when internal sills are at least 1,100mm from the finished floor level. However, where a window in a roof serves the function of a means of escape in case of fire, then the bottom of the openable area may be 600mm above the floor (a trade-off between the likelihood of a fall and fire safety).

22.15 To allow views from a seated position (see Lighting) the height of glazing above floor level should not be more than 800mm. Where there is any glazing extending to within 800mm of the floor level, it should be guarded or of safety glass.

22.16 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 such buildings, and preferably from the second floor upwards, glazing below 1,100mm from floor level should be guarded with a safety rail.

22.17 The design of the windows should facilitate safe cleaning of the outer surface. It should be such that there is no reason to climb on a chair or stepladder 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.

22.18 Guarding (e.g. balustrade) should be provided to balconies and landings to prevent falls. It should be at least 1,100mm high and designed and constructed so as to discourage children climbing and strong enough to support the weight of people leaning against it. There should be no openings to the guarding which would allow a 100mm sphere to pass through.

22.19 For further information on windows see – Building Regulations *Approved Document L1: conservation of fuel and power, Approved Document K: protection from falling, collision and impact, Approved Document N: Glazing – safety in relation to impact, opening and cleaning, Approved Document B: fire safety*, and British Standards *BS 8213: Part 1*, and *BS6262*. On balconies etc, see – Building Regulations *Approved Document K: protection from falling, collision and impact*, and British Standards *BS6180*, and *BS6399 Part 1*.

Relevant matters affecting likelihood and harm outcome

22.20 For windows, matters relevant to the likelihood of an occurrence include:

a) Ease of window operation – degree of difficulty 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) Sill heights – less than 1,100mm above floor level and/or lack of safety glass or guarding.

e) Disrepair of window – to frame, catches, hinges, sashes, safety devices and opening lights.

f) Ease of cleaning – outer surfaces that are difficult to clean.

22.21 For balconies, landings, roof parapets, basement wells, etc, matters relevant to the likelihood of an occurrence include:

a) Height of guarding – extending less than 1,100mm above the balcony, roof surface or floor.

b) Easily climbed guarding – constructed so as to facilitate climbing by young children.

c) Openings in guarding –openings greater than 100mm.

d) Construction/repair of guarding – insufficient strength and fixing.

22.22 For windows, balconies, landings, roof parapets, basement wells, etc, matters relevant to the severity of the outcome include:

a) Height above ground – the distance of a fall to the ground or next level.

b) Nature of ground – the nature of the surface and any features which may be collided with.

c) Non-safety glass – the lack of safety glass where appropriate in the window or guarding.

Hazard Assessment

22.23 All deficiencies which may contribute to the hazard, including those associated with windows, balconies, landings, basement wells, etc., both internally and externally, should be considered in the assessment. 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 covers hazards from shock and burns resulting from exposure to electricity, including from lightning strikes. (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

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 %	
All Dwellings	16869	0.6	8.2	49.2	42.0	2 (J)

Basis of estimates

23.03 The averages relate to persons aged under 5 years harmed by a domestic electrical accident in England and Wales in the years 1997, 1998 and 1999. The statistics are based on the number of fatal injuries reported in the mortality statistics. The Class II to IV outcomes are based on the Home Accident Surveillance System details of the number children under 5 years old treated in hospital during those three years for 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 than for many of the other accident statistics, particularly for the spread of health outcomes.

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.

Causes

23.09 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.

23.10 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.

23.11 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.

Preventive measures and the ideal

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 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.

23.14 If equipment operating at 230 volts or higher is used, a Residual Current Device (RCD)[38] 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 dangers from electricity. 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 (e.g. electric showers). There should be no socket outlets in bathrooms other than 12 volt AC (e.g., shaver sockets).

23.16 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.

23.17 For further information see – British Standard *BS7671 Requirements for electrical installations*, and *BS6651* on a procedure for calculating the overall lightning strike risk factor for a building.

Relevant matters affecting likelihood and harm outcome

23.18 Matters relevant to the likelihood of an occurrence and severity of the outcome include:

a) Electrical installation out-of-date – non-compliance with current requirements.

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.

38 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.

g) Lightning protection system –lack of, or defective system to buildings at significant risk of lightning.

Hazard Assessment

23.19 A visual inspection of the electrical installation and fixed appliances to the whole dwelling may identify obvious deficiencies which contribute to the hazard. 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 should be commissioned.

23.20 In multi-occupied properties, the owner or manager may provide non-fixed appliances. These should also be taken into account.

24 Fire

Description of the hazard

24.01 This category covers threats from exposure to uncontrolled fire and associated smoke at a dwelling.

24.02 It includes injuries from clothing catching alight on exposure to an uncontrolled fire, which appears to be common when people attempt to extinguish such a fire. However, it does not include injuries caused by clothing catching alight from a controlled fire or flame, which may be caused by reaching across a gas flame or an open fire used for space heating.

Potential for harm

Most vulnerable age group and statistical averages

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
			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)
Apts	Pre 1920	1,681	5.6	0.0	27.7	66.7	39 (H)
	1920-45	3,372	5.6	0.0	27.7	66.7	19 (I)
	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 averages 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 fires 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.

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 (around 38%) is being overcome by gas or smoke. 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 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 likelihood is probably because adults are distracted by children whilst cooking.

24.09 Although children are more likely to be exposed to fire, 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.

Causes

24.10 Occupier behaviour is a major factor in relation to fires starting. 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.

24.11 As well as being responsible for some fires starting, occupiers' reactions on discovering fire influence escape and prevention of fire spread.

24.12 The main sources of ignition attributable to the dwelling, rather than occupiers, are cooking appliances, space heaters, and electrical distribution equipment.

24.13 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 (e.g. close to flammable materials).

24.14 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.

24.15 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).

24.16 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.

24.17 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. Only around 2% of fires start in each of bathroom/wcs, circulation spaces, and store-rooms, and airing cupboards.

24.18 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.

24.19 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.

24.20 The level of harm suffered is influenced by the presence or absence of a fire detection and alarm system. 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. 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. 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%.

24.21 There is a greater risk of a fire occurring in flats than houses. Apartments 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. The increased risk is related to the number of storeys, such that the risks for flat and bedsit occupiers escalate when they live in accommodation of over two storeys in height. 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.

Preventive measures and the ideal

24.22 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.

24.23 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 help contain and 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.

24.24 All fitted appliances and equipment which present a possible source of ignition should be correctly and safely installed and maintained. The space for siting cookers should be safe, with no flammable materials immediately adjacent, or close to windows where curtains may be hung. 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. Facilities for drying clothes indoors during inclement weather will discourage placing clothing near to or on heaters.

24.25 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 current requirements, and should be properly installed and maintained and be regularly checked and tested. There should be no defects to socket outlets or switches.

24.26 Residual Current Devices (RCDs) help prevent fires associated with electrical deficiencies where surface tracking across insulation is a cause of fire ignition.

24.27 Properly working alarms, connected to smoke or heat detectors probably do more to save lives in the event of a fire. They provide early warning to the occupants, allowing them to escape before they are overcome by fumes or burned. 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. (Alarms are available for those with hearing impairment.)

24.28 There should be adequate, appropriate and safe means of escape in case of fire from all parts of the dwelling. There should be primary means of fighting fire, such as fire blanket and extinguishers.

24.29 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.

24.30 For further information see – Building Regulation *Approved Document B*, and British Standards *BS5588, Code of Practice 5839*, and *BS5446*.

Relevant matters affecting likelihood and harm outcome

24.31 Matters relevant to the likelihood of an 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 encouraging use of supplemental heaters.

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 – allowing fire to spread.

h) Smoke permeable fabric – allowing smoke to spread.

i) Fire stops to cavities – lack of, allowing fire to spread.

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) Fire fighting equipment – lack of adequate and appropriate means of primary fire fighting.

o) Lightning protection system – lack of a system where appropriate.

24.32 Matters relevant to the severity of the outcome include:

a) Smoke/heat detectors – lack of or defective smoke and/or heat detectors with alarms or of a detection and alarm system.

b) Means of escape – inadequate safe means of escape in case of fire.

c) Combustible furnishings – including furniture and furnishings.

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 include both the likelihood of a fire starting, and, once started, how likely it is the fire will go undetected and spread.

24.34 The severity of harm suffered will depend on how quickly a fire 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.

24.36 For dwellings in multi-occupied buildings, the assessment is made for each individual dwelling (including the associated shared rooms and areas, if any). 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 be assessed the same 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 – the spread of harms would be more severe for a victim in the third storey bedsit because there will be a greater distance of travel to safety than from the ground floor bedsit. Similarly, differences may be because 90% of fires do not spread beyond the room in which they start.

24.37 Assessment of each individual dwelling within a multi-occupied building should include consideration of the common parts.

25 Flames, Hot Surfaces etc

Description of the hazard

25.01 This category covers threats of:

a) burns – injuries caused by contact with a hot flame or fire, and contact with hot objects or hot non-water based liquids; and

b) scalds – injuries caused by contact with hot liquids and vapours.

25.02 It includes burns caused by clothing catching alight from a controlled fire or flame, for example, when reaching across a gas flame or open fire used for heating. It does not include burns resulting from an uncontrolled fire at a dwelling.

Potential for harm

Most vulnerable age group and statistical averages

25.03 The most vulnerable age group is all persons under 5 years of age.

Flames, hot surfaces etc
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	38 (H)
	1920-45	191	0.0	2.5	16.4	81.1	43 (H)
	1946-79	156	0.0	1.2	16.4	82.4	45 (H)
	Post 1979	230	0.0	0.9	17.1	82.0	30 (H)
Apts	Pre 1920	246	0.1	2.6	20.5	76.8	43 (H)
	1920-45	306	0.2	0.0	15.0	84.8	24 (H)
	1946-79	161	0.0	1.9	24.3	73.8	62 (G)
	Post 1979	138	0.0	0.0	27.1	72.9	64 (G)
All Dwellings		**182**	**0.0**	**1.3**	**17.8**	**80.9**	**41 (H)**

Basis of Estimates

25.04 The averages relate to persons aged under 5 years injured due to hot surfaces and materials in and around their dwelling, in England and Wales in the years 1997, 1998 and 1999. The Class I figures are based on the number of such fatal accidents reported in the mortality statistics. The Class II to IV estimates are based on the number of such persons suffering such injuries 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 averages. 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 112,000 people 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.

25.07 Burns or scalds in this hazard category account for the great majority of non-fatal burn accidents (burns caused by uncontrolled dwelling fires result in the most deaths).

25.08 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.

25.09 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.

25.10 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.

25.11 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.

25.12 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.

Causes

25.13 Around 50% of severe burn and scald injuries to young children happen in the kitchen. 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.

25.14 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.

25.15 While human behaviour is a factor, the design and layout of the dwelling can also contributes to these accidents. In particular, the design and layout of kitchens, the relationship between the kitchen and living/dining areas, the cooker location, the design or adjustment of fixed heating appliances, and the means of heating water.

25.16 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. 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.

25.17 The elderly appear to be involved frequently with burns involving unfixed heating appliances, cookers and flammable liquids.

25.18 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. 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.

25.19 Water temperatures above 45ºC 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.

25.20 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 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.

25.21 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.

25.22 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.

25.23 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.

Preventive measures and the ideal

25.24 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 43ºC, 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.

25.25 The best way to address both risks from scalding and *Legionella* is to store hot water at 60ºC 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 44ºC and 46ºC, 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 41ºC 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 60ºC.

25.26 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.

25.27 Where a cooker is provided, it should be in good working order and stable and securely placed. 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.

25.28 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 43ºC, or appropriately guarded.

25.29 For further information see – Building Regulation *Approved Document J*, and British Standard *BS4086, BS 1945* and *BS 8423*.

Related matters affecting likelihood and harm outcome

25.30 Matters relevant to the likelihood of an occurrence include:

a) Unprotected hot surfaces – exposed surfaces to fixed appliances or pipework with surface temperatures of 43ºC 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 46ºC.

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.

g) Inadequate separation – of kitchen from living or sleeping areas.

25.31 Matters relevant to the severity of the outcome include:

a) Surface/liquid temperature – the temperature of the hot liquid or surface.

b) Exposure – the length of time exposure is expected.

Hazard Assessment

25.32 The assessment should include the provision for space and water heating, the temperature of water at taps, and the design and layout of the dwelling as a whole.

25.33 For dwellings in multi-occupied buildings, whether bathrooms and/or kitchens are shared and, if so the numbers sharing, will be relevant. Where people from different households share facilities, there may not be good communication or co-operation between them, and risks can increase.

Collisions, Cuts and Strains

26 Collision and Entrapment

Description of the hazard

26.01 This category includes risks of physical injury from:

a) trapping body parts in architectural features, such as trapping limbs or fingers in doors or windows; and

b) striking (colliding with) objects such as architectural glazing, windows, doors, low ceilings and walls.

Potential for harm

Most vulnerable age group and statistical averages

26.02 For most entrapment and collision hazards, the most vulnerable group is all persons aged under 5 years. For collision hazards due to low headroom the vulnerable age group is all persons aged 16 years or over.

Basis of Estimates

26.03 The averages for entrapment and collision and those for collision hazards from low headroom 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 dwellings 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 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.

Collision and entrapment
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	0.0	0.1	4.3	95.6	59 (G)
	1920-45	41	0.0	0.1	3.8	96.1	54 (G)
	1946-79	31	0.0	0.0	4.0	96.0	70 (G)
	Post 1979	42	0.0	0.1	4.2	95.7	55 (G)
Apts	Pre 1920	76	0.0	0.0	2.8	97.2	24 (H)
	1920-45	80	0.0	0.0	2.0	98.0	20 (H)
	1946-79	43	0.0	0.1	4.0	95.9	53 (G)
	Post 1979	32	0.0	0.0	7.6	92.4	100 (F)
All Dwellings		**39**	**0.0**	**0.1**	**4.1**	**95.8**	**59 (G)**

Collision hazards from low architectural features
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**	**0.0**	**0.5**	**7.0**	**92.5**	**20 (H)**

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. 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). Most door accidents, particularly a door shutting on part of the body, involve children aged 9 years and under. Accidents involving door glazing (15% of door accidents) are most likely to occur to young adults (20 to 29 years).

26.07 Children and young adults (15 to 24 years) are most vulnerable to glazing and window accidents.

26.08 Children and the frail elderly are vulnerable to accidents involving lifts/elevators.

Causes

26.09 There is always an inherent risk of entrapment by doors and windows. However, certain features can affect that risk.

26.10 The risk increases where doors or windows are difficult to close. Where a door closer is over-powerful a small child may not be strong enough to resist it. Doors and windows which pivot (rather than being hinged) can trap fingers or hands. Weak or broken sash cords mean that the window cannot be operated without a risk of physical injury.

26.11 The siting of doors and windows and the direction of opening can affect the risk. Doors opening into passages, small rooms (such as bathrooms) or onto stairs can be a collision hazard, as can be windows or doors opening across paths. Doors to wall hung cupboards over worktops in kitchens can also be a collision hazard.

26.12 Gaps, particularly in guarding to balconies, landings and stairs, which are over 100mm can be attractive to small children who may become trapped.

26.13 Areas or points of low head room are collision hazards. Examples are at door openings, at the top of stairs, and the soffit to open-plan stairs

Preventive measures and the ideal

26.14 Window opening lights should not project over pathways to obstruct the passage of those using the path.

26.15 Doors and windows should be maintained in repair, with particular attention to items such as sash cords, to avoid increasing the risk of an occurrence. Self-closers on doors should be adjusted so as not to cause over-vigorous closing.

26.16 Safety glazing should be provided in doors and windows in vulnerable locations.

26.17 For further information see – Building Regulations *Approved Document K, Approved Document N*, British Standard *BS 8213: Part 1*, and *BS6262: Part 4*.

Relevant matters affecting likelihood and harm outcome

26.18 Matters relevant to the likelihood of an occurrence and to the severity of the 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 100 mm in banisters in which young children could get trapped.

j) Low headroom to doors – well under 1.9 metres.

k) Low beams and ceilings – well under 1.9 metres.

Hazard Assessment

26.19 All potential entrapment and collision features, deficiencies and problems identified at the dwelling should taken into account in the overall assessment.

27 Explosions

Description of the hazard

27.01 This category covers the threat from the blast of an explosion, from debris generated by the blast, and from the partial or total collapse of a building as the result of an explosion.

Potential for harm

Most vulnerable age group and statistical averages

27.02 No particular age group appears to be more vulnerable than others.

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 %	
All Dwellings	156,528	11.2	0.0	5.4	83.4	1 (J)

Basis of estimates

27.03 The averages 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 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.

Health effects

27.05 While the average likelihood of an explosion is very small, explosions can result in extreme harm. There are around 10 deaths per year in dwellings as a result of explosions, and over 500 non-fatal accidents where the victim was struck by debris from an explosion.

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.

Causes

27.07 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.

27.08 The most likely causes are defective installation or design, and defects from inadequate maintenance.

Preventive measures and the ideal

27.09 Gas supplied to dwellings should satisfy the requirements of the current quality regulations and should be supplied by an authorised supplier at a standard pressure and of a standard composition.

27.10 There should be appropriate properly designed and installed gas pressure regulators, meters and pipework. It should be properly installed by a competent person (i.e. registered with the Council for Registered Gas Installers (CORGI)) and in accordance with the current safety regulations. 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 installations.

27.11 Gas appliances should be properly designed and installed and should satisfy the relevant safety regulations. The appliances and associated flue should be regularly serviced and maintained by a competent person.

27.12 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.

27.13 Hot water systems should be correctly installed to meet the requirements of safety regulations No hot water storage tank of more than 3 gallon (15 litre) capacity should be connected directly to the mains water supply. For ventilated hot water 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.

27.14 For further information see – Building Regulations *Approved Document G, Approved Document J* and British Standards *BS 5258, BS6700* and *BS 5482 – Part 1.*

Relevant matters affecting likelihood and harm outcome

27.15 Matters relevant to the likelihood of an occurrence and to the severity of the 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

27.16 It is not just the possibility of an explosion which is relevant, but also the consequences if one occurs. If there is any indication that there may be an above average risk, further investigation and a safety report from an appropriate engineer should be considered to fully assess the hazard.

28 Position and Operability of Amenities etc

Description of the hazard

28.01 This category covers threats of physical strain associated with functional space and other features at dwellings.

Potential for harm

Most vulnerable group and statistical averages

28.02 The most vulnerable age group is all persons aged 60 years or over.

Position and operability of amenities 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	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	1.7	16.9	81.4	0 (J)
Apts	Pre 1920	9,074	0.0	1.7	16.9	81.4	1 (J)
	1920-45	8,443	0.0	1.7	16.9	81.4	1 (J)
	1946-79	22,883	0.0	1.7	16.9	81.4	0 (J)
	Post 1979	22,421	0.0	1.7	16.9	81.4	0 (J)
All Dwellings		**12,925**	**0.0**	**1.7**	**16.9**	**81.4**	**1 (J)**

Basis of estimates

28.03 The averages 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 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. Because of this, the averages given for all dwellings will be significantly more accurate than those given for individual dwelling types. In addition, the averages given for Likelihood will be more accurate than those given for the Spread of Harms. 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.

Causes

28.06 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.

Preventive measures and the ideal

28.07 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.

28.08 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.

28.09 For further information see – British Standard *BS 8213, BS6465 Part 2*, and *BS 4467*. Building Regulations *Approved Document M* addresses welfare and convenience for building users.

Matters affecting likelihood and harm outcome

28.10 Matters relevant to the likelihood of an occurrence and to the severity of the 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 functional 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 functional 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

28.11 All potential ergonomic problems throughout the dwelling should be taken into account to give an overall assessment.

28.12 Where an ergonomic hazard is the result of trying to avoid or negotiate another hazard such as a collision or fall hazard, the assessment should be of both hazards. However, account should be taken of whether removing (or minimising) one hazard will also deal with the ergonomic hazard.

29 Structural Collapse and Falling Elements

Description of the hazard

29.01 This category covers the threat of whole dwelling collapse, or of an element or a part of the fabric being displaced or falling 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

29.02 There is no particular age group more vulnerable than others.

Structural collapse and falling elements
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	89.9	1 (J)
	1920-45	9010	0.2	0.0	9.6	90.2	1 (J)
	1946-79	10440	0.3	0.0	7.5	92.2	1 (J)
	Post 1979	14701	0.3	0.0	4.5	95.2	0 (J)
Apts	Pre 1920	24098	0.7	0.0	8.6	90.7	0 (J)
	1920-45	21126	0.7	0.0	8.6	90.7	1 (J)
	1946-79	14561	0.7	0.0	8.6	90.7	1 (J)
	Post 1979	14762	0.7	0.0	8.6	90.7	1 (J)
	All	**11170**	**0.3**	**0.1**	**8.2**	**91.4**	**1 (J)**

Basis of estimates

29.03 The averages 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, 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, 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.

Causes

29.06 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.

29.07 All elements of the structure of dwellings should be properly maintained to ensure they remain safe and stable.

Preventive measures and the ideal

29.08 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.

29.09 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.

29.10 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.

29.11 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.

29.12 All external pipework and eaves gutters should be securely fixed and properly maintained. Eaves gutters should be capable of coping with the weight imposed by typical snowfalls.

29.13 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.

29.14 Ceilings should be designed, constructed, fixed and maintained to be strong enough to remain intact.

29.15 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.

29.16 Fittings and fixtures (such as electric lights, kitchen wall-cupboards and showers) should be properly and securely fixed.

29.17 For further information see – Building Regulations Part A and *Approved Documents A* and *F2*.

Relevant matters affecting likelihood and harm outcome

29.18 Matters relevant to the likelihood of an 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 – loose cupboards, shelves or handrails.

29.19 Matters relevant to the severity of the 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

29.20 Visual inspection of the whole of the dwelling should provide evidence and indications of deficiencies which could contribute to this hazard. However, further investigation, sometimes destructive, may be necessary to establish the extent or seriousness of some structural problems. In some instances it may be necessary to commission investigations by a structural engineer.

ANNEX D
Selected References and Sources of Further Information

The HHSRS

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Sources of Further Information

American Journal of Epidemiology – publishes research papers on health and housing.

American Journal of Public Health – publishes research papers on health and housing.

British Medical Bulletin – publishes research papers on health and housing.

British Standards Institution, London – the UK's national standards body. Publishes *British Standards* and international standards (including European standards). *British Standards* are relevant to the *Ideals* of many hazards, particularly in relation to building and services design.

Building Research Establishment, Garston – carries out housing and health related research, and publishes (through Construction Research Communications Ltd) a wide range of documents across the full range of housing and health issues.

Chartered Institute of Environmental Health, London – the professional body representing Environmental Health Practitioners.

Chartered Institution of Building Services Engineers, London – the professional body representing Building Services Engineers. Publishes a range of Guides and other documents on the design, installation and maintenance of building services, including lighting, heating, ventilation, electrical services and fire safety.

Department for Environment, Food and Rural Affairs, London – government department, with responsibility for, amongst other matters, energy conservation, air quality (including pollutants in the home), water quality and supply, and noise and nuisance.

Department of Health, London – government department with overall responsibility for health.

Department of Trade and Industry, London – government department with responsibility for business and commerce. The Home Safety Network section has information on accidents and carbon monoxide.

Health Development Agency, London – national authority for public health, commissions and reviews research, and advises on best practice across the broad range of public health disciplines.

Office of the Deputy Prime Minister, London – government department with broad responsibility for, amongst other matters, housing policy and housing quality and standards, and also fire.

Office for National Statistics – government department with overall responsibility for publishing National Statistics, including mortality statistics.

World Health Organization, Geneva – the United Nations' specialized agency for public health. Amongst other responsibilities, sets standards, produces guidelines for risk reduction, and publishes a wide range of public health documents.

A Physiological requirements

Hygrothermal conditions

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Health and Safety Commission and Health and Safety Executive, Caerphilly – regulate health and safety from work activity. The Health and Safety Executive publish widely on health and safety, including information on asbestos, and other hazards in the home (for example, in the use of pesticides and biocides). The Health and Safety Executive are also responsible for domestic gas safety.

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B Psychological requirements

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Health and Safety Executive, Caerphilly – regulate health and safety from work activity, publishes widely on health and safety, including risk assessment for Legionella.

D Protection against accidents

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Sources of further information

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National Inspection Council for Electrical Installation Contracting, London – consumer safety organisation and independent regulatory body for the electrical industry, publishes information on electrical safety matters.

Royal Society for the Prevention of Accidents, Birmingham – charity, with information and publications on, amongst other matters, home safety. Holds the Department of Trade and Industry's Home Accident Surveillance System database from 1978 to 2002.