DETR
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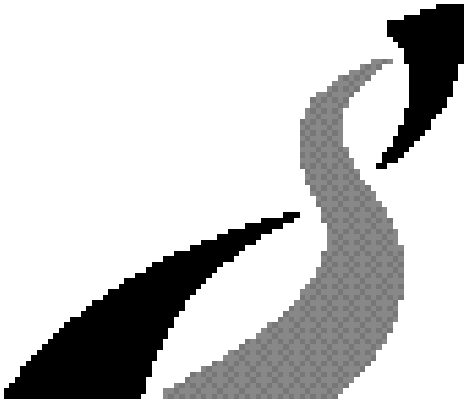
Guidance on the Interpretation of Major Accident to the Environment for the Purposes of the COMAH Regulations



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Preface

Guidance on what should be regarded as a major accident to the environment was first published by the then Department of the Environment in June 1991 following extensive consultation with industry, regulators, research institutes and environmental organisations. The guidance was designed to help inspectors in the Health and Safety Executive who were undertaking the assessment of safety reports submitted under the Control of Industrial Major Accident Hazards (CIMAH) Regulations 1984 (implementing the 1982 Seveso Directive) but also proved helpful to the operators preparing the reports in the first place.

The Seveso II Directive was adopted in 1996 and the Control of Major Accident Hazards (COMAH) Regulations 1999 to implement this Directive revoke the CIMAH Regulations. Requirements to protect the environment from the consequences of major accidents have been strengthened in Seveso II and the COMAH Regulations will be enforced jointly by the Environment Agency, the Scottish Environment Protection Agency and the Health and Safety Executive; together these bodies form the Competent Authority for enforcement of the Regulations.

The 1991 guidance on major accidents to the environment has been reviewed to ensure that its scope is adequate for the purposes of COMAH. In initiating the review process, the Department of the Environment, Transport and the Regions (DETR) was also aware of progress made in understanding ecosystem operation and recovery following accidents and wanted to take account of the experience of industry in preparing safety reports under the CIMAH Regulations.

This guidance is the result of the review and a phase of public consultation undertaken on the Department's behalf by the Institute of Terrestrial Ecology (ITE) and the Medical Research Council's Institute for Environment and Health during 1998. DETR is grateful to all those who responded to ITE's requests for information and advice during the project, participated in the consultation phase, and spent time commenting on the guidance in draft.

The duty on operators under the COMAH Regulations is to take all measures necessary to prevent major accidents and limit their consequences to persons and the environment. Whilst much of this guidance is related to particularly rare or valued features of the environment, often part of designated sites, the duty is to protect the whole environment from the potentially devastating effects of a major accident such as those occurring in the past at Seveso or to the River Rhine following the chemical warehouse fire at Basle.

The definition of major accident within the COMAH Regulations is 'an occurrence (including in particular, a major emission, fire or explosion) resulting from uncontrolled developments in the course of the operation of any establishment and leading to serious danger to human health or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances'. All elements of this definition are necessary for an occurrence to be defined as a major accident.

Major accidents to the environment encompass events with the potential to cause severe,

widespread, long-term or even permanent damage to ecosystems. This guidance is intended to help regulators and operators judge the scale of event which would be interpreted as leading to serious damage to the environment under COMAH and to assist operators with the identification of potential major accident scenarios for the compilation of safety reports for top tier COMAH sites. It should also help with the development of preventive measures to be taken to avoid such an accident, and in the preparation of emergency plans and clean-up and restoration strategies to be followed in the event of an incident.

The guidance is intended to encourage good practice in the management of all potential accidents and, although informed by them, is not limited solely to consideration of those types of event which are reportable to the European Commission as major accidents under the Seveso II Directive.

During revision of the guidance it became clear that the conservation bodies were reviewing the way in which they define the valued components of designated sites. In addition, account needs to be taken of experience gained during the new phase of safety report preparation and assessment that will be entered as the COMAH Regulations come into effect. The guidance is intended to be a living document and as such should evolve in the light of such new developments and experience. The Department thus welcomes comments on the contents of this guidance for any future revision, which should be sent to: Chemicals and Biotechnology Division, Department of the Environment, Transport and the Regions, Ashdown House, 123 Victoria Street, London, SW1E 6DE.

CHAPTER 1
Introduction

1.1 BACKGROUND

The Seveso Directive (82/501/EEC) on the control of major chemical accidents was implemented in Great Britain in 1984 by the CIMAH (Control of Industrial Major Accident Hazards) Regulations. Guidance to these Regulations was published by the Health and Safety Executive (HSE) and was supplemented by a Department of the Environment Guidance Note in 1991, *Interpretation of Major Accident to the Environment for the Purposes of the CIMAH Regulations*. The Guidance Note provided criteria for defining a major accident to the environment for HSE inspectors and operators of establishments covered by the CIMAH Regulations.

Following adoption of the new Seveso II Directive (96/82/EC), there was a need to review and update the original guidance because:

- The criteria in the original guidance have been in use for a number of years by industry, regulators and consultants, who have identified areas in need of further clarification.

- Scientific research in recent years has led to an increased understanding of:

    - the structure and functioning of components of the environment
    - the response of ecosystems and habitats to disturbance
    - subsequent ecosystem recovery.

- Additional European Union legislation has been introduced on nature conservation and other issues (e.g. quality of water intended for different uses).

General guidance on the Control of Major Accident Hazards (COMAH) Regulations 1999 which implement the Seveso II Directive and more specific guidance on particular aspects within the Regulations, such as the preparation of safety reports and requirements for emergency planning, has been prepared; details are given at the end of this document. This additional guidance on the environment provides help with:

- determination of what is considered to be a major accident to the environment
- identification of what constitutes a long-term and/or significant consequence for the environment of a potential or actual accident
- identification of sources of information about the environment that can be gathered at a scale appropriate to a site-based regulatory regime
- identification of accident scenarios
- providing indicative criteria by which to determine whether a major accident to the environment has occurred
- understanding the relationship between the Seveso II Directive and the provisions of other pieces of legislation concerned with protecting or enhancing environmental quality.

Although not dealt with in detail, this Guidance should also help with:

- initial notification to the competent authority about a proposed Seveso II establishment
- preparation and assessment of safety reports
- establishing the correct amount of environmental provision in emergency plans
- planning post-accident clean-up and restoration
- predicting when the consequences of an accident would be severe enough to need reporting to the European Commission under Annex VI of the Directive
- meeting the requirements for the provision of information related to the environment of an establishment (e.g. in safety reports, see Section 2.1.3)
- providing a framework for risk assessments and risk management by indicating what would constitute important damage to the environment and what would constitute the first signs of change in the environment following an incident at a site covered by Seveso II.

1.2 STRUCTURE

To provide guidance along the lines set out in Section 1.1 the following structure has been adopted:

- Section 2 sets out the main environmental requirements of the Seveso II Directive, from its aims to its reporting requirements.

- Section 3 describes in general terms the types of environmental effects that accidents can have in both the short and long term.

- Section 4 provides the scientific context that needs to be taken into account when an operator and regulator are acting to prevent accidents, limit their consequences, assess damage, and/or repair damage after an accident. It explains what type of environmental event would constitute a major accident, as defined by regulation 2 of COMAH, and indicates why the event would be so regarded. It also lists criteria and thresholds for a range of events relevant to several parts of the Seveso II Directive, the implementing Regulations and supporting guidance.

- Section 5 suggests a series of questions to be asked when assessing the environmental risks and facts of accidents. This section is neither exhaustive nor prescriptive.

- Section 6 deals briefly with matters of post-accident clean-up and restoration.

- Section 7 provides details of additional sources of information to assist operators in obtaining environmental information.

The Guidance deals primarily with major accidents. It is not concerned with lesser types of incidents that are covered by other legislative arrangements. The Guidance cannot be exhaustive and must not be considered as prescriptive. Best practice in this area must be developed on a case-by-case basis, as all potential accidents will be unique in their potential interaction with the environment. In particular, the Guidance does not attempt to prescribe how individual risk assessments, risk management, or clean-up and restoration should be done. The Government has provided generic guidance, recently revised, on environmental risk assessment (*A Guide to Risk Assessment and Risk Management for Environmental Protection*, DETR, 1998a).

CHAPTER 2

Environmental requirements of the Seveso II Directive and associated regulations and guidance

2.1 INTRODUCTION

A number of the Articles and Annexes to the Directive, and a number of the Regulations and Schedules implementing the Directive in Great Britain (the COMAH Regulations), make reference to environmental matters. The main points relevant to the environment are as follows.

2.1.1 Aims of the Directive

The Seveso II Directive (96/82/EC) is aimed at (i) preventing major accidents resulting from certain industrial activities, and (ii) limiting the consequences of accidents for both people and the environment.

2.1.2 Scope of the Directive

The CIMAH Regulations specified certain types of industrial activity including both process activities and storage. Process activities were covered by CIMAH if they met tests of: the type of process operation carried out; the involvement of 'dangerous substances'; and the potential of the operation to present a major accident hazard. Storage was covered by CIMAH on the basis of whether threshold quantities of 'dangerous substances' were met or exceeded.

The Seveso II Directive and the associated COMAH Regulations do not apply to specified industrial activities, but (with limited exceptions) to all 'establishments' where quantities of 'dangerous substances', at, or in excess of, specified thresholds, are used or stored. There is no differentiation between storage and processing, and the list of 'dangerous substances' relies on fewer named chemicals and more on generic classes of dangerous substances, compared with CIMAH.

2.1.3 Environmental requirements of the Directive and the Regulations

Articles 5-9, 11-15, 18 and 19 are those most relevant to environmental concerns. In broad terms, the Seveso II Directive requires that operators of establishments that fall within scope prevent major accidents and limit their consequences for persons and the environment by identifying potential major accident hazards and implementing all measures necessary not only for accident prevention, but also for the limitation of accident consequences. This should guarantee a high level of protection for persons and the

environment. The steps taken in this respect should form part of the major accident prevention policy (MAPP) or safety report prepared for the establishment. In particular, for top tier sites (as defined in regulation 3 of COMAH), the safety report should include information related to the environment of the establishment, and specifically 'a description of the site and its environment including the geographical location, meteorological, geological, hydrographic conditions and, if necessary, its history', and a description of areas where a major accident may occur. Section 7 of this Guidance indicates the type of information operators will need to supply in relation to this particular aspect of the safety report.

Operators and others should recognise that environmental responsibilities run throughout the whole Directive. An outline of these responsibilities for establishments within scope of the Directive is as follows. Some of the Directive's provisions only apply to top tier sites:

Management policy: Operators must have a general approach to accident prevention and limitation that includes environmental considerations and helps to guarantee a high level of protection for the environment. It must be clear the establishment's management system takes Seveso II requirements into account.

Notification: Before construction, new establishments must be notified to the competent authority in a manner that supplies various types of information. Existing establishments have to supply notification information by February 2000. The key environmental areas to be covered at this stage are: (a) features of the environment that might cause an accident (e.g. flooding, proximity of transport routes); and (b) features of the environment that might make the consequences of an accident more severe (e.g. presence of a Site of Special Scientific Interest (SSSI) near enough to the establishment to be affected by an accident, or location of the site near a high quality water course or over an aquifer used for drinking water). The information required should include a description of local land use that need not, at this stage, involve detailed ecological surveys (say, to establish precise population density). Such detailed surveys may be necessary for other legislative purposes (e.g. for an environmental impact statement).

Safety report: For top tier sites, the safety report is at the heart of what is required to protect the environment under Seveso II. Prior to the start of operation of an establishment, or on a time-scale specified in the Guidance to the Regulations for existing establishments, operators of top tier sites must:

- identify all major hazards by conducting a hazard analysis that covers the potential consequences of potential accidents caused by internal or external influences and pays particular attention to the possible extent (over time as well as area) and severity of an accident;

- provide maps showing land use (e.g. urban and agricultural areas) and the location of sensitive parts of the environment (this will include designated land and areas of high environmental quality);

- describe the environment and surroundings of the establishment in a level of detail proportionate to the hazard (more detail will be required the greater the quality or the value of the environmental resource that is threatened), including those areas where an accident may occur;

- take into account data on the ecotoxicology of substances that might be released in an accident (including both acute effects on organisms and long-term effects on habitats as well as consideration of possible synergistic or additive effects of chemical mixtures);

- describe the measures of protection and intervention designed to limit the consequences of accidents (in most cases this will involve measures that limit the exposure of the environmental resource to material released during and after an accident, whether it be part of the human food chain or a wild organism or its habitat);

- set out provisions made to mitigate post-accident impacts and aid the recovery of the environment from the impacts of the accident;

- review the report when circumstances, including environmental ones, change in important ways.

Although operators are expected only to supply information reasonably available to them, the competent authority is entitled to ask for further information to that originally supplied.

Emergency plans: Regulations 9 and 10 of COMAH provide for the preparation of on-site and off-site emergency plans for top tier establishments, aimed at containing and controlling incidents so as to minimise the effects, and to limit damage to persons, the environment and property. Emergency plans must provide for the restoration and clean-up of the environment following a major accident. The on-site emergency plan, prepared by the operator, covers features of the environment within the boundary of the establishment, which may include designated land and controlled waters. The off-site emergency plan, prepared by the relevant local authority, needs to include provision for reviewing the effectiveness of restoration measures. Further guidance is provided by HS(G)191, *Emergency Planning for Major Accidents*, produced in support of the COMAH Regulations 1999.

Reporting: In the event of a major accident at a site an operator will need to inform the competent authority, and be prepared to supply information on the accident to that authority. This information includes that needed for assessing the effects on the environment and alleviating medium-term and long-term effects. Operators may have to supply further information if subsequent investigation reveals facts that alter earlier findings. Accidents that meet the reporting criteria in Schedule 7 of the Regulations (Annex VI of the Directive) must be reported to the Commission of the European Union by the competent authority, as must certain near-misses. Accidents and near-misses can occur which do not meet the reporting criteria in Annex VI of the Directive. Section 4 of this Guidance provides criteria and thresholds that may be used for a number of purposes, including determining whether Annex VI criteria have been met. Other authorities concerned with environmental accidents may also require information to help them discharge their functions.

Supply of information to the public: Under regulation 14 of COMAH, operators of top tier establishments are required to ensure that persons who are likely to be in an area which, in the opinion of the competent authority, they are liable to be affected by a major accident occurring at the establishment, are supplied, without their having to request it, with information on safety measures at the establishment and on the requisite behaviour in the event of a major accident at the establishment. Information to be supplied includes: details of the dangerous substances involved at the establishment which could give rise to a

major accident, indicating their principal dangerous characteristics; general information relating to the nature of the major accident hazards, including their potential effects on the population and the environment; relevant details of the operator's on-site emergency plan; and reference to the local authority's off-site emergency plan.

2.1.4 A practical approach to major hazards and risk analysis

The COMAH Regulations thus place many responsibilities on operators of both new and existing establishments that fall within scope. They place complementary responsibilities on the competent authority. Potentially, a great deal of work could be involved. Some of this could be difficult to undertake because of limited scientific knowledge on the effects of chemicals released from accidents. A practical approach to major hazard and risk analysis is required.

As all accidents have special features it is impossible to be prescriptive about an approach that would suit all circumstances. But a suitable approach might be one that encompasses the following main elements:

- *Thoroughly analyse the characteristics of the establishment and the chemicals it contains.* Analyse the features of the immediate environment that could cause an accident or lead to the consequences of the accident being worse. Including the environment in the initial analysis will make it more likely that potential interactions between the site, its chemicals, and the environment will be spotted at an early stage. For example, operators of establishments within flood plains, river valleys, coastal or estuarine locations might need to think about what would happen if flooding, storm conditions or tidal surges prevented activation of the emergency plans.

- *Maximise the information available to the management of the establishment on the characteristics of the environment in the area that might be affected by an accident.* Armed with this information it should be readily apparent to an operator where the most valuable features of the environment are. Such valuable features (e.g. Natura 2000 sites) must be guaranteed a high level of protection. At present, there are many changes in hand to the way the Government's conservation authorities are thinking about protecting the environment from the negative influences of human activity. The operators of COMAH establishments should be aware that steps must be taken to avoid deterioration of features (natural habitats or habitats of species) for which sites have been designated. These features may be particularly important for Natura 2000 sites designated under the terms of the Habitats Directive. Small changes in the structure of communities of plants and animals following an accident would not necessarily constitute a major accident to the environment under the terms of the COMAH Regulations. In part, this is because small changes could, in the right circumstances, enhance conservation interest or have only temporary effects recoverable by natural ecological processes, such as succession and immigration from neighbouring areas of similar habitat. One key aspect of information gathering will be consideration of the need to do baseline environmental surveys around the site. Some operators may be reluctant to do these because of costs, but they have substantial advantages and can be conducted in a number of ways that keep costs in proportion (e.g. see Section 7 of this Guidance).

- *Manage the risks.* Operators of establishments need to be aware of the very considerable uncertainties that exist in risk assessments of potential environmental impacts. There are many sound scientific reasons for this. One is simply lack of

knowledge. Despite the uncertainties inherent in risk assessment, it should be carried out as part of the overall risk management process for controlling hazards that have been identified. The indicative criteria and thresholds in Section 4 of this Guidance set out the kind of damage that could constitute a major accident (i.e. valuable environmental features affected for a period of time in a particular way). These may help operators meet the requirements of COMAH as they indicate the type of effects that need to be prevented. In examining risks, operators should note that once an event has occurred there is little that can be done to prevent atmospheric deposition, unless the event can be contained within the buildings of an establishment. Moreover, where deposition will occur depends on prevailing weather conditions. However, spills and fire water run-off probably can be contained within the boundaries of the establishment with considerable environmental damage being avoided. In all cases it is probably best to assume worst-case impacts will occur and take all steps necessary to protect the more valuable of the environmental resources in the vicinity of a plant.

- *Major events in the environment*. It is not possible to provide a scientific definition of changes in the environment caused by an event at an establishment that would constitute a major accident to the environment. However, the more extensive the areas and quantities of natural and semi-natural resource damaged, the longer the effects are likely to last, and the more intense or severe these effects, then the more likely it is that the event will be regarded as a major accident to the environment by the competent authority.

  Moreover, if the event affects land designated for nature conservation purposes (and in particular Natura 2000 or Ramsar sites in the UK) then the event is likely to be regarded as a major accident at lower thresholds than those that apply to other designated areas, amenity areas, the wider countryside or the more common types of agricultural land. As a general rule, the specific threshold levels (Section 4 of this Guidance) that apply to other designated sites, scarce habitats and more widespread habitats vary in relation to the importance of the particular type of site.

CHAPTER 3
Accident scenarios

3.1 INTRODUCTION

Instances where chemicals are released unexpectedly into the environment occur on a regular basis. The size and scale of these events vary greatly and the environmental consequences of these releases are equally variable. Small-scale events include releases on or from domestic or small commercial premises where chemicals enter only the local environment. Larger-scale events, such as fires at major warehouses or spills that penetrate aquifers or enter rivers, may have consequences over large geographical scales or long time periods.

The severity of the effects of such releases depends very much on the nature of the receiving environment. Thus, a release at one location may have limited significance whereas a similar release at another could have serious implications. For example, it could eliminate a population of rare organisms, the integrity of a habitat, or some service function the environment was performing (e.g. supply of drinking water, loss of amenity land in a dense urban environment). Equally, the time of year at which an accident occurs can have a significant bearing on the outcome of an accident. For example, exposure of an agricultural field outside the planted period may have no impact on crops. Equally, an accident on an estuary important for wintering populations of wildfowl and waders may pose less of a threat to the birds if it occurs in summer and leaves no persistent residues of toxic substances.

The following sub-sections outline some broad aspects of the more common and likely major accident scenarios and provide a broad framework within which major accident hazards might be identified.

3.2 FIRES

Fires can pose a substantial threat to the environment because:

(i) they release chemicals into the air that may disperse over many tens of kilometres at concentrations well above background;

(ii) they create new chemicals as part of oxidative and pyrolytic processes (the conditions for which vary greatly during the course of the fire);

(iii) through the dispersion of fire water they can cause material from the fire to enter water bodies. It is also possible that as fire water passes over surfaces and through soil it will mobilise other substances that have been resident on surfaces or in soils as a result of earlier instances of contamination. Extinguishing media other than water, i.e. halons, dry powder, etc., themselves have the potential for environmental damage.

As well as the long-distance dispersion of chemicals there may also be intense local deposition of material from the fire including parts of the structure of the building (including asbestos roofing materials). Dispersion effects may extend several hundred metres beyond the accident location.

Fires can also cause mass flows of liquefied material, so that the consequences resemble those of a spill.

Fire-fighting activity itself can release a range of material depending on the composition of the fire-fighting water. If on-site sources of fire-fighting water are used, its composition may need to be considered, especially if it contains run-off from the site or has been treated with biocides or foaming agents.

3.3 SPILLS

Spills can pose considerable threats to the terrestrial as well as the aquatic environment.

Spills onto land can cause long-term changes to the soil ecosystem which can undermine the functional relationships between different types of organism in the ecosystem. If a spill changes the physical, chemical or biological conditions of the soil this too could have notable consequences, perhaps limiting the ability of the ecosystem to recover from damaging change.

Spills onto land can also cause the contamination of groundwater, especially if material is water soluble. However, even substances with limited or no degree of water solubility can enter groundwater eventually.

Spills into river systems are likely to lead to chemicals being transported rapidly away from the original site over several tens of kilometres. The effects of spills would then be related to the degree of dispersion of chemical in the water body. Especially in the upper reaches of rivers, concentrations of chemicals may not fall much below those at the source of the spill. Dispersion in estuaries or on the coast would be greater, but might be balanced by localised deposition caused by salinity changes and tidal forces.

3.4 EXPLOSIONS

In general, explosions will pose a substantial threat to the environment because they initiate either a fire or a spill. However, explosions that release toxic material into the air could cause considerable damage to vegetation or birds. Explosions that lead to subsequent release of a cloud of material could pose a particular threat under stable air conditions when the cloud could travel many kilometres before dispersing.

3.5 A FRAMEWORK FOR IDENTIFYING MAJOR ACCIDENT HAZARD SCENARIOS AT PARTICULAR SITES

For a number of years the scientific research community has analysed environmental problems in terms of (a) identification and quantification of sources of chemicals, (b) quantification of the dynamics of chemical transport processes and mechanisms, and (c)

characterisation of the distribution, abundance and responses of sensitive receptors. More recently this conceptual framework has been formalised by a number of industrial and commercial bodies into the Source-Pathway-Receptor approach to scoping, and initially quantifying, risks to the environment from chemical use. It is almost self-evident that a chemical will not have an effect in the environment unless it can, by some means, reach a receptor in a concentration high enough to cause a change in the receptor's state. Thus, the Source-Pathway-Receptor approach is a sound starting-point for operators analysing potential impacts of an accident at their establishment for the first time.

Identifying major accident hazards with this approach will require operators to obtain a good deal of information on the characteristics of the environment around a site (see Section 7 of this Guidance), with particular attention being paid to sensitive receptors such as (i) designated land, and (ii) ecologically important and/or high quality habitats and protected species found in the wider environment. Operators will, of course, also have regard to the possibility that urban areas and agricultural land or forestry could be damaged in an accident.

It will also be necessary for operators to understand the pathways by which uncontrolled releases from their site might enter and travel through the environment under a range of weather and seasonally-related conditions. Note also that certain 'pathways' may also be receptors, i.e. water courses. The atmosphere is similarly considered as a pathway rather than a receptor, and thus no criteria specific to atmospheric pollution have been included. Existing criteria and thresholds should cover any atmospheric contamination or pollution following deposition (to land or water).

However, as presently constituted, the Source-Pathway-Receptor approach may not cover all eventualities. For example, incidents may have impacts on more than one receptor and, although not necessarily reaching the thresholds shown in Section 4 of this Guidance for any individual receptor, may nevertheless be defined as a major accident under the COMAH Regulations.

Some further examples of the complex ways in which chemicals can move through and affect the environment are contained in the Department of the Environment, Transport and the Regions (DETR) research report *Environmental Follow-up of Industrial Accidents* (DETR, 1998b).

CHAPTER 4

Identifying major accident hazards: examples, criteria and thresholds

4.1 BACKGROUND AND EXAMPLES

Identifying major accident hazards is one of the most important requirements for operators and regulators alike. This will not be an easy task in cases where the threat posed is to the environment rather than human health, as each and every major accident event has its own unique characteristics. This section provides actual and theoretical examples of eventualities that would probably be considered as major accidents to the environment.

In the most general terms, major accident hazards to the environment will be those where events have the potential to:

(i) pose knock-on threats to human health by contamination of food or drinking water or impacts on sewage treatment regimes;

(ii) affect large areas of land designated for conservation, amenity or planning purposes. Note that large in an ecological sense may include extensive agglomerations of fragmented habitats;

(iii) be long-term or persistent and/or inhibit natural processes of regeneration;

(iv) be severe by causing significant permanent or long-term damage to the ecosystem (direct, indirect, or knock-on), such as reduced breeding success of protected species, or reduced biodiversity of protected habitats (including local or national extinctions of protected species), or destruction/reduction in quality of a significant proportion of the area of a rare habitat.

Operators are advised that if, after scoping for potential accidents at their establishment by the Source-Pathway-Receptor approach, it seems likely that hazards of the kind listed above, and which meet the definition of major accident within the COMAH Regulations, might occur, then they should take the necessary risk management actions to prevent a major accident and limit its consequences for people and the environment. Past practical and regulatory experience has shown that the following eventualities (a-k) might constitute major accidents to the environment:

(a) Fires leading to the contamination (with substances specified in the Directive or products of a major accident) of surface waters and reduction in the chemical and

biological quality of the water for a period of time in excess of a few days (or an acute kill of a large number of fish).

(b) Loss of control of an industrial process leading to contamination of a substantial area of agricultural land sufficient to necessitate restriction being placed on the sale and movement of produce from the agricultural land.

(c) Contamination from a spill (not necessarily with attendant biological damage) of a water body for a period of time in excess of that normally required for the water to return to its normal state following some natural or minor fluctuation.

(d) Release of material to an aquifer such that the aquifer's use as a source of drinking water has to be curtailed.

(e) An explosion in a storage facility leading to the release of noxious gases across an adjacent SSSI used as a roost by thousands of wildfowl and wading birds.

(f) Fires leading to long-term contamination of designated land with potentially toxic chemicals (or other materials resulting from a major accident) such that the protected nature of the land is compromised (e.g. by the contamination being so severe as to parallel that pertaining in urban or industrial areas).

(g) Fires or explosions or spills leading to deaths of trees in woodland and/or alterations in soil characteristics that could lead to reduced ability of the woodland to generate naturally, and/or deaths of trees continuing over a period of years.

(h) Loss of habitat (such as ancient woodland) such that its essential character would not naturally be restored within a few years.

(i) Loss of a population of a Red Data Book species, or loss of species found at only a single site such that the species becomes extinct nationally.

(j) Loss of the amenity use of land regarded as of importance to the local community (or environment) by virtue of contamination with a chemical that poses a threat to human health or companion/domestic animals for a period in excess of a few days or weeks.

(k) Spills into water bodies leading to the deaths of predatory birds or large mammals or large numbers of wading birds and wildfowl (or other game birds).

4.2 CRITERIA AND THRESHOLDS FOR RECEPTORS

The following tabulated information further defines major accident hazards by providing generic information on what should be valued in the environment and associated criteria and thresholds that can be used indicatively to:

(i) help identify major accident hazards

(ii) determine whether there is the potential for a major accident to the environment to occur

(iii) determine (post-accident) whether a major accident has occurred

(iv) establish the need for a range of actions (and their adequacy) after an accident. These actions would include the need to notify the Commission of an accident and carry out restorative action.

The practical effect of setting out these criteria and associated thresholds is to clarify what post-event changes in the environment would constitute a major accident to the environment. The criteria and thresholds can then be used in a variety of ways, for example:

(a) In the risk assessment phase of preparing a safety report: Here the potential to exceed any of these thresholds would indicate the possibility of a major accident occurring. Thus, if the receptors listed could be affected to the extents and durations stated, there would be the potential for a major accident.

(b) During damage assessment following an incident: At this stage, exceedence of the thresholds would in all cases initiate further investigation at the site and in its surrounding environment to determine whether the consequences of an event were severe enough to have constituted a major accident to the environment requiring clean-up and restoration. Thus post-accident, investigation would be necessary to determine whether the receptors had been damaged to the extents or durations stated.

(c) When drawing up or executing emergency plans: Here, the criteria and thresholds might be used (alongside other measures such as Environmental Quality Standards) in preparing emergency plans and, post-accident in determining whether plans for restorative action were adequate.

These criteria have been developed in relation to the COMAH Regulations and their primary purpose is to help operators and regulators satisfy the aims of only these Regulations. The criteria should not be taken to mean that damage or even change in the environment below these criteria or thresholds is in any sense acceptable. The information in the tables relates principally to the type of major environmental damage that might occur following an event at an establishment that falls within the scope of the COMAH Regulations. The criteria have been produced to help with safety reports, emergency planning arrangements and in the post-accident assessment of the extent, severity and duration of environmental change.

Table 1 National Nature Reserves, Sites of Special Scientific Interest, Marine Nature Reserves (Land/Water)

Medium:
Land/Water (inter-tidal/near-shore sub-tidal)

Receptor:
NNRs, SSSIs, MNRs

Definition of receptor:
National Nature Reserves (NNRs)
Sites of Special Scientific Interest (SSSIs), both biological (terrestrial and water-based) and geological
Marine Nature Reserves (MNRs)

Threshold:
The following thresholds apply:

- Greater than 0.5 ha adversely affected, or greater than 10% of the area of the site affected (whichever is the lesser), or
- Greater than 10% of an associated linear feature adversely affected, or
- Greater than 10% of a particular habitat or population of individual species adversely affected.

Explanation/justification:
Sites of Special Scientific Interest (SSSIs) represent areas judged to be special on the basis of their plant or animal communities, geological features or landforms. They represent the basic minimum area of habitat that should be conserved to maintain the current range and distribution of native plants and animals. SSSIs can be terrestrial (biological or geological), freshwater or marine. In practice, the seaward limit of an SSSI depends upon the definition of 'land', but generally can extend to mean low water (inter-tidal).

SSSIs are notified under Section 28 of the Wildlife & Countryside Act 1981.

National Nature Reserves (NNRs) are a key selection of nationally important SSSIs. NNRs have been established to protect the most important national areas of wildlife habitat and geological formation. They are among the best examples of particular habitat types, and therefore represent a nationally important resource. The selection of NNRs is based on criteria including fragility of, and threats to, habitats and species, size, lack of disturbance, presence of species-rich communities and rare species, and the degree of 'naturalness' of the site.

NNRs are designated under Section 19 of the National Parks and Access to the Countryside Act 1949.

Marine Nature Reserves (MNRs) are designated under Section 36 of the Wildlife & Countryside Act 1981 in areas between the high water mark and the territorial limit.

Table 2 Natura 2000 sites, Ramsar sites (Land/Water)

Medium:
Land/Water

Receptor:
Natura 2000 sites (SPAs, SACs), Ramsar sites

Definition of receptor:
Special Areas of Conservation (SACs)
Special Protection Areas (SPAs)
Ramsar sites

[Note that these receptors are often also SSSIs]

Threshold:
Lower thresholds than for SSSIs.

For SACs, SPAs, and Ramsar sites, the thresholds are:

- Greater than 0.5 ha or 5% of the area of the site adversely affected (whichever is the lesser), or
- Greater than 5% of an associated linear feature adversely affected, or
- Greater than 5% of a particular habitat or population of individual species adversely affected.

Explanation/justification:
Central to the European Union's policy of protecting and conserving wildlife and habitats is the creation of an ecological network of protected areas – Natura 2000. Natura 2000 sites are SACs and SPAs.

SPAs are aimed at conserving bird species listed in Annex I of Council Directive 79/409/EEC on the conservation of wild birds (the 'Birds Directive'), and also migratory birds. This is primarily through designation of bird habitats, and particularly wetlands.

SACs conserve the habitat types, animals and plant species listed under Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna (the 'Habitats Directive'), and thus contribute towards maintenance of favourable conservation status of selected habitats and species. Marine habitats and species are included.

The Habitats Directive (Article 6) sets out a legal framework for protecting these sites. Article 6(2) outlines a general duty for Member States to avoid habitat deterioration and significant species disturbance within a site.

Ramsar sites are wetlands of international importance (arising from the Convention on Wetlands of International Importance especially as Waterfowl Habitat).

As a matter of policy the Government wishes sites listed as potential SPAs and candidate SACs to be treated as if they are already designated.

Further details may be found in Appendix 2.

Table 3 Other designated land (Land)

Medium:
Land

Receptor:
Other designated land

Definition of receptor:
Environmentally Sensitive Areas (ESAs)
Areas of Outstanding Natural Beauty (AONBs)
Greenbelt land
National Parks
Local Nature Reserves (LNRs), Wildlife Trust sites
National Trust land
Common land/country parks

Threshold:
- Greater than 10% or 10 ha of land damaged, whichever is the lesser.

Explanation/justification:
Nature conservation values are covered by designations such as SSSI and NNR. However, there are many more land designations that aim to conserve areas purely for amenity and aesthetic reasons.

Such areas may (or may not) have associated wildlife value, but are valued for landscape, aesthetic (outstanding natural beauty), historic and archaeological, geological amenity or recreational features.

Table 4 Scarce habitat (Land/Water)

Medium:
Land/Water

Receptor:
Scarce habitat

Definition of receptor:
Biodiversity Action Plan habitats
Geological features: caves, fossil beds, mineral veins, moraines, etc.

Threshold:
- Damage to 10% of the area of the habitat or 2 ha, whichever is the lesser, would be considered a major accident.

Explanation/justification:
Scarce/key habitats are awarded protection principally on the basis of the declines in distribution and extent of such habitats within the recent past. Those habitat types which have undergone major or rapid declines, or which are rare, are considered to be 'at risk'. Additionally, certain areas, particularly marine/coastal/estuarine, are extremely important in terms of their functioning, and are thus 'key' in this respect. Other habitats, whilst not necessarily of great intrinsic value in themselves, are worthy of consideration/protection because of the particular species that they may support.

The local English Nature/Scottish Natural Heritage/Countryside Council for Wales office should be consulted to identify these receptors locally.

Table 5 Widespread habitat (Land/Water)

Medium:
Land/Water

Receptor:
Widespread habitat

Definition of receptor:
More widespread habitat, including agricultural land, that has not been otherwise classified, i.e. is not designated or scarce

Forestry

Threshold:

- Contamination of 10 ha or more of land which, for one year or more, prevents the growing of crops or the grazing of domestic animals or renders the area inaccessible to the public because of possible skin contact with dangerous substances, or
- Contamination of any aquatic habitat which prevents fishing or aquaculture or which similarly renders it inaccessible to the public.

Explanation/justification:
The size criteria of 10 ha of land can relate either to the total area contaminated or the total land taken out of production as a result of a smaller area being contaminated. It is assumed that contamination of a proportion of a field will result in the whole field being unusable due to the difficulties associated with determination of 'safe' and 'unsafe' areas of the same field.

It should be remembered that there may still be areas within the wider countryside of high conservation value, and that the lack of current designation does not necessarily imply that an area is of no ecological worth.

Table 6 Aquifers or groundwater (Water)

Medium:
Water

Receptor:
Aquifers or groundwater

Definition of receptor:
Water resources in or under the soil

Threshold:
A major accident would be:

- Any incident likely to require large-scale and long-term remedial measures, or
- Any incident of contamination/pollution (by persistent compounds) occurring within groundwater protection zone 1 (the most vulnerable groundwater resources).

Explanation/justification:
Groundwater is water that is held underground, mainly within rock formations. Approximately 75% of the groundwater that is abstracted in England and Wales is used for drinking water. Because groundwater is inaccessible, it is difficult to remediate contamination incidents. Therefore, any incident likely to result in pollution of groundwater should be considered to be serious.

The Environment Agency has published a groundwater protection policy for England and Wales, classifying groundwater vulnerability to pollution on the basis of the nature of the overlying soils, the presence and nature of unconsolidated deposits overlying solid rock formations, the nature of the rock strata, and the depth to the water-table. Vulnerability maps have been produced which identify areas in which groundwater requires protection. Similarly, the Scottish Environment Protection Agency (SEPA) has produced a Groundwater Protection Policy for Scotland.

This information should be used to identify the presence of vulnerable groundwaters locally.

The Directive on the protection of groundwater against pollution caused by certain dangerous substances (80/68/EEC) will be integrated into the forthcoming Water Framework Directive. The current Directive aims to control the direct and indirect discharge of certain substances into groundwater: List 1 substances, which should be prevented from entering groundwater; and List 2 substances, which could have a harmful effect on groundwater.

Table 7 Soil or sediment (Land/Water)

Medium:
Land/Water

Receptor:
Soil or sediment

Definition of receptor:
Material at the earth's surface or the base of the water column to a depth of 1 metre (soil samples to be obtained from the top 10 cm for chemical analysis)

Threshold:
Contamination or pollution of the receptor such that

- Soil would be regarded as contaminated land by relevant authorities (i.e. contamination such that planned present or future uses could be compromised), or
- Sediment would become loaded with sufficient material to compromise the chemical or biological quality of overlying waters for any period in excess of a few days.

Deterioration of the biological quality of soil or sediment such that

- Common organisms of these ecosystems (e.g. earthworms) were absent, the structure of the biological community altered for periods in excess of a season, or normal ecosystem function was severely impaired for a period in excess of one year.

Explanation/justification:
There are no existing numerical criteria for soil quality that are thought adequate for indicating what might constitute a major accident to the environment in relation to soils and sediments. Thus, thresholds have been set in non-numerical terms. As a guide, long-term 'capping' or other forms of physical amendment of soil or sediment are likely to lead to loss of soil biodiversity, as will high levels of chemical contamination with a range of individual substances (such as metals and persistent organic compounds) and mixtures of substances.

Operators' attention is drawn (a) to earlier work by the Interdepartmental Committee on the Redevelopment of Contaminated Land (ICRCL 59/83) that lists trigger thresholds for different contaminants according to future uses of the land, and (b) to work from the Netherlands that sets optimum and action levels for a range of contaminants in soil (the so-called 'Dutch list'). These documents provide particular perspectives on soil contamination that mean they cannot be used to meet the requirements of Seveso II/COMAH. Similar documents available from North America have similar limitations.

Table 8 Built heritage (Land – man-made)

Medium:
Land – man-made

Receptor:
Built heritage

Definition of receptor:
Buildings
Listed buildings

Threshold:

- Damage to a Grade I listed building (England and Wales) or a category A building (Scotland) or a scheduled ancient monument such that it no longer possesses its architectural, historic or archaeological importance, and which would result in it being de-listed or de-scheduled if no remedial/restorative work was undertaken, or
- Damage to an area of archaeological importance or to a conservation area similarly resulting in loss of importance.

Explanation/justification:
Buildings of architectural or historic interest (England and Wales) are listed in accordance with the Planning (Listed Buildings and Conservation Areas) Act 1990. The list includes most buildings constructed before 1840, together with others depending on quality, character and/or architect. Grade I buildings are of 'exceptional importance'.

Buildings of special architectural or historic interest (Scotland) are listed under the terms of the Town and Country Planning (Scotland) Act 1972, using similar criteria to those used in England. Category A buildings are those of national architectural or historic importance.

Ancient monuments of national importance (England and Wales) are scheduled under the Ancient Monuments and Archaeological Areas Act 1979.

Table 9 Various receptors, as defined (Water)	
Medium: Water Receptor: Various, as defined Definition of receptor: Groundwater Drinking water Fish and shellfish water Bathing waters Threshold: Standards relating to continuous emissions and contained within the relevant European legislation (listed here) should not be adopted to define a major accident. However, the specific level of exceedence of these standards should be considered in the post-accident remediation and restoration works.	Explanation/justification: Groundwater Directive (80/68/EEC) on the protection of groundwater pollution caused by certain dangerous substances aims to control the direct and indirect discharge of these substances into groundwater. The Drinking Water Directive (80/778/EEC) relates to the quality of water for human consumption, and establishes standards for quality of drinking water designed to safeguard human health. The Surface Water for Drinking Water Abstraction Directive (75/440/EEC) lays down requirements to ensure that surface water intended for the abstraction of drinking water meets certain minimum specified standards. The Dangerous Substances Discharges Directive (76/464/EEC) on pollution caused by certain dangerous substances discharged into waters requires control of emissions. Directive 78/659/EEC on fish water quality seeks to protect fresh waters identified as fish waters and sets water quality standards for salmonid and cyprinid waters. Where the water quality in such waters does not comply with the standards, pollution reduction is required. Directive 79/923/EEC on shellfish water quality similarly seeks to protect those coastal and brackish water bodies identified as shellfish waters. The Bathing Water Directive (76/160/EEC) seeks to ensure the quality of bathing waters, both freshwater and coastal. Nineteen physical, chemical and microbiological parameters are set, and monitoring of bathing waters is required. The Integrated Pollution Prevention and Control Directive (96/61/EC) deals with emissions to air and soil as well as to water, and will have a central role in the control of point source pollution. The proposed Water Framework Directive will establish a common approach to environmental objectives for all ground and surface waters. The target of 'good water status' would have to be achieved within a specified period of the Directive coming into force.

Table 10 Particular species (Land/Water/Air)

Medium:
Land/Water/Air

Receptor:
Particular species

Definition of receptor:
'Common' species
Species listed under European legislation
Species listed in the Wildlife & Countryside Act
Red Data Book species

Threshold:

- For common species, where reliable estimates of population numbers exist, the death of, or serious sub-lethal effects within, 1% of any species would be significant.
- For common plant species, the death of, or serious sub-lethal effects within, 5% of the ground cover would be considered a major accident.
- For species listed in Appendix 4, the threshold may be lower than 1% or 5%, and liaison with the appropriate statutory conservation organisation should be used to determine the appropriate threshold.

Moreover, for all species, where reliable estimates of population numbers do not exist, liaison with the statutory authority will be necessary to determine appropriate thresholds.

Any loss of a Red Data Book species (or a Red Data Book species site) would be considered a major accident.

Explanation/justification:
Damage to individuals (sub-lethal effects and death) within populations may not only have implications for the survival of that species, but may also have knock-on consequences for other species, the habitat or the ecosystem. Thus major accidents to species need to be considered not only in terms of the sustainability of the affected species, but also in terms of other species that may be wholly or partly dependent upon that species.

For species listed in Appendix 4 (threatened and rare species), a major accident will generally be deemed to have occurred at lower thresholds than for common species, i.e. the definition of a major accident will depend upon the commonness or rarity of that species.

Furthermore, the mobility and dispersal ability of species could be considered in the context of other suitable habitat in the locality. Certain species may be able to move away from a site following an incident and utilise resources elsewhere, whereas others may be unable to move or be dependent upon that area.

In addition, the effect of the same event at different times of the year should be considered, i.e. between seasons different species may be present at differing population densities; an event coinciding with the breeding season may be more serious than the same event at a different time of year.

Table 11 Marine (Water)

Medium:
Water

Receptor:
Marine

Definition of receptor:
Non-estuarine marine waters
Littoral, sub-littoral zone
Benthic community adjacent to coast
Fish spawning grounds

Threshold:
Permanent or long-term damage to

- An area of 2 ha or more of the littoral or sub-littoral zone, or the coastal benthic community, or the benthic community of any fish spawning ground, or
- An area of 100 ha or more of the open sea benthic community.

Or a count of

- 100 or more dead sea birds (not gulls), or
- 500 dead sea birds of any species, or
- 5 dead or significantly injured/impaired sea mammals of any species.

Explanation/justification:
Damage is assessed relative to the area impacted, or the number of individuals affected, rather than by contaminant concentrations in the water. Dilution may subsequently reduce the concentration of a released substance to levels difficult to measure (and thus monitor), although initial concentrations may be sufficiently high to damage sub-littoral, littoral and inshore organisms. Moreover, low concentrations of substances may still pose a hazard if they are highly toxic or if they are persistent and bioaccumulate.

The number of animal casualties detected following an accident will depend on local circumstances, such as geographical location, season and whether the incident occurred near a breeding colony. Moreover, the extent of the impact on species will rarely be quantifiable immediately following the accident, and will require long-term monitoring to adequately assess the true extent of the impact.

The number of animals killed in an incident is almost certain to be considerably more than the number of casualties detected. For example, the proportion of casualties recovered may be as low as 10-20% of the total number of animals impacted.

Table 12 Freshwater and estuarine habitats (Water)

Medium:
Water

Receptor:
Freshwater and estuarine habitats

Definition of receptor:
Stream, river, canal, reservoir, lake, pond or estuary

Threshold:

- Effects on a significant part of any receptor defined above which, when assessed using the Environment Agency General Quality Assessment (GQA) scheme, either lower the chemical water quality by one class for more than one month or lower the biological quality by one class for more than one year or cause long-term damage to the habitat overall (but see explanation).

Explanation/justification:
A 'significant part' of a river, canal or stream is taken to be a 10 km stretch or 10% of the length of the water course, whichever is the lesser.

For estuaries and ponds, a significant area is taken to be 2 ha or 10% of the area, whichever is the lesser.

Long-term damage will be deemed to have occurred if the system takes longer than 3 years to recover.

There are several factors to be taken into consideration when assessing the severity of impacts to fresh waters:

The importance of lowering the quality of the water when assessed using the Environment Agency GQA scheme may be considered to be of greater importance in the case of higher quality water courses than already degraded systems.

The precise location of the impact relative to the water course may be important, such that an impact affecting the head waters may be more serious than one further down stream, particularly in relation to the potential for recovery. Downstream habitats may be readily recolonised by organisms from further upstream, but upstream areas may take much longer to recover.

Increased consideration should be given to the use to which the water is put when assessing the severity of an impact.

Evaluation techniques exist to assess not only water quality but also existing vegetation and fauna, i.e. RIVPACS (see Glossary).

CHAPTER 5
Assessing accidents and appraising risks

5.1 ASSESSING ACCIDENTS

There are no rules that can be universally applied to the assessment of accidents. However, research over recent years has indicated that the following aspects of accidents need to be considered in order to determine whether an event constitutes a major accident to the environment:

- the extent of the contamination or damage to habitats, species or communities
- the severity of the effects
- the likely duration of any effects.

It is important to realise that the obvious scale of an event is no real guide to its potential severity or long-term effects. Consideration must also be given to whether the area of land involved includes high quality habitats, species of high conservation value, or valuable environmental resources such as aquifers or urban land or certain surface waters. In certain circumstances, impacts on amenity areas may also constitute a major accident if the events restrict access. For example, an event that destroyed the physical fabric of the habitat of a Red Data Book species at one of its few known locations would probably be regarded as a major accident to the environment because the impact would be regarded as severe in terms of loss of genetic diversity/biodiversity. This would be the case, even though the area of land could be quite small (well below the Seveso II Directive's Annex VI reporting criteria) and the prospects of recovery good if the site were managed and monitored carefully for a number of years.

In general terms, terrestrial habitats that are so badly damaged that they would not be on a clear path to recovery within three years of an event could be said to have been involved in a major accident. In the aquatic environment, recovery times from natural perturbations are much faster and so here, if recovery had not commenced within the same season, it is likely that the event could be classed as a major accident. These recovery periods refer to expected natural recovery rather than to assisted recovery.

There is a growing view that damage to an ecosystem is an injury to its important features that impairs its functional or conservation value through a deterioration in quality that requires compensatory action to repair. In such circumstances it is conceivable that damage could occur as a result of contamination alone or as a result of changes in community structure or the nutritional balance within the physical fabric of an ecosystem.

5.2 RISK ASSESSMENT

Operators and regulators may require detailed risk assessments to be done for certain major accident hazards. Much will depend on the perception of the severity of the effects of hazard should the risk be realised.

If operators and regulators decide that a detailed risk assessment is required they should both bear in mind the uncertainties involved in the procedure, and be aware that information needed to calculate environmental risks is incomplete and uncertain.

A key element of risk assessment will be a need to develop some comparison between the concentrations likely to be found in the real world and those likely to do harm. Of particular importance will be a need to determine the concentrations that some biotic or abiotic part of the environment will be exposed to, and the proportion of that exposure that is likely to be available to that compartment.

There are numerous questions to ask when appraising risks. Some of the most important ones are:

- How much chemical in what composition and concentration is likely to be released?
- Have chemicals which could potentially be generated in the course of an accident been included, e.g. combustion and oxidation products?
- Are environmental concentrations in water, air, food or soil likely to be in excess of any Environmental Quality Standard (EQS) or Environment Agency (EA) guideline figures? If so, by how much and for how long (remembering that EQSs or EA guidelines normally refer to continuous emissions, such that a higher level, short-term emission would not automatically be a major accident)?
- Are concentrations within toxic ranges (e.g. in excess of LD_{50} or LC_{50} values for a range of species, with many species being affected at values below these levels)?
- Is there a potential for two or more substances to react, or for their effects to interact, or act independently but additively?
- Are the chemicals involved likely to persist in the environment and/or bioaccumulate?
- What environmental receptors are likely to be exposed? And what is the pathway? What is the transport mechanism?
- How sensitive are the receptors to the chemical?
- What effects are there likely to be?
- Is there a great uncertainty about the likely effects?
- Are effects likely to vary in kind or severity depending on the time of year?
- Could human health be threatened by contamination of drinking water or the food chain?

- What are the possible indirect effects on humans, apart from through the food chain?
- Do effects constitute damage to biota, their habitat or the ecosystem (i.e. the function or structure of the environment)?
- What type of habitat, and how much, would be affected?
- What is the likelihood of designated sites being affected?
- Is damage to biota likely to have a significant effect on any species or populations?
- Are any sensitive species threatened, i.e. Red Data Book species or species which the UK Government otherwise has a statutory responsibility to maintain?
- Would damage to some valued species found on the site be repaired by natural processes during a generation?
- How long might effects last for?
- Is the type of damage one to which the receptor is adapted?
- Would natural processes lead to complete restoration in a reasonable period of time and how could this be determined (i.e. such that EQS values are no longer breached)?

No list can be made exhaustive but the above questions should provide sufficient guidance for operators to estimate risk to specific parts of the ecosystem.

5.3 RISK MANAGEMENT

This is the decision-making phase following risk identification, analysis and assessment, when the various options available for dealing with the identified risk(s) are considered. Once the magnitude and acceptability of the potential risk has been determined, the three main options available are to accept, reject or reduce the risk. The aim of risk management is to 'manage' risks to acceptable levels. Thus, if an incident arising at an establishment has the potential to affect the environment at or above the criteria and thresholds set out in Section 4 of this Guidance, appropriate actions will need to be taken by the operator to minimise the risk. Even where a potential event is of very low frequency, if the consequences could be extremely severe, mitigation of the risk will need to be considered.

Risk management options may themselves introduce new risks. Therefore, each option must itself be subject to the process of risk identification, analysis and assessment to determine whether the existing risks have been reduced to acceptable levels and whether new unacceptable risks have been introduced.

CHAPTER 6
Clean-up and restoration

Under regulation 10 of COMAH, the relevant local authority must prepare an adequate emergency plan for dealing with the off-site consequences of possible major accidents at top tier establishments. The objectives of the off-site emergency plan include provision for clean-up and restoration of the environment and the plan needs to detail the arrangements and resources necessary to ensure timely and effective restoration of the environment in the event of an accident. Operators must take appropriate measures or arrange for them to be taken to fulfil requirements for clean-up and restoration. Satisfactory remediation involves restoring, as far as is possible, the environmental conditions that prevailed before the accident or establishing conditions that will, by natural processes, lead to restoration of those conditions in the fastest time possible. It is accepted that some features of the environment might be impossible to replace.

Post-accident clean-up and restoration may require actions beyond simple tidying up and horticultural actions. Such actions might look good for a short period of time but are unlikely to lead to reasonable replacement of lost habitat. It is essential that remedial actions produce a self-sustaining ecosystem, of the kind and quality that was damaged, and which does not require further support.

The effort required for clean-up will be proportional to the extent, severity and likely duration of damage and risk of causing harm to people and the environment. If the resource damaged is an SSSI or Natura 2000 site then remedial action and clean-up costs could be very high, involving treatment of soil or groundwater to remove contaminating materials. Additional guidance to operators on clean-up and restoration is provided in the Guide to the Regulations (see references).

Recent research has shown that accidents at industrial sites can lead to aerial deposition at distances ranging from 10 m to over 4 km from the site and that solid debris can be found at such distances. Clean-up and remedial actions may be needed over an extensive area, or in the case of rivers for many tens of kilometres downstream.

Although there are various methods available for cleaning contaminated soil and water, the amount of information available on the restoration of self-sustaining ecosystems is limited. The restoration of populations of certain rare or uncommon species has been undertaken by various research bodies and the conservation agencies, and some parts of ecosystems can be restored with careful management regimes.

Almost by definition it is impossible to restore certain habitats, such as ancient woodland. There are various reasons for this. In these circumstances remedial actions should focus on establishing an appropriate vegetation community that might, in time, lead to the re-establishment of the lost habitat.

Clean-up and restoration may not always be appropriate. Some restoration methods may

themselves be detrimental to health or the environment. Where remedial action may involve further environmental risks, the risk assessment process should aim to take these potential further risks into account.

Where remediation and restoration are undertaken, monitoring of progress towards the desired end-point will be essential in determining whether the course of action followed is successful.

CHAPTER 7
Sources of information on the environment

7.1 RELEVANT ORGANISATIONS

There are many sources of information on the environment. At the temporal and geographical scales likely to be relevant to COMAH requirements, the following organisations could be consulted:

- the Environment Agencies (the Environment Agency in England and Wales, and the Scottish Environment Protection Agency in Scotland)
- the conservation agencies: English Nature, Scottish Natural Heritage, the Countryside Council for Wales, English Heritage, National Park Authorities, Association of National Park Authorities, etc.
- local or county level conservation groups, conservation charities (e.g. the Royal Society for the Protection of Birds (RSPB), County Wildlife Trusts, British Trust for Ornithology (BTO))
- local government Planning Officers, Environmental Health Officers
- water companies
- Department of the Environment, Transport and the Regions (DETR), Welsh Office Environment Division, Scottish Office Agriculture, Environment and Fisheries Department (SOAEFD), Ministry of Agriculture, Fisheries and Food (MAFF), Welsh Office Agriculture Department (WOAD), Fisheries Research Services, Centre for Environment, Fisheries and Aquaculture Studies
- the component institutes of the Natural Environment Research Council
- local universities
- environmental consultants.

Operators may well find that in cases where they have had to prepare a full Environmental Impact Statement under the terms of the Environmental Assessment Directive they will have already obtained much of the relevant information needed to identify major hazards under COMAH.

7.2 PUBLISHED SOURCES OF INFORMATION

DETR has published a research report on environmental quality which identifies several key pieces of environmental information whose use could assist compliance with the terms of the COMAH Regulations (*Comparative Environment Index*, DETR, 1999a). These pieces of information relate to the following characteristics of the environment within an area of search:

(i) land cover (percentage cover for about 20 different types of land cover that may be aggregated in various ways)

(ii) scarce or rare habitat types

(iii) land designated for a range of purposes

(iv) presence of Red Data Book species

(v) extent of good quality habitat

(vi) extent of land of economic importance such as urban land or agricultural land

(vii) water bodies and groundwater.

This research report provides details on where and how such information can be obtained for areas surrounding industrial sites. DETR has supported the development of a PC-based information system containing much of the relevant information, the Countryside Information System (CIS), disseminated and supported by the Environmental Information Centre of the Institute of Terrestrial Ecology.

There are no reasons why groups of companies should not combine to obtain information on the environment in the vicinity of their plants and thereby share costs. Each would, of course need to use the information in their own way. For example, the Teesside Industry and Nature Conservation Association (INCA) has already established, for its industrial members, an ecological database that has proved to be useful in the aftermath of a major accident.

7.3 BASELINE SURVEYS

Outlined below are some of the ways baseline surveys of environmental conditions might be used. It should be noted that whilst baseline surveys are not a generic requirement, they would be good practice and may be required in specific situations based on the risks, and where a clear benefit can be identified.

Baseline field surveys could be expensive, but they have several advantages. If used with the type of semi-automated information gathering indicated in Section 7.2, baseline surveys can be targeted on the more valuable or high quality environmental resources.

In whatever form they take, baseline surveys of the characteristics of the environment around an establishment are useful under COMAH in a number of ways, for example, in the preparation of safety reports. In which case:

- they should ensure that the highest quality and most valued parts of the environment in the vicinity of the plant are identified, thus helping to determine the kinds of accident prevention measures that are required (e.g. the operator of an establishment would want to ensure that it did not accidentally discharge noxious material to a water course that could affect downstream, and possibly distant, aquatic or riparian nature reserves);

- they could help limit the scope of any hazard analysis and focus risk assessment, ensuring here that expensive resources are used to best effect and concentrated on worst-case scenarios.

Also, after an accident has occurred, and in the implementation of the on-site or off-site emergency plan:

- they could speed the process of assessing the effects of an accident;

- they could help determine the need for post-accident clean-up and restoration work (being particularly useful, perhaps, in establishing a baseline against which recovery can be judged).

In general, operators should know that the environment is a very heterogeneous place with many of the more high quality and valuable resources located on relatively small areas of land (e.g. much of the biodiversity of agriculturally-dominated counties of England may reside in the woodlands and SSSIs). Furthermore, many sources of information on the environment are, at present, only able to provide information at particular scales and time periods.

APPENDIX 1

Damage to the environment: scientific background

1. Introduction

Because of the complexity of the environment and the individual characteristics of each accident it is important to consider the way in which the environment responds to damaging impacts.

1.1 Definition of 'damage'

Damage to vegetation may be death, i.e. vegetation dieback, loss of features, e.g. trees or shrubs, scorching, or the deposition of contaminants upon plant surfaces that are unlikely to be readily washed off. In ecological terms, damage may be related to losses of particular species that affect the community composition, the structure or the functioning of the particular ecosystem. However, this may be difficult to determine in practice.

Immediate damage is likely to be more rapidly apparent. Longer-term damage will be less easy to determine, i.e. a general decline in species (numbers, abundance, vigour, fitness, etc.) following an incident, but could be equally important.

Damage to fauna may be death of individuals (immediate) or longer-term persistent effects, which will again be more difficult to determine, i.e. chronic physical effects, sterility, reproductive impairment, bioaccumulation of toxins, etc.

2. General principles related to environmental vulnerability and response

There is a degree of resilience in nature to external influences, such that ecosystems can recover from a degree of perturbation. Indeed, the environment has a considerable capacity to withstand destabilising influences.

The susceptibility of ecosystems to perturbation will be affected by many factors, including ecosystem size, fragmentation and landscape pattern. Vulnerability to hazardous substances will vary because of differences in: (i) the fate and transport of chemicals through ecosystems; (ii) the complexity of the particular ecosystem; and (iii) individual species responses to the contaminant.

For aquatic ecosystems, both the size of the system and the degree of water movement or turn-over are critical factors affecting susceptibility. Additionally, susceptibility of estuarine systems will vary with acidification, salinity, temperature and seasonality.

The consequences of a contamination incident may be manifested in a number of ways, through both immediate and delayed effects.

Immediate and obvious effects will include, for example, mortality of humans, animals or plants; deposition of toxic substances; measurable pollution of resources valuable to man; hazards to human health.

Longer-term effects may include a general degradation of the environment, reducing its 'value' (however defined); persistence of chemicals in the environment; genetic effects within populations leading to reduced fitness of individuals; decreased adaptation to the environment.

The assessment of the severity or duration of effects of an incident will depend upon a number of factors, including:

- the precise nature of the particular resource impacted, i.e. habitats will vary in their vulnerability to pollution; certain habitats are more readily rehabilitated/recreated;
- the total area impacted, and the area of particular resources;
- the importance of the resource at a range of scales, i.e. local, national, international;
- the particular substances involved, their toxicity and persistence in the environment;
- the nature of the accident, i.e. fire, explosion, spillage.

2.1 Resource evaluation

In deriving criteria for the definition of harm to the environment, decisions concerning the relative 'value' of resources have to be taken. There are two main types of evaluation: ecological assessment of ecosystem qualities regardless of social interests; and socio-economic evaluation to estimate the function of the natural environment for humans. The current Guidance criteria necessarily have to encompass both of these definitions of evaluation, so that species and habitats are given adequate protection, whilst those areas (often more 'degraded') which are of greater importance for human use are considered also.

2.2 Scale

The importance of scale in the evaluation of habitats, and in the application of criteria, should also be stressed. The environment is variable, not only in terms of response to similar impacts, but also in size of resources between different locations, and the relative importance attached to particular resources as a result of their under- or over-representation in the 'local' area.

The criteria allow for this geographic and environmental variability in the application of criteria for harm. The proportional representation of resources among different localities can be taken into account through collaboration/consultation with the relevant authorities or organisations, such that regionally scarce resources may be valued more highly if deemed appropriate, and those regionally important resources are always given due consideration. Appropriate organisations are (i) the statutory advisers to Government, e.g. English Nature (EN), Scottish Natural Heritage (SNH), Countryside Council for Wales (CCW), the Environment Agency (EA), and the Scottish Environment Protection Agency (SEPA), and (ii) non-governmental organisations (NGOs), including the County Wildlife Trusts, Royal Society for the Protection of Birds (RSPB), British Trust for Ornithology (BTO), World Wide Fund for Nature (WWF), Plantlife, Butterfly Conservation, etc.

2.3 Indirect damage

Direct damage to landscapes, ecosystems, habitats or species may be visible and thus readily identifiable. However, habitats (or species) are not discrete units within the landscape, but have many linkages. Indirect damage (that is not immediately apparent) may result from accidents and manifest itself via a number of alternative routes. For example, predatory species may be indirectly impacted following a reduction in the population numbers of their prey. Similarly, herbivorous species may suffer following loss of their grazing resources. There may be rapid expansions in the populations of prey species following the loss of their major predator. This in turn may result in huge increases in the population numbers of other predatory species able to take advantage of an abundant source of food.

2.4 Persistence of effects

Whilst many substances have immediate and relatively short-lived effects, others may persist in ecosystems, for example, in sediments and soils. The persistence of dangerous substances in the environment may result in cumulative effects on organisms and ecosystems. The bioaccumulation of industrial chemicals within individuals may enhance persistence in the environment. Storage of chemicals in the tissues and organs of individuals may affect the health of the individual directly. A further risk with chemicals that are bioaccumulated is that concentrations may be biomagnified through the food chain, such that top predators feeding on affected individuals may indirectly receive large doses of the chemical in their diet.

Again, baseline data will be necessary from pre-impact populations/habitats in order to relate subsequent measurements to a probable source, i.e. the incident itself, or background levels.

2.5 Genetic effects

Genetic alteration may occur as a direct result of the effects of toxic substances on individuals. However, when the effects of an accident include damage to ecosystems such that a reduction in the area of an already fragmented habitat (or species population) occurs, then the associated genetic effects may have implications for the long-term survival of the habitat/species.

When habitats are reduced in size or fragmented and isolated, there may be erosion of genetic variation, and a reduction in fitness due to inbreeding, increasing the risk of extinction for small populations. The erosion of genetic variation in fragmented populations may have significant evolutionary consequences, but is also of immediate concern because genetic changes may directly affect individual fitness and the short-term viability of remnant populations.

2.6 Timing of impacts

It should be stressed that an incident will have different impacts at different times of the year. For example, in the case of estuarine/wetland habitats, seasonal use by waterfowl will mean that pollution incidents may impact hugely different numbers of individuals/species at different times of the year. Similarly, impacts during the breeding season may have more severe consequences for affected populations than at other times of the year.

Examples of the effects of seasonality include: differential tolerance of fish embryos to mercury relative to date of lunar spawning cycle; differential body condition due to winter starvation influences mercury effects in birds. In addition to effects on individuals at different seasons, the differential use of habitats by species will need to be considered in the assessment of seriousness of impact, i.e. seasonal use of wetlands by waterfowl could significantly increase the numbers of species and individuals impacted. Similarly, transient pollution of a newt pond out of the breeding season may have little impact on the population as a whole, but may be catastrophic if it coincided with the breeding season when all adults and offspring may be in the water.

2.7 Damage to habitats, species and populations

The precise habitat requirements of most species are difficult to determine, and are not known for the majority of species. Sessile species such as plants and less mobile species of animal may rely wholly on one particular patch of habitat to meet their requirements. However, the long-term survival of a local population of a species within a patch of habitat may depend upon the presence of other populations in other patches of habitat. Populations in the various patches may be linked into a 'metapopulation' as a result of immigration and emigration processes between patches.

Mobile species such as birds and larger mammals may utilise a variety of environmental resources, and as such may not be wholly dependent upon one particular habitat patch. However, loss or damage to part of the area used by a particular species may still impact that species. For example, minimum area requirements for breeding pairs of certain bird species are known. If part of that area becomes unusable following an accident, then the whole area may be abandoned as a result, with a reduction in breeding success.

Similarly, when habitat used by migratory bird species is lost, populations may be able to migrate to different areas if their migration strategies allow. However, it cannot be assumed that all species are able to alter their migration strategies in response to habitat loss. Loss of wintering or breeding habitat may lead to a reduction in population size, even if the species involved are not impacted directly by the incident.

Furthermore, the life history/stage of the life cycle of individual species may need to be considered because organisms may be differentially affected during different life stages.

The disruption of structure itself (e.g. community composition) is likely to be a nature conservation concern, irrespective of whether functions and processes continue unaffected.

2.8 Habitat restoration, rehabilitation and recovery

Recovery of ecosystems and habitats will in part depend on the factors determining the initial susceptibility or vulnerability of the system, i.e. ecosystem size, degree of fragmentation/isolation, species richness, etc.

The assessment of recovery will require detailed ecological survey and information. The definition of the duration of the impact relies upon the ability to determine whether effects are persistent, which itself is reliant upon the determination of ecosystem structure and function. In order to assess recovery to a state approximating to the original, base-line information will thus be necessary detailing the species composition and abundance of the pre-impact habitat with which to compare post-impact conditions.

There is very little 'natural' habitat remaining in Britain, with the exception of vegetation in extremely remote and inaccessible areas. The majority of land within Britain has been modified by man (i.e. agriculture, industrialisation, urbanisation), and much of the remaining 'semi-natural' habitat has been degraded, with the loss of associated species. The full implications of wide-scale habitat degradation are as yet unrealised. There is a responsibility to preserve representative, good quality habitat and to protect natural resources that humans rely upon such as soil and groundwater.

Many of the semi-natural communities present within Britain developed their characteristic flora and fauna over extended time periods, possibly centuries. It is not realistic to expect that any such resource, once seriously damaged, can be easily rehabilitated. Practical attempts to recreate semi-natural communities have proved that, although many of the species may be reintroduced, restoration cannot be achieved instantaneously. The structure, and functioning, of these communities is not something that can be easily 'made'.

Many terrestrial semi-natural communities now exist as isolated fragments within the wider countryside, separated by inhospitable habitat (such as intensively farmed land or the built environment). Many species characteristic of these communities have limited dispersal capabilities, and thus once an isolated habitat is degraded, opportunities for natural recolonisation are few. The aquatic environment, and particularly flowing water, perhaps offers more scope for recolonisation after an impact, through unaffected tributaries, reaches and upstream waters, etc.

The potential for recovery will obviously depend upon the scale of damage. If only a small, representative area of a larger habitat is damaged, and the contamination is not persistent, then recovery should be relatively straightforward, i.e. the undamaged area will enable species to recolonise the damaged area. However, as the area impacted increases relative to the total area of the habitat, recovery is not certain, since healthy individuals for recolonisation are drawn from a decreasing area of undamaged habitat. An additional concern with small populations is that of the effects of reduced genetic variability, such that the system may not be able to persist due to a narrowed range of responses to further environmental variability.

Reversion of the damaged system to the pre-impact condition cannot be assumed. As the area damaged increases, so does the potential for invasion by weedy, competitive species, which may themselves affect vegetation establishment. Furthermore, the impact, or post-impact management, may have been responsible for altering physical conditions, i.e. soil structure and nutrients, hydrology, which will influence which species recolonise and flourish subsequently.

Even assuming the pre-impact species are all still available to recolonise, differing environmental conditions may result in the establishment of species adapted to those particular conditions, and different communities may develop. Experiments on the rehabilitation of agriculturally degraded grasslands found that vegetation types will not necessarily revert to their original condition, suggesting unidirectional environmental processes induced by management practices.

Once damaged, the ecosystem in question would need to be monitored for a number of years (at least equal to the length of time defined as 'short-term' damage) to determine whether the damage was indeed transient or longer lasting. Each industrial accident will be unique, i.e. the particular range of chemicals, the concentrations and quantities involved, the receiving environment, available pathways for dispersion of pollutants, prevailing meteorological conditions, etc. This individuality of incidents may mean that it is generally not possible to predict precisely the impact, or duration of effects, suffered by the local environment. Additionally, 'damage' is not a fixed quantity, but can be considered as a continuum from total destruction of habitat to relatively minor disturbance. Obviously, recovery from different positions on the continuum will take variable amounts of time.

In addition, certain impacts arising from industrial accidents may only be apparent after a time lag. Mobile species, such as mammals, may well migrate away from degraded areas. However, vegetation, and less mobile animals (i.e. non-flying invertebrates, soil fauna) do not have the capacity for rapid migration. Additionally, effects arising from disturbance to vegetation communities often do not become apparent concurrent with the disturbance. Vegetation can be slow to react to perturbation, and only physical damage may be immediately obvious following an incident.

2.9 Determination of the severity of impact

The difficulty arises not so much from the actual definition of damage, but more from the problem of placing the effects of an incident on a scale that enables quantification of different levels of impact, from minor impacts with few effects to major impacts that may devastate ecosystems.

The particular threshold levels of impact chosen, below which an incident is not considered as 'major', are also difficult to determine.

A system of classification currently being developed by the Environment Agency contains useful phraseology that clarifies qualitatively what might be considered as a major accident to the environment. For example, for land a major accident may include: persistent and extensive contamination impacting the use or quality of the land and likely to require extensive decontamination measures; destruction/major damage to important wildlife habitats, or widespread destruction/damage to terrestrial fauna and flora; large-scale deposition of waste requiring extensive remediation measures; major effect on amenity use of recreational area/public space; widespread contamination of crops or livestock; fatalities or serious impacts on man.

Similarly, for water, a major accident may involve the following: persistent or extensive effects on water quality, or major damage to aquatic ecosystems through damage to fish population/habitat, important wildlife habitat, invertebrate population or other aquatic flora or fauna, or extensive contamination of the water bed; closure of potable extraction; severe impacts on amenity value; major damage to agriculture or commerce; serious public health impacts.

However, the quantification of the precise level of damage witnessed and the determination of the severity of that impact is more difficult and will require further consideration.

APPENDIX 2

Nature conservation legislation and guidelines

Wildlife and Countryside Act 1981
This is a piece of national legislation aimed at protecting birds, animals and plant species. The Act has functions in many areas, including licensing and scheduling of species, notification of Sites of Special Scientific Interest, protection of nationally important sites and the establishment of Marine Nature Reserves.

Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC) (the 'Habitats Directive')
The aim of the Directive is to contribute to the maintenance of biodiversity within the European territory of the Member States through the conservation of natural habitats and wild flora and fauna. Certain habitats and species have been selected as being of Community interest because they are in danger, and the aim is to establish a 'favourable conservation status' for these by establishing a network of protected areas to maintain the distribution and the abundance of threatened species and habitats, both terrestrial and marine.

Natural habitat types of Community interest
These are defined as 'terrestrial or aquatic areas distinguished by geographic, abiotic and biotic features whether entirely natural or semi-natural'. Annex I of the Directive contains a list of 'natural habitat types of Community interest'. These may be habitats in danger of disappearance within their natural range, or those with a small natural range or those representing outstanding examples of one or more of six biogeographical regions – Alpine, Atlantic, Continental, Macronesian, Boreal and Mediterranean. The list reflects European priorities and not necessarily UK national priorities. A sub-set of these habitats, judged to be in danger of disappearance and mainly or exclusively found within the European Community, are 'priority habitats'. Within the UK there are 22 priority habitats.

Species of Community interest
Annex II of the Directive lists animal and plant species of Community interest, which need their habitats to be specially designated in order to conserve them, and upon which site designations are based. The species are defined as generally endangered, or vulnerable, or rare, or endemic, and requiring particular attention. A limited number of these species are present within Britain.

Natura 2000
The Directive also aims to establish a coherent European ecological network of sites of Community importance (Natura 2000 sites). The sites to be included within this network are:

i) Special Areas of Conservation (SACs) which will contain habitat types of Community interest listed in Annex I, and the habitats of certain animal and plant species listed in Annex II, of the Habitats Directive; and

ii) Special Protection Areas (SPAs) to conserve migratory species and the 182 bird species and sub-species listed under Annex I of Council Directive 79/409/EEC on the conservation of wild birds (the Birds Directive).

Member States will contribute to the network in proportion to the representation within their territory of Annex I habitat types, and habitats of Annex II species.

A listing of UK species named within the Habitats Directive can be found within Joint Nature Conservation Committee (JNCC) Report No. 242. P.T. Harding and J.M. Croft. 1995. *EC Habitats Directive: a review of the European distribution of UK terrestrial and freshwater species on Annexes II, IV and V.*

The Habitats Directive: A list of possible Special Areas of Conservation in the UK. JNCC Report No. 270 (1997) details possible Special Areas of Conservation in the UK.

The UK Biodiversity Action Plan (produced by the UK Biodiversity Steering Group) further sets out the position of Britain as regards species and habitats of international importance.

Directive on the conservation of wild birds (79/409/EEC) (the 'Birds Directive')
This Directive obliges Member States to maintain populations of naturally occurring wild birds at levels corresponding to their ecological requirements. Article 4 requires Member States to take measures to conserve the habitat of certain listed threatened species through the designation of Special Protection Areas (SPAs). Such sites are part of the Natura 2000 network (see above).

Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat
The Convention is the inter-governmental treaty providing the framework for international co-operation for the conservation of wetland habitats. Its broad objectives are to stem the progressive encroachment on, and loss of, wetlands now and in the future, and to promote their wise use. Under the Convention there is a general obligation for Contracting Parties to include wetland conservation considerations within their national land use planning; to promote the conservation of wetlands through the establishment of nature reserves; and to encourage the wise use of wetlands.

In the UK no site is designated as a Ramsar site unless it has already been notified as an SSSI under the Wildlife and Countryside Act 1981, and is therefore legally protected from activities likely to harm its nature conservation interests.

National Nature Reserves (NNRs)
These are declared under Section 19 of the National Parks and Access to the Countryside Act 1949 or Section 35 of the Wildlife and Countryside Act 1981. The fundamental purpose of this designation is to secure the protection and effective management of nationally important wildlife sites, and provide appropriate opportunities for study and research.

NNRs are established to protect the most important areas of wildlife habitat and geological formations in Britain. Well-managed NNRs have helped governments honour their international obligations to designated sites of wildlife importance.

Nature conservation designations applicable in the UK		
Importance	Site designation	UK statutory designation
Sites of international importance	*Ramsar sites* – Listed under the Convention on Wetlands of International Importance	SSSI
	Special Protection Areas (SPAs) – Classified under the EC Directive on the conservation of wild birds (the Birds Directive)	SSSI; SPA
	Special Areas of Conservation (SACs) – Designated under the EC Directive on the conservation of natural habitats and of wild flora and fauna (the Habitats Directive)	SSSI; SAC
Sites of national importance	*National Nature Reserves* (NNRs) – Declared under Section 19 of the National Parks and Access to the Countryside Act 1949 or Section 35 of the Wildlife and Countryside Act 1981	SSSI; NNR
	Sites of Special Scientific Interest (SSSIs) – Notified under Section 28 of the Wildlife and Countryside Act 1981	SSSI
Sites of regional or local importance	*Local Nature Reserves* (LNRs) – Designated by local authorities under Section 21 of the National Parks and Access to the Countryside Act 1949	LNR
	Non-statutory nature reserves – Established and managed by a variety of public and private bodies, e.g. County Wildlife Trusts, RSPB	–
	Sites of importance for nature conservation – Usually adopted by local planning authorities for planning purposes; the name and status of sites vary considerably	–

Further details of nature conservation designations and details of specific sites can be obtained from English Nature, Countryside Council for Wales and Scottish Natural Heritage.

A Guide to Wildlife Law Enforcement in the United Kingdom has been prepared for DETR and is accessible at the 'wildlife and countryside' section of DETR's web-site (http://www.wildlife-countryside.detr.gov.uk). This guide gives general information on nature conservation, site protection, legislation and policy.

APPENDIX 3

Scarce habitats

Key habitats listed within the Biodiversity Action Plan were selected on the basis of the following criteria:

- habitats for which the UK has international obligations; or
- habitats at risk, e.g. those that have declined rapidly within the last 20 years, or which are rare; or
- areas, particularly marine, which are extremely important in terms of their functioning; or
- areas important for particular species.

The key habitats can be listed as follows; caves and natural rock exposures are also being considered for inclusion:

coastal and flood plain grazing marsh
purple moor grass and rush pasture
ancient and/or species-rich hedgerows
reedbeds
limestone pavements
lowland heathland
upland oakwood
chalk rivers
saline lagoons
seagrass beds
fens
cereal field margins
mesotrophic lakes
native pine wood
lowland beech woods
upland mixed ash woodland
wet woodlands
lowland wood pastures and parklands
lowland hay meadows
upland hay meadows
lowland dry acid grassland
lowland calcareous grassland
upland calcareous grassland
raised bog
eutrophic standing waters
aquifer-fed naturally fluctuating water bodies
upland heathland
blanket bog
maritime cliff and slope
coastal vegetation shingle structure
machair
coastal saltmarsh
coastal sand dune
estuaries
Ascophyllum nodosum mackii beds
maerl beds (inlets and bays)
deep mud
maerl beds (open coast)
chalk coasts (littoral and sub-littoral)

Full details of these key habitats are to be found in *Biodiversity: The UK Steering Group Report, Volume 2: Action Plans* (1995).

APPENDIX 4

Species of high value or those with special protection

Species of high value or those with special protection are considered to be:

- priority species under the UK Biodiversity Action Plan
- species listed in the Habitats Directive Annexes (UK species only)
- species listed in the Annexes of the Birds Directive
- species listed in the schedules of the Wildlife and Countryside Act 1981 (and subsequent amendments to these schedules)
- all Red Data Book species.

UK Biodiversity Action Plan species classification
The UK Biodiversity Action Plan classifies species into 'priority species' and 'species of conservation concern'. Action plans are concerned generally with species which qualify for one or more of the following reasons:

- threatened endemic species or globally threatened species;
- species for which the UK has more than 25% of the world (or appropriate biogeographical area) population;
- species which have declined in numbers or range by more than 25% in the last 25 years;
- species found in fewer than 15 ten kilometre squares in the UK;
- species listed in the EC Birds or Habitats Directives, the Bern, Bonn or CITES Conventions, the Wildlife and Countryside Act 1981 or the Nature Conservation and Amenity Lands (Northern Ireland) Order 1985.

For further details see *UK Biodiversity Group Tranche 2 Action Plans. Volume 1 – Vertebrates and vascular plants.* 1998. English Nature.

GLOSSARY

affect	influence; make a material impression upon
clean-up	actions to move and/or treat or remedy contamination or pollution
contamination	release of a by-product (chemical or physical) of human activity; may cause harm to human health and/or the natural environment, but need not
damage	injure so as to diminish value or usefulness; cause harm to (cause deterioration)
harm	adverse effects on individuals or ecological systems; hurt, injury, damage
hazard	the intrinsic property of a dangerous substance or physical situation, with a potential for creating damage to human health and/or the environment; a measure of the potential of a substance or process to cause harm to human health or the environment
LNR	Local Nature Reserve
long-term	lasting for or pertaining to a relatively long period of time; maturing or becoming effective only after a long period
MNR	Marine Nature Reserve
NNR	National Nature Reserve
persistence	the capacity of a chemical to endure (without change) in the environment
persistent	enduring; of a chemical – remaining within the environment for a long time after its introduction
pollution	release of by-products of human activity that cause harm; contamination causing adverse effects
remediation	the process of remedying (putting right) the effects of pollution, or attempts to do so
(ecological) restoration	the return of an ecosystem to an approximation of its structural and functional condition before damage occurred
risk	the likelihood of a specific effect occurring within a specified period or in specified circumstances
RIVPACS	River Invertebrate Prediction And Classification System, a scheme for determining the biological quality of a waterway developed by the Institute of Freshwater Ecology (IFE) for the Environment Agency
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

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