Practical guidance on applying the PRECAUTIONARY PRINCIPLE
Matters to be aware of include the following:

• The content of the precautionary principle is not settled and there is disagreement over its precise meaning, particularly in European case law, and its content may vary from that in the Rio Declaration. This potential for difference will require to be borne in mind in applying the principle in the context of any EU-based legislation.

• It is possible that different areas of EU law may require different applications of the precautionary principle, due to the principle being expressed in a number of different contexts in the EC Treaty. For each decision, it is important to check the legal basis for the principle being applied and, if necessary, adjust the application of the principle accordingly.

• As a matter of law, the precautionary principle cannot yet be said to exist as a standalone principle of administrative decision making. It will also be important to consider the decision maker’s other statutory powers and duties to ensure that consideration or application of the principle is consistent with them.

• The continued development of the principle in the courts will require to be followed carefully (for regular updates please visit http://www.curia.europa.eu/en/transitpage.htm).
1 Summary

This document provides generic practical guidance on the application of the precautionary principle, primarily in the field of environmental and health regulation. The guidance applies to new developments or activities and to existing ones, where changes are proposed or new information is available that is relevant to a prior decision.

The guidance:

i: does not replace, over-ride or undermine existing risk assessment or risk management processes based on sound science;

ii: recognises that many statutory and legislative approaches already incorporate precaution, i.e. precaution is implicit;

iii: suggests that as scientific uncertainty increases and where potentially serious consequences might arise then a more explicit application of precaution might be required;

iv: demonstrates, by means of a flow chart, how the precautionary principle is considered at each stage of the decision-making process and when and how explicit precaution should apply, with reference to examples for each stage; and

v: describes and discusses some ‘principles of best practice’ some of which are necessary to avoid risk of challenge and some of which simply help build confidence in decision-making.

The guidance should assist regulators in screening cases to determine those circumstances where explicit precaution is required, due to a:

• threat of serious or irreversible damage; and
• lack of full scientific certainty.

Existing regulatory risk management practices and decision-making processes adopted by a competent authority may, by their very nature, already apply the precautionary principle. The guidance serves to reaffirm and engender confidence by promoting generic good practice to secure consistency in and transparency of the decision-making process.

The precautionary principle illuminates the application of environmental and health regulations. It is a principle, indicating the direction of decision making, not a rule requiring a particular decision.
2 Introduction

2.1 Background
The precautionary principle as a concept can be traced back to the 1970s but it was not until the 1990s that it was included in international treaties, for example: the Bergen Declaration on Sustainable Development (1990)\(^1\) and the Rio Declaration (1992)\(^2\). European Community (EC) environmental policy has, as a matter of law, under Article 174 of the EC Treaty\(^3\), to be based on the precautionary principle. Many EC Directives and Member States transposing legislation therefore embody the precautionary principle expressly and many more do so by implication. The UK Government has now included the precautionary principle as one of the shared UK principles for sustainable development\(^4\).

A number of agencies with a duty to consider the precautionary principle agreed that guidance was required to help put the precautionary principle into practice. The aim was to produce a document to ensure a consistent and transparent approach whilst recognising that the outcome of applying the principle may vary legitimately in different situations. “Applying the Precautionary Principle – an Overview”\(^5\) describes the international and legal context for adoption of the precautionary principle and presents initial thinking by the Steering Group on its application by environmental and health regulators in Scotland and Northern Ireland.

2.2 Adopted Definition of the Precautionary Principle
The UK Government is committed to using the definition of the precautionary principle set out in the Rio Declaration\(^2\):

“where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation.”

For ease of reference, the guidance adopts this definition and suggests that the same practice should apply concerning potential impacts on human health, including indirect threats that may arise from environmental degradation.
3 Implementation

3.1 Legal Basis
There is a duty to consider whether the precautionary principle applies and whether or not it should be applied. In each case, however, considering and/or applying the principle does not create an obligation for specific actions: the precautionary principle is only one of many factors that must be taken into account when making a decision.

In each case it is important to be clear on the legal source of the duty or discretion to consider and/or apply the principle. It will also be necessary to ensure that the form of the principle being applied is consistent with that detailed in any direction or guidance to the decision maker or that applying in the circumstances under EU case law.

3.2 The Continuum Model
The Interdepartmental Liaison Group on Risk Assessment suggests that the precautionary principle should be applied where:

- there is good reason to believe that harmful effects may occur to human, animal or plant health, or the environment may be harmed; and

- the level of scientific uncertainty about the consequences or likelihoods is such that risk cannot be assessed with enough confidence to inform decision-making.

To put this into practice the decision maker would need to determine, first of all, what level of proof of a causal link between a potential hazard and possible harm to the environment or human health would be required, in order to apply the precautionary principle. To address this difficulty, the guidance adopts the Continuum Model, Figure 1. This advocates that the question of whether or not the precautionary principle applies should be considered for all decisions where there is a plausible risk to the environment or human health. The way in which precaution is applied will depend on factors such as the degree of uncertainty, the plausibility of a causal link and the potential severity of impact.
Practical guidance on applying the Precautionary Principle

At one end of the model (left hand side of the diagram) are those decisions that are relatively uncomplicated and where the risk can be quantified. Many decisions made by environmental and health regulators are of this nature, i.e. subject to precautionary principles applied in the development and subsequent drafting of the legislation. For example, the Integrated Pollution Prevention and Control Directive requires regulators to consider “the principles of precaution and prevention” when determining Best Available Technique (BAT).

The setting of statutory standards to protect the environment or human health incorporates a precautionary approach. Such standards are derived to take account of inherent uncertainties and usually incorporate a safety factor, see Box 1.

At the other end of the model (right hand side of the diagram) are those decisions which are more complicated and where the risks are uncertain or unknown. In some cases the decision may become highly contested and will be referred to government. For example, there is growing scientific consensus that human activities resulting in the increase of greenhouse gases in the atmosphere is driving changes in the Earth’s climate. However, there is considerable scientific uncertainty as to how sensitive the climate is to increases in these gases. There is uncertainty concerning the resulting effects on the environment, and there is uncertainty on the economic costs of possible measures to reduce greenhouse gases. In effect the uncertainty and the potential scale of the impacts render this decision much more political in nature and, for practical purposes, beyond the reach of a regulator or agency. A second example concerns the application of nanotechnologies. The Government has expressed its support for a Royal Society/Royal Academy of Engineering recommendation that “industry reduce or remove these [nanotubes and nanoparticles] from waste streams and prohibit their use for environmental remediation, while the uncertainties about the risks they pose are being addressed”.

The ‘grey area’ in the Continuum Model represents decisions where the likelihood of a hazard is less clear, and the risk cannot be fully quantified due to gaps in knowledge. There is uncertainty, but there may be reasonable evidence of a possible causal link between an action and an outcome. This situation is encountered in a significant number of regulatory decisions, and under these circumstances the decision-maker may need to take precautionary measures.

Where risks or hazards may be quantified with reasonable certainty then conventional risk assessment and management practices may continue to apply. However, as uncertainty about the scale of the consequences and/or the probability of consequences occurring increases, quantifying the risk will be more difficult. In such cases a more qualitative approach, as presented here, may become more relevant although conventional risk assessment may still have a role as an aid to decision-making provided its limitations are understood and documented.
Box 1: The precautionary principle in the derivation of regulatory standards

Health Standards
An uncertainty factor is built into standard health risk assessment processes to derive the amount of a specific chemical that can be safely consumed — the Acceptable Daily Intake.

The Acceptable Daily Intake of a chemical is generally calculated as being:

\[
\text{ADI} = \frac{\text{NOAEL}}{\text{UF}}
\]

where:

\[
\text{ADI} = \text{Acceptable Daily Intake}
\]

which is the amount of chemical that can be consumed every day for a lifetime, on the basis of all known facts that no harm will result;

\[
\text{NOAEL} = \text{No Observed Adverse Effect Level},
\]

calculated from toxicity studies; the highest level of continued exposure to a chemical which causes no significant adverse effect on morphology, biochemistry, functional capacity, growth, development or lifespan of individuals of the target species which may be animal or human.

\[
\text{UF} = \text{Uncertainty Factor}
\]
of 100 which allows for potential differences in sensitivity between individuals or species.

Environmental Quality Standards
An Environmental Quality Standard (EQS) is intended to define the level of a toxic substance below which unacceptable effects would not be expected to be observed in the environment. It is derived from two components; the toxicity endpoint (which may be based on a defined level of effect, or on the absence of effects) and an assessment factor.

The magnitude of the assessment factor is determined by the reliability of the toxicity data to which it is applied. Toxicity datasets that are robust, extensive and relevant will attract lower assessment factors than datasets that contain few data considering only exposures of short duration.

Assessment factors may vary from 1 to 1000. In cases where there are very large uncertainties in correlating test data with the environment, assessment factors of 10000 may be used. Conversely, an assessment factor of 1 may be used if a large volume of long-term data is available for a wide range of taxonomic groups relevant to the protection goal and the mode of toxic action is understood. In such cases, there are much lower uncertainties in extrapolating from test data to the environment.
4 How to apply the precautionary principle: a step-by-step guide

“The implementation of an approach based on the precautionary principle should start with a scientific evaluation as complete as possible and where possible identifying at each stage, the degree of uncertainty.” EC Communication on the Precautionary Principle⁹.

4.1 The Flow chart
The flow chart opposite operates as a screening tool to assist determination of when explicit precautionary measures are required, i.e. where:

• there is a risk of serious or irreversible damage; and
• there is a lack of scientific certainty;

The flow chart is designed to be simple, transparent and easy to follow, both for decision-makers and for those wishing to understand how decisions are made. Examples, illustrating each step of the process, are provided in Annex 1.

There are 2 main phases represented in the flow chart:

The Investigation Phase (Steps 1 – 4) is about deciding whether or not the precautionary principle should be applied explicitly. Questions are asked about the development or activity to determine, for example, whether lower risk options have been considered, what is the scale and seriousness of risks and whether they can be quantified with sufficient certainty. In the majority of cases these questions can be answered to an extent that enables a decision to be reached by following, for example, good practice or published guidance. For a minority of cases, the process will move into the Action Phase.

The Action Phase (Steps 5 – 9) identifies how to apply the precautionary principle, i.e. whether to prevent the activity or development (strict precaution) or to allow the process to continue with adaptations (adaptive precaution). In practice, strict precaution is not often applied as steps may be taken to reduce uncertainty and the extent of the potential hazard, and the decision may therefore be subsequently reviewed; this is adaptive precaution and is akin to risk management. Adaptive precaution is a common regulatory risk management tool that applies mainly to “process” type activities, for example the volume, composition and location of an emission or the timing and duration of an intermittent event such as dredging and fishing.

The flow chart can be applied to both new activities and changes to existing activities. For a new development or activity the flow chart applies from step one where a series of options may still exist. For changes to an existing activity options will be limited, Step 1 may not apply, so the process will probably start from Step 2.
Flow chart

**STEP 1** Has a range of options for the development or activity been considered, have environmental and health implications been assessed? **SEE EXAMPLE A**

**STEP 2** For the chosen option, are the consequences for the environment or human health predictable? **SEE EXAMPLE B**

**STEP 3** Is a causal link between activity and impact plausible and more than hypothetical? Consult stakeholders and/or experts, as appropriate. **SEE EXAMPLE C**

**STEP 4** Is there a potential risk of serious and/or widespread and/or irreversible damage to the environment or human health? **SEE EXAMPLE E**

**STEP 5** Can uncertainty be resolved in practical timescales and without excessive costs? Further research or investigations may be required to reduce uncertainty. Whether these are conducted by the promoter, regulator, government etc. will be case specific. **SEE EXAMPLES E & F**

**STEP 6** Is the development/activity adaptable or can the impact be minimised by the use of regulatory tools? **SEE EXAMPLES F & G**

**STEP 7** Is it technically feasible to establish a feedback monitoring regime? **SEE EXAMPLE G**

**STEP 8** Can steps be taken to ensure that sufficient safeguards remain in place for the life of the activity/development? **SEE EXAMPLES H & I**

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**THE PRECAUTIONARY PRINCIPLE SHOULD BE A FACTOR IN DECISION MAKING. PRECAUTIONARY MEASURES APPLY.**

**STEP 1** Has a range of options for the development or activity been considered, have environmental and health implications been assessed? **SEE EXAMPLE A**

**Where appropriate, promote a range of options. Options for existing activities will be more limited. **SEE EXAMPLE B**

**STEP 2** For the chosen option, are the consequences for the environment or human health predictable? **SEE EXAMPLE B**

**Risk quantifiable and PP embodied in regulatory standards.**

**STEP 3** Is a causal link between activity and impact plausible and more than hypothetical? Consult stakeholders and/or experts, as appropriate. **SEE EXAMPLE C**

**NB**, An absence of evidence or contradictory evidence may mean further investigation is required.

**STEP 4** Is there a potential risk of serious and/or widespread and/or irreversible damage to the environment or human health? **SEE EXAMPLE E**

**Impact is unlikely to be significant - PP does not apply.**

**STEP 5** Can uncertainty be resolved in practical timescales and without excessive costs? Further research or investigations may be required to reduce uncertainty. Whether these are conducted by the promoter, regulator, government etc. will be case specific. **SEE EXAMPLES E & F**

**Uncertainty reduced sufficiently to enable conventional risk assessment and management, PP embodied in standards etc.**

**STEP 6** Is the development/activity adaptable or can the impact be minimised by the use of regulatory tools? **SEE EXAMPLES F & G**

**ADAPTIVE PRECAUTION**

**NB**, Ensure that all actions are agreed and legally binding before proceeding.

**STEP 7** Is it technically feasible to establish a feedback monitoring regime? **SEE EXAMPLE G**

**STEP 8** Can steps be taken to ensure that sufficient safeguards remain in place for the life of the activity/development? **SEE EXAMPLES H & I**

**STRICT PRECAUTION** Not often applied in practice as steps usually can be taken to reduce uncertainty and, potential risk, and the decision may then be reviewed.

See examples illustrating different steps in Annex 1.

*Although the precautionary principle may not apply, the principles supporting good practice should be considered nevertheless and documented as part of the decision-making process.*
4.2 Principles supporting good practice

When making a decision based on the precautionary principle there are several supporting principles that should be adopted to help regulators reach more informed and robust decisions that are easier to defend and are less likely to be contested. Some of these principles are familiar to regulators who must demonstrate adherence to principles of good practice in the exercise of their powers and duties. All or most of the principles are likely to be relevant to the more difficult decisions and may help avoid legal or other challenges.

**Acknowledge ignorance**

*Have any knowledge gaps been identified and declared?*

No matter how sophisticated, knowledge will always be subject to some degree of ignorance, where we don’t know (or perhaps even only suspect) what we don’t know. This needs to be clear in any transparent decision. This is consistent with good risk assessment practice.

**Absence of evidence of risk versus evidence of absence of risk**

*Has a clear distinction been made between any evidence of low or no risk and a lack of evidence providing confidence in the degree of risk?*

Evidence of absence of risk is where there is scientific evidence from which it may be concluded that any risk is very low.

Absence of evidence of risk is where there is a potential risk but scientific evidence is lacking, inconclusive or ambiguous and subject to differing interpretations. In such circumstances, if the scientific evidence is sufficient to support a conclusion that the risk is more than hypothetical, then the precautionary principle should apply.

**Monitoring and review**

*Have transparent arrangements for monitoring and review of the decision been put in place?*

Applying the precautionary principle is a dynamic process, with ongoing requirements for feedback and new information to support monitoring and review. An understanding of changing requirements likely to affect use of the precautionary principle is also necessary. Many regulatory regimes have these requirements built into the regulatory process, but care must be taken where this is not the case. Failure to do so may result in challenge.

The European Commission Communication on the Precautionary Principle advises “measures, although provisional, should be maintained as long as the scientific data remain incomplete, imprecise or inconclusive and as long as the risk is considered too high to be imposed on society. Maintenance of the measures depends on the development of scientific knowledge, in the light of which they should be re-evaluated. …Measures based on the precautionary principle shall be re-examined and if necessary modified depending on the results of the scientific research and the follow up of their impact.”

The Office of Science and Technology “believes that public perceptions of science play an increasingly important role in developing policy, just as, for example, public opinion is an important part of health policy. This has been highlighted by recent science-related controversies. The controversy over genetically modified food has, in particular, reinforced awareness of the need for dialogue with the public and for informed debate.”

**Openness, communication and public trust**

*Has the decision been made in an open and transparent way?*

Failure to do so will mean the decision is susceptible to challenge.

When applying the precautionary principle within a decision-making framework, the regulator should ensure that stakeholders, including those communities potentially affected by a decision, have an opportunity to express relevant concerns which, where appropriate, will be taken account of in reaching a decision. These requirements are addressed, for the most part, under regulations and statutory guidance which invariably will direct a competent authority as to when and in what manner stakeholder consultation should be undertaken by stipulating advertisement and consultation requirements and also what provisions should be made for a public register. However it may be necessary to go further than those requirements, particularly where lack of knowledge requires to be acknowledged.

The way a decision is communicated is crucial. If information is only disclosed under duress then it may discredit the source. An open and transparent organisation will define how it makes its decisions.

**Costs and benefits**

*Has an appropriate assessment of costs and benefits been carried out?*

Failure to do so is likely to result in challenge.

Making a decision about an action, or inaction, presupposes examination of the associated benefits and costs, where appropriate and feasible. This is not simply an economic cost-benefit analysis: its scope is much broader, and includes non-economic considerations, such as the efficacy of different options, health implications, potential loss of amenity or benefits forgone as a result of a preferred option; both in the short and the long term. The EC Communication advises that account should also be taken of the general principle and the case law of the Court that the protection of health takes precedence over economic considerations (although note that no similar statement has yet been made in the domestic courts). It is also prudent to consider whether an action taken to protect one aspect of the environment may cause damage elsewhere. Finally, if the consequences of an action are irreversible, the option of “doing nothing” should always be considered.
Impartiality

*Have all relevant points of view been considered in reaching a decision?*

Failure to consult all persons affected by the decision will mean it is susceptible to challenge.

Apart from avoiding challenge, one of the main benefits of stakeholder involvement is that listening to different points of view improves the information on which a decision is based. Stakeholders may provide new information, which needs to be taken into account. In addition, the range of views on an issue can sometimes in itself provide a significant input into decision-making, as it may indicate how practicable a decision may be, especially where it depends on others in order to be implemented successfully. For these reasons, as well as for reasons of equity, it is important that all relevant points of view are heard when making decisions.

Risk Analysis and Risk Management

*Have the risks of potential options and/or outcomes been identified and analysed?*

Failure to do so may result in challenge.

Sound risk assessment and management practices are critical to any regulatory decision. Risk is commonly defined as the product of the probability of occurrence and the consequence. It is important when communicating risk to stakeholders that concepts such as probability and uncertainty are clearly explained in the context of potential outcomes. There is considerable literature concerning risk analysis and management. The UK Climate Impacts Programme Technical Report provides a good example of applying best practice in the context of the precautionary principle.

Proportionate

*Are any proposed risk management measures proportionate to the seriousness of the risk?*

If not, they are likely to be challenged.

“The measures envisaged must make it possible to achieve the appropriate level of protection. Measures based on the precautionary principle must not be disproportionate to the desired level of protection and must not aim at zero risk, something which rarely exists. However, in certain cases, an incomplete assessment of the risk may considerably limit the number of options available for risk management. In some cases a total ban may not be a proportionate response to a potential risk. In other cases, it may be the sole possible response to a potential risk. Risk reduction measures should include less restrictive alternatives which make it possible to achieve an equivalent level of protection, such as appropriate treatment, reduction of exposure, tightening of controls, adoption of provisional limits, recommendations for populations at risk, etc. The risk reduction measure should not be limited to immediate risks where the proportionality of the action is easier to assess. It is in situations in which the adverse effects do not emerge until long after exposure that the cause–effect relationships are more difficult to prove scientifically and that – for this reason – the precautionary principle often has to be invoked. In this case the potential long-term effects must be taken into account in evaluating the proportionality of measures in the form of rapid action to limit or eliminate a risk whose effects will not surface until ten or twenty years later or will affect future generations. This applies in particular to effects on the ecosystem. Risks that are carried forward into the future cannot be eliminated or reduced except at the time of exposure, that is to say immediately.”

Consistent and non-discriminatory

*Are the measures and/or approach consistent with those adopted in similar circumstances?*

“Risk evaluations include a series of factors to be taken into account to ensure that they are as thorough as possible. The goal here is to identify and characterise the hazards, notably by establishing a relationship between the dose and the effect and assessing the exposure of the target population or the environment. If the absence of certain scientific data makes it impossible to characterise the risk, taking into account the uncertainties inherent to the evaluation, the measures taken under the precautionary principle should be comparable in nature and scope with measures already taken in equivalent areas in which all the scientific data are available.”

Accountable

The thinking and decision making on each step of the flow chart should be recorded, thus producing an audit trail in the event of a decision ever being challenged or revisited.

While the above principles seek to identify the major requirements of good regulatory decisions in the context of the precautionary principle, they should not be regarded as exhaustive. Different organisations and different circumstances may require application of additional principles.

5. Conclusions

Applying the precautionary principle is a dynamic process of seeking sustainable ways of reducing the impacts of economic activity on human health and the environment. It is an evolving approach to sustainable development and benefits from lessons shared and learned amongst those organisations that have a duty to consider the precautionary principle. This integrated approach will ensure consistency and help to ensure that regulators are proactive in protecting the environment and human health rather than simply responding to problems as they occur.
Annex 1: Examples illustrating each step in the flow chart

Example A  
Assessment of Pollution Prevention and Control (PPC) Applications

Step 1

BAT options appraisal, as detailed in the PPC H1 horizontal guidance, is a good example of legislative adoption of precaution whereby any risks and uncertainties identified during consideration of an application will determine whether the application should be revised, refused (strict precaution) or granted with conditions (adaptive precaution). Of course decisions on licences will be affected by other considerations also and not the precautionary principle alone.

Example B  
Polycyclic aromatic hydrocarbons in shellfish

Step 2

As part of the Food Standard Agency’s (FSA) monitoring of chemical contaminants in shellfish very high levels of Polycyclic Aromatic Hydrocarbons (PAH) (> 70ng/g wet weight total PAH) were observed in mussels harvested from Kinlochleven. At that time there was no Regulatory Limit for PAH. The shellfish producers implemented a voluntary prohibition on harvesting mussels for human consumption from both farms in Loch Leven. The Committee on Toxicology, Consumer Products and the Environment (COT) issued an interim pragmatic guideline of 15ng/g wet weight. Following closure of an industrial smelter that discharged into Loch Leven the PAH concentrations decreased. In 2001 the voluntary closure was lifted based on concentrations of total PAH and three individual PAH’s identified by COT. A regulatory limit of 10ng/g wet weight was introduced as an amendment of EC 466/2001 in February 2005.

Example C  
PPC substantial change

Step 3

The regulator may decide to review a PPC permit via the substantial change mechanism set out by the legislation if new scientific evidence indicates a risk to human health or the environment. The legislation thus embodies the precautionary principle in the form of the Substantial Change provisions.

Example D  
Landfill epidemiological study

Step 3

Following research conducted on birth defects and proximity to landfill sites some correlations were identified, but no causal link was found. The decision to date is that there is insufficient evidence to justify changing landfill site licences, but the correlations are sufficient to trigger further research.
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Example E
Mobile phone base stations
Step 4 & 5
Public concerns exist concerning health hazards posed by radio frequency (RF) emissions from mobile phone base masts. Current guidance concludes that there is significant scientific uncertainty regarding the importance of non-thermal, biological effects induced by very low intensity RF fields. This uncertainty and the present inability to rule out the possibility of adverse health effects, i.e. absence of evidence, forms the basis for suggesting the adoption of a strategy based on the precautionary principle. See the report of the ‘Independent Expert Group on Mobile Phone’ at http://www.iegmp.org.uk/

Example F
Ammonia discharge to tidal estuary
Step 5 & 6
A discharger requested an increased consent limit for a discharge of ammonia to the estuary. High background concentrations of ammonia in the estuary from other discharges, combined with natural benthic inputs from the disturbance of sediments in a turbid estuary, gave rise to high risk and low certainty with regard to the degree of impact. The request was denied unless the discharger could demonstrate that the discharge would not lead to eutrophication. The company undertook ecosystem modelling to assess the impact of the proposal and to address uncertainties.

Example G
Composting of industrial waste
Step 6 & 7
Given an absence of evidence and uncertainties concerning potential health effects, the regulator has refused to exempt composting of industrial waste. This example of adaptative precaution was subsequently adopted by the exemption legislation. If monitoring results indicate low risk, the decision will be reviewed.

Example H
Zebra mussel management for Northern Ireland
Step 8
The mussel has had a detrimental impact on native biodiversity in those lakes where it has become established. Lough Erne has undergone rapid and extensive ecological change. Although the economic impacts have not been severe to date, there remains the potential for greater impacts with future spread. These include the costs associated with excluding the zebra mussel from municipal and industrial water intakes, impacts on important commercial fisheries and impacts on recreational fisheries and related tourist income. The decision has been taken to develop and implement a Zebra Mussel Management Strategy for Northern Ireland (2004 – 2010) which aims to minimise the spread of zebra mussels by raising awareness, developing policy and legislation, monitoring and research and developing contingency plans for immediate action in the event of further Zebra mussel spread.

Example I
Bottlenose dolphins in Moray Firth
Step 8
Dredging activities were thought likely to have an impact on a protected species. Strict precaution applied as it was not possible to remove uncertainty without perhaps putting the population unnecessarily at risk.
Annex 2: References


3. Treaty establishing the European Community, March 1957


10. Science and the Public: A Review of Science Communication and Public Attitudes to Science in Britain, A Joint Report by the Office of Science and Technology and the Wellcome Trust, October 2000 (http://www.wellcome.ac.uk/assets/wtd003419.pdf)


12. EC Directive 466/2001 on setting maximum levels for certain contaminants in foodstuffs, March 2001
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