

Precaution: principles and practice in Australian environmental and natural resource management*

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Since the late 1980s, the concept of precaution has been incorporated into numerous international agreements and laws, as well as in domestic statutes and policies in many countries. This paper examines the international emergence of the concept and its application in Australia. Despite rapid growth in adoption of the so-called ‘precautionary principle’, the concept remains highly controversial, and its success in terms of improving environmental and natural resource management has been questioned. A common misconception is that the principle prescribes action. In fact, internationally accepted definitions are about decision-making processes. This paper argues that implementation guidelines are essential to ensure that precautionary decision-making is consistent with good decision-making principles, and to avoid unnecessary costs and perverse outcomes.

Key words: environment, natural resource management, precautionary principle, uncertainty.

1. Introduction

Since the late 1980s, the precautionary principle – in one of its many guises – has been incorporated into numerous international agreements and laws, as well as in domestic statutes and policies in many countries, including Australia. Despite rapid growth in its adoption, the principle remains controversial, and its success in terms of improving environmental and natural resource management, and of promoting sustainable development, has been questioned.

Increasing awareness of serious environmental degradation and damage to human health – in some cases, many years after potential hazards were first identified – prompted pressures for anticipatory action. The precautionary principle was conceived as a means to ensure that decision-makers would take into account uncertain but potentially serious and/or irreversible threats

* This report was prepared with research assistance from Annette Weier, and benefited from helpful comments from a number of people. I would like to thank Neil Byron, Gavan Dwyer, Geoff Edwards, Steve Hatfield-Dodds, Warwick Gullett, Lindsay Hogan, Phil Hughes, John Quiggin, Roger Rose, Ian Wills, and Mike Young.

[†] Presidential address presented at the 50th Annual Australian Agricultural and Resource Economics Society Conference, Manly, New South Wales, 8–10 February 2006, Deborah C. Peterson (email: dpeterson@pc.gov.au) Productivity Commission, LB2 Collins Street East, Melbourne, Victoria, Australia, 8003.

Note: The views expressed in this paper do not necessarily reflect those of the Australian Government or the Productivity Commission.

of harm. Prior to its introduction, pollution controls had been rejected due to absence of definitive proof of environmental damage.

The principle originated in Europe in the early 1970s, but it was not until the 1992 United Nations Conference on Environment and Development that it achieved broad international recognition (LaFranchi 2005). The principle was included in the 1992 Rio Declaration on Environment and Development as part of the broader framework for sustainable development. It was further promulgated in the 1992 UN Framework Convention on Climate Change and the 1992 UN Convention on Biological Diversity. The precautionary principle has, since then, spread rapidly in multilateral agreements, international laws, and domestic laws and policies.

In practice, the precautionary principle has proven difficult to apply, due largely to the absence of a clear formulation of the principle, and a lack of clear guidelines on when and how to apply it. This has created difficulties for public decision-makers, uncertainty for business, opportunities for legal challenges to environmental policies and regulatory decisions, and the potential for its misuse as a barrier to trade.

This paper begins by examining key formulations of the principle. A classification system is described and applied and the significance of differences between various formulations is highlighted. Frequently raised concerns are then discussed. Australian definitions of the principle and key legal decisions on its application are considered next. A number of the implementation problems experienced in Australia result from the absence of official guidelines to assist decision-makers. An assessment of a number of overseas guidelines concludes the paper. These may provide a useful starting point for developing Australian guidelines for managing uncertainty in significant environmental problems.

2. The meaning of precaution

There is no universally accepted definition of the principle. Although most share common features, the differences between the various formulations complicate the task of interpreting what the principle means and how it should be applied. In this section, a classification system proposed by Cooney (2005) is discussed, and the range of potential precautionary actions is noted. Finally, the question of whether the concept of precaution constitutes a principle or an approach is canvassed.

The most widely cited definition of the principle is that contained in the Rio Declaration:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (Principle 15, Rio Declaration on Environment and Development 1992)

However, there are many alternative definitions and interpretations that complicate the principle's application. The main differences are:

- What level (threshold) of threat or potential for harm is sufficient to trigger application of the principle?
- Are the potential threats balanced against other considerations, such as costs or non-economic factors, in deciding what precautionary measures to implement?
- Does the principle impose a positive obligation to act or simply permit action?
- Where does the burden of proof rest to show the existence or absence of risk of harm?
- Is liability for environmental harm assigned and, if so, who bears liability?

Based on these differences, Cooney (2005) suggests categorising the different versions of the principle as 'weak', 'moderate', or 'strong' (adapted from Wiener 2002).

Most of the influential international definitions of the principle, such as those contained in the Rio Declaration and other UN agreements, fall into the weak (or least restrictive) category. A key characteristic of the weak formulation is that 'lack of scientific certainty should not be used as a reason for postponing action'. Weak formulations act as a 'rebuttal to the mistaken claim that uncertainty warrants inaction' (Wiener 2002, p. 1520). However, this form does not require action to prevent environmental damage, even if the threshold of threat has been satisfied.

Under the weak form, the precautionary principle comes into play when threats of harm are 'serious', 'irreversible', or 'significant'. To satisfy the threshold of threat, there must be some evidence relating to both likelihood of occurrence and severity of consequences. Scientific uncertainty alone, or the possibility of environmental damage below the threshold level, will not satisfy the threshold test.

Many, but not all, weak formulations are qualified by an explicit requirement to consider the costs of precautionary measures. For example, both the Rio Declaration and the UN Framework Convention on Climate Change require precautionary measures to be 'cost-effective'. Cost-effectiveness means achieving the stated objective using the minimum level of inputs, and is often used as an alternative to cost-benefit analysis for cases where benefits can be identified but are difficult to value. A cost-effectiveness study cannot by itself demonstrate a conclusive case for or against the appropriateness of a proposal. However, weak versions do not *preclude* a weighing up of benefits against costs. Economic considerations (among others) may provide legitimate grounds for postponing action, even though lack of scientific certainty may not.

Under weak formulations, the requirement to justify the need for action (the burden of proof) generally falls on those advocating precautionary action. No mention is made of assignment of liability for environmental harm.

In moderate versions, the threat of environmental damage justifies or requires action to address the threat. An example is the Ministerial Declaration of the Third International Conference on the Protection of the North Sea:

The participants . . . will continue to apply the precautionary principle, that is to take action to avoid potentially damaging impacts of substances that are persistent, toxic, and liable to bioaccumulate even where there is no scientific evidence to prove a causal link between emissions and effects. (Ministerial Declaration 1990)

In practice, such formulations might not be as different from weak versions as they may first appear, because precautionary measures include 'wait and see' approaches (see below). However, the language is suggestive of stronger forms of action. In addition, there are usually no explicit qualifications requiring proposed precautionary measures to be assessed against factors such as economic or social costs. The trigger for action may be defined less rigorously, for example, as 'potential damage', rather than 'serious or irreversible' damage as in the weak version. Liability is not mentioned, and the burden of proof remains unchanged.

Strong versions of the principle differ significantly from the weak and moderate versions in reversing the burden of proof. An example is the 1998 Wingspread Statement:

When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context the proponent of an activity, rather than the public, should bear the burden of proof. (Wingspread Statement on the Precautionary Principle 1998)

Like moderate formulations, strong versions justify or require precautionary measures. The threshold for action varies, sometimes expressed simply as 'harm'. Some strong versions, for example, that of Earth Charter, establish liability for environmental harm:

Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach. . . . Place the burden of proof on those who argue that a proposed activity will not cause significant harm, and make the responsible parties liable for environmental harm. (Article 6, Earth Charter 2000)

Under the reversal of proof, proponents of an activity with any potential for harm are required to prove that the product, process or technology is sufficiently 'safe'. Virtually no human actions are risk free, including actions designed to address environmental degradation. Inherent scientific uncertainty, which the precautionary principle is designed to address, thwarts attempts to

definitively prove safety, even for products and processes for which no plausible hazards have been identified. At the extreme, such a requirement could 'involve bans and prohibitions on entire classes of potentially threatening activities or substances, without the option for proponents or others to demonstrate that they are harmless' (Cooney 2005, p. 7). However, the standard of proof, such as 'reasonable certainty' of safety or safety 'on the balance of probabilities', can moderate the potential negative economic and social impacts from reversing the burden of proof.

Official statements of the precautionary principle do not generally fall within the strong category. Most strong versions are framed by private organisations. As such, they have no international or domestic legal status – yet they are frequently cited by critics of the principle. Earth Charter, for example, is a community-based environmental organisation, and the Wingspread Statement emerged from a conference of 32 scientists, academics, and environmental activists.

The particular formulation of the precautionary principle applied by decision-makers will be a major factor determining the economic consequences of precautionary measures (discussed in section 3).

Much opposition to the application of the precautionary principle derives from a belief that it requires the prohibition of activities associated with uncertain, but potentially serious, environmental damage. Yet no formulation of the principle specifies the nature of any precautionary measures that must be taken. There are many ways to approach and implement precaution (see, for example, CEC 2003).

Examples of possible precautionary measures include a 'wait and see approach' where the issue is reviewed when better information becomes available; adoption of flexible policies that can be adapted in response to new information; and prohibition (either temporary or permanent). Options may be combined; for example, an action might be temporarily prohibited while research of alternative options is undertaken. The appropriate course of action will depend on the circumstances, which include:

1. The extent and significance of the information gaps and uncertainties, and the prospects and costs and benefits of obtaining better information.
2. The seriousness of possible hazards, including the possibility of catastrophic events, and society's degree of risk aversion.
3. The incidence of damage; for example, whether those likely to be most seriously affected are children (where larger safety factors are often applied), whether adverse effects are concentrated on future generations, or whether environmental impacts will have large flow-on effects through ecological systems.
4. The capacity and costs of altering policies in the future, which may depend on whether policy measures would require, or generate incentives for, long-lived investments.
5. The potential costs and benefits to society of each alternative action.

There has been considerable debate over whether the various expressions of the concept of precaution are appropriately described as a 'principle' or as an 'approach'. A dictionary definition of a principle is 'a fundamental truth or law as the basis for reasoning or action' (Moore 2004). Opponents to the label 'principle' consider that the concept falls well short of this standard. Some suggest that the use of the term 'principle' dictates a 'hard line' approach involving mandatory risk-averse action whenever there are potential threats to the environment or to human health, and regardless of any balancing of costs and benefits (Graham 2004; Cooney 2005). A precautionary 'approach' is argued to allow for flexible context-specific measures, a balancing of various objectives, and a weighing of expected costs and benefits (OIRA 2003; Cooney 2005).

There is also debate over the legal status of the term 'precautionary principle'. Despite broad application of the precautionary principle in international law and policies, and its prominent role in several trade disputes, the OECD notes that none of the international tribunals that have dealt with cases involving the principle has 'clarified the legal status of precaution, nor confirmed the existence of a precautionary principle as a principle of international law' (OECD 2002, p. 13). Considerable conflict remains between the EU view of the principle as a 'general customary rule of international law' and the US view that the principle is no more than 'an "approach" – the content of which may vary from context to context' (WTO Appellate Body Report, quoted in Sindico 2005, pp. 27–28).

Despite questions over the legal standing of the precautionary principle, and debate over its status as a 'principle', it is clear that precaution is widely applied in decision-making concerning environmental and natural resource management. Widespread application indicates that, regardless of whether it is described as a principle or as an approach, precaution is used by many decision-makers responding to uncertainty.

The most important factor influencing outcomes is how precaution is actually implemented in decision-making. Clear implementation guidelines may potentially resolve many of the underlying difficulties perceived to arise from the use of the term 'principle' in the context of precautionary decision-making. For the purposes of this paper, the two terms will be used interchangeably.

3. Concerns related to the precautionary principle

Critics have identified potential problems with application of the precautionary principle, including environmental harm and the imposition of significant costs on society. The likelihood of these problems depends on the principle's formulation and implementation. Careful definition and good design of implementation guidelines may help avoid many of these problems. The most frequent criticisms are considered below.

Some commentators note that the definitional problems involved in implementing the principle are likely to confer a high degree of discretion on decision-makers (Wills 1997; PC 2004). Excessive discretion may lead to unpredictable

and inconsistent environmental management decisions, which create uncertainty and higher costs for businesses (Wills 1997; Harding and Fisher 1999).

A lack of clarity in how decisions have been made opens up opportunities for legal challenge, and the potential for courts to adopt an interpretation of the precautionary principle at odds with that intended by the policy maker. As Segal observes: 'To leave the entire application of the principle to judicial discretion does not provide industry with sufficient guidance or certainty' (Segal 1999, p. 77). Some urgency attaches therefore to the development of guidelines that place the precautionary principle within a framework of good regulatory practice.

Some critics oppose the precautionary principle on the grounds that a reversal in the burden of proof imposes excessive costs on developers and producers. Most regulatory regimes, such as development approvals and licensing systems, require developers and producers to provide, at their own expense, evidence about the proposed activity and its consequences. It is not clear, except perhaps under some strong versions of the principle, that a reversal in the burden of proof under the precautionary principle would be significantly more onerous than existing obligations. A more important factor influencing the costs of proposals may be the standard of proof. Further, assignment of the burden of proof does not necessarily dictate who will pay the costs of scientific assessment of safety.

Concerns have also been expressed that application of the precautionary principle may distort regulatory priorities (Majone 2002), by causing a loss of focus on the most dangerous hazards (Goldstein and Carruth 2003), and redirecting regulatory attention from 'known or plausible hazards to speculative and ill-founded ones' (Graham 2004, p. 1). Distortions to regulatory priorities are less likely under weak formulations of the principle, which require that potential hazards are 'serious or irreversible', often qualified by a requirement for an assessment of costs.

A frequent criticism is that application of the principle will stifle technological innovation and paralyse development (Goldstein and Carruth 2003; Graham 2004; Hahn and Sunstein 2005). Weak versions of the principle are unlikely to have this effect as they do not require precautionary measures and there is no reversal of the burden of proof. The effect of stronger versions will depend on how they are implemented, including, for example, the standard of proof of safety that is required.

Supporters of the principle suggest that its application may promote development and implementation of safer, technologically feasible, and commercially viable alternatives that are discounted when potential hazards to the environment or human health are ignored (EEA 2001; LaFranchi 2005). A UK Government working group, for example, found that:

Properly applied it is a positive, proportionate policy tool to encourage technological innovation and sustainable development by helping to engender stakeholder confidence that appropriate risk control measures are in place. (ILGRA 2002, p. 4, emphasis added)

Some critics highlight the costs of measures taken to avoid potential, but uncertain, risks (Cross 1996). Such criticism frequently overlooks or discounts the potential benefits from precautionary measures, such as avoiding or minimising damage to human health and/or the environment. Case studies presented by the EEA (2001) indicate substantial benefits from avoiding some hazards. Of course, due to the existence of uncertainty, some anticipated hazards may prove to be either overestimated or unfounded (see, for example, the case studies in Lieberman and Kwon 2004).

The European Energy Agency suggests that benefits from precautionary measures may be overlooked because 'the costs of preventative actions are usually tangible, clearly allocated, and often short-term, whereas the costs of failing to act are less tangible, less clearly distributed, and usually longer term' (EEA 2001, p. 3). In addition, scientific uncertainty about the probability of harm, or even about the specific nature of potential hazards, may lead to a downgrading of the estimated benefits from avoiding such hazards.

If such hazards do not eventuate, expenditures on measures to avoid the potential hazard may be seen by some as 'wasted'. Although this may be true in hindsight, some forms of precautionary action (involving costs) are akin to taking out insurance – just because the house does not burn down, for example, does not mean that it was the wrong choice to take out homeowner's insurance. Even if an expected hazard does not eventuate, a decision to take regulatory measures to avoid it will be optimal *ex ante* provided: (i) the expected benefits of precautionary measures outweighed the expected costs; (ii) the most cost-effective and efficient alternative was chosen; and (iii) all relevant information available at the time was taken into account. Decisions applying precaution within the context of a consideration of costs and benefits are most likely to satisfy these criteria.

A common criticism is the potential for perverse consequences. Wills, for example, argues that, where precautionary measures are costly but ultimately revealed to be ineffective, 'a risk-averse society could make things worse' (1997, p. 58).

Goklany (2001), Cross (1996), and Lieberman and Kwon (2004) present a large number of examples where regulations had perverse impacts. Perverse outcomes generally result from a failure to recognise that regulatory measures have costs, as well as benefits, and may themselves give rise to risks (OIRA 2003; Hahn and Sunstein 2005). This is really a failure of the application of the principle, rather than of the concept itself. The potential for perverse outcomes can be reduced by thorough assessment of the costs, risks, and consequences of the policy options as well as of the potential environmental hazard, using the best information available at the time. Decision makers may have to determine appropriate risk trade-offs where all of the alternatives have associated risks.

Full assessment of potential hazards and of policy options for addressing these hazards, although seen as desirable, has been criticised as unrealistic and too demanding of information (Wills 1997; Goklany 2001). The precautionary

principle was specifically formulated to assist decision-makers in circumstances of limited information and scientific uncertainty. Implementation guidelines should ideally give decision-makers guidance on how to deal with information gaps and conflicting scientific opinions.

A final common concern is that the precautionary principle is open to misuse and opportunistic manipulation by rent-seeking commercial interests (Treich 2001; Majone 2002; Graham 2004), and that the precautionary principle may be used as a disguised form of protectionism. Commercial interests, for example, may oppose a new product or process that would compete effectively with existing products or processes on the grounds that it may have unproven adverse environmental or health impacts.

The principle has been implicated in a number of international trade disputes. For example, the EU has referred to the precautionary principle, and a desired high level of protection, to justify import barriers to hormone-treated beef and genetically modified food products. The USA (and other countries) challenged the import bans on the grounds that there was no scientific evidence of potential harm to human health from either the hormones used in beef or from genetically modified foods.

The WTO Agreement on the Application of Sanitary and Phytosanitary Measures requires that precautionary measures are taken in the context of risk assessment and identification of potential hazards. Although the WTO upheld the European Union's right to determine an appropriate level of protection for its citizens, it decided in 1998 that the ban on hormone-treated beef was in breach of the Agreement because no risk assessment had identified plausible health risks from the hormones used to produce the beef (WTO 1998). This decision accords with the OECD view that:

Invoking precaution in situations where . . . there is no risk, or the risk is very negligible, or where there is a perceived risk for which there is no scientific basis, may be seen as a misuse, or abuse, of the concept. Such abuse could lead to undesired consequences, such as imposing disproportionate costs on society and business, stifling technological innovation, or creating unjustified trade barriers. (OECD 2002, p. 8)

In summary, some of the alleged shortcomings of the precautionary principle appear to be due to a lack of care in interpretation and application. Many may be avoided or minimised by good implementation processes. Under strong formulations, there may be no attempt to assess the costs, benefits, and risks of various hazards and options to prevent them. Implementation of precautionary measures that are not justified by some weighing of potential costs and benefits may expose society to substantial costs with, in some cases, no real benefits for the environment or for human health.

Weak formulations of the principle generally avoid many of these problems. They draw attention to the issue of uncertainty, but do not allow the mere existence of uncertainty to justify taking any particular action. Weak versions

incorporate thresholds of harm to avoid taking inappropriate actions to address trivial risks. Some weak statements of the principle require cost-effectiveness analysis. Guidelines developed to support application of the principle could require some form of modified cost–benefit analysis to ensure that expected benefits outweigh expected costs.

Although guidelines will assist decision-makers in applying the principle, a legal statement requiring precaution in decision-making still has a role to play. Without a legal foundation for the application of precaution, decision-makers may lack sufficient authority and/or incentives to take precautionary decisions.

4. Australian application of the precautionary principle

The precautionary principle is already firmly established in Australian environmental and natural resource management legislation. It is incorporated in a number of international treaties and agreements that Australia is party to, as well as a multitude of domestic policies and statutes (Dovers 2002; Peel 2005).

Precautionary principle provisions are included in Australian legislation and policies in various ways – either directly as a legislative objective or substantive legal provision, or implicitly through reference to the principles of ecologically sustainable development (ESD). In addition, it may be legally relevant ‘because its widespread acceptance in the environmental policy context has imbued it with general relevance for environmental decision-making’ (Gullett 2006, p. 186).

The precautionary principle is one of seven guiding principles enunciated in the 1992 National Strategy for Ecologically Sustainable Development (NSES). It is also one of four guiding principles of ESD included in the Inter-Governmental Agreement on the Environment (IGAE), which provides an overarching framework for environmental and natural resource management. The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), which applies to a broad range of environmental, natural resource management and conservation activities, requires the Minister for the Environment and Heritage to consider the precautionary principle in decision-making (s. 391(2)).

Definitions of the precautionary principle in Australian and State legislation and policies are generally similar, in many cases modelled on, or referring directly to, the definition in the IGAE (Peel 2005). The IGAE states:

Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by: (i) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment; and (ii) an assessment of the risk-weighted consequences of various options. (Australian Government 1992, para. 3.5.1)

Most definitions refer to a risk of serious or irreversible harm. The majority state that a lack of full scientific certainty is not a reason to postpone measures to protect the environment, so that they do not require action.

Not all definitions include reference to measures being 'cost-effective' or to an 'assessment of risk-weighted consequences'. However, decision-makers applying definitions that do not make reference to costs or consequences, such as the EPBC Act, may nevertheless be influenced by the NSESD and IGAE provisions, either because they refer to these directly or because of their overarching nature. These provisions require that economic, social, and equity considerations are taken into account in decision-making, which could moderate the application of the precautionary principle (Harding and Fisher 1999).

In much legislation, the precautionary principle is one of a number of factors to be taken into account in any particular decision, such as in the formulation of management plans under the Great Barrier Reef Marine Park Act 1975, and in determining total allowable catch limits under the NSW Fisheries Management Act 1994 (s. 30). The Fisheries Management Act 1991 (Cth) (ss. 3–4) requires decision-makers to pursue fisheries exploitation objectives in a manner consistent with the precautionary principle simultaneously with more traditional fisheries management objectives of optimal resource utilisation and economic efficiency, and compliance with international fisheries laws and agreements.

Despite broad application of the principle to environmental and natural resource management issues, no official implementation guidelines have been adopted. As Gullett concludes:

Existing legislative and policy formulations are too vague or ambiguous to enable it [the precautionary principle] to be implemented systematically. Its practical use is currently limited because decision-makers are not bound to apply it and are in doubt as to how to apply it. (1997, p. 64)

The absence of implementation guidelines provides decision-makers with a significant degree of discretion, but also can generate extra costs for government agencies if those adversely affected by regulatory and policy decisions mount a legal challenge. In addition, businesses and individuals may incur costs as a result of uncertainty about the application of precaution or inconsistency in administrative decision-making, for example, by applying for approvals for which they have little chance of success.

There are a growing number of legal decisions involving the precautionary principle. Virtually all Australian cases have involved merits review of administrative decisions by tribunals or specialist courts, which have authority to substitute a new decision for the one under review. These tribunals and courts reach their own conclusions about the merits or reasonableness of the decision under review, which may involve examination of how the precautionary principle has been applied in the decision-making process.

To date, there has been no judicial review of the legality of the precautionary principle itself. Such review could potentially clarify the legal standing and interpretation of the principle in Australia, increasing certainty for those operating under the legislation and reducing litigation and the associated costs. Where court interpretations differ from those intended by policy-makers, clarification of the courts' approach would facilitate legislative review to ensure that policy-makers' intentions are accurately embodied in legislation.

The most widely quoted legal case on the application of the precautionary principle in Australia is that of *Leatch v National Parks and Wildlife Service* (1993) 81 LGERA 270. In that case, Justice Stein accepted, in the NSW Land and Environment Court, the relevance of the precautionary principle in the context of a lack of scientific certainty about the impact of a proposed road on an endangered frog species. Justice Stein considered the principle to be a 'statement of common-sense', requiring decision-makers to adopt a 'common-sense duty to be cautious' where scientific uncertainty exists. Justice Stein's ruling discussed methods of balancing different factors in decision-making. He emphasised that taking a precautionary approach did not require a 'no risk' policy but did require consideration of alternatives that protect the environment.

The ruling in the case overturned the decision to proceed with construction of the proposed road on the grounds that there had been insufficient consideration of less environmentally damaging alternative routes. Justice Stein made clear his view that the precautionary principle was not simply a means of accounting for uncertainty in isolation but required the adoption of decision-making procedures that balanced economic cost-benefit analyses, scientific uncertainty, and social concerns (Fisher and Harding 2001). In finding that an alternative road route had been rejected on the basis of a cost-benefit analysis that did not include environmental factors, Justice Stein stated:

There are a number of environmental economic models which factor environmental values into cost/benefit analysis. Surely an approach which attempts to integrate economic and environmental factors is preferable. (*Leatch v National Parks & Wildlife Service* (1993) 81 LGERA 270, pp. 285-6)

While the Leatch case has been widely referred to in subsequent legal cases, most emphasis has been placed on the finding that the precautionary principle is a 'common-sense duty to be cautious', with much less attention given to Justice Stein's comments about the need to balance economic, environmental, social, and other factors (Fisher and Harding 2001). Legal interpretations of the precautionary principle as a matter of 'common sense' provide little guidance to decision-makers on the procedures that should be followed to implement the principle, how it should be weighed against

conflicting factors, or what action is required. Consequently, uncertainty remains about what decision processes to implement in order to satisfy the courts, in the event of legal challenge, that due regard has been given to the principle (Gullett 2006).

In addition, there is some doubt about whether the principle is legally binding, when no statutory directions to apply or take account of the precautionary principle are included in the legislation in question (Bates 2002). Legislative provision for the precautionary principle, such as s. 30(2)(c) of the NSW Fisheries Management Act 1994, would clarify for decision-makers and those affected by their decisions when the principle is 'a legally relevant, and therefore an obligatory consideration, in decision-making' (Bates 2002, p. 132).

Balancing of the various factors involved in precautionary decision-making, including taking into account society's risk preferences, is appropriately a matter for governments, rather than courts. In *Greenpeace Australia Ltd v Redbank Power Co Pty Ltd* (1994) NSWLEC 178, development consent for a power station was opposed on the grounds that it would contribute to greenhouse emissions. In rejecting the application, the NSW Land and Environment Court stated that 'application of the precautionary principle dictates that a cautious approach should be adopted in evaluating the various relevant factors in determining whether or not to grant consent; it does not require that the greenhouse issue should outweigh all other issues'. Evaluation of the various factors was seen as 'a matter of government policy'.

Some commentators have been concerned that, without clear guidelines, decision-makers may pay only 'lip service' to the principle (Bates 2002, p. 132). Others consider that almost any decision can be seen as applying a precautionary approach (Fisher and Harding 2001). This view appears consistent with that expressed by Justice Talbot:

... the precautionary principle adds nothing to the consideration that the Court undertakes by applying common sense. (*Alumino (Aust) Pty Ltd v Minister Administering the Environmental Planning & Assessment Act 1979*, unreported, Land and Environment Court, Talbot J, 29 March 1996).

Similarly, in *Friends of Hinchinbrook Society Inc v Minister for the Environment* (1997) 142 ALR 632 in the Federal Court, the Minister was considered to have taken a cautious approach by addressing the risks to World Heritage values identified in scientific and other reports available to him even though the precautionary principle was not explicitly mentioned in his decision. In many court judgements, application of the precautionary principle has apparently added little to conventional decision-making 'given that caution and commonsense are generally assumed to form the basis of environmental decision-making and review' (Peel 2005, p. 204). However, as Gullett points out, in 'the absence of a unified detailed conceptualisation of the principle

. . . courts have had little ability to identify its legal content and have generally deferred to a department's interpretation or application of legislation' (2006, p. 187).

Implementation guidelines, and legislative provisions clarifying when the principle is to be applied, could promote consistency and greater certainty in its application. Guidelines would also provide decision-makers with techniques for dealing effectively with uncertainty and information gaps (Peel 2005). It is important to note, however, that some scope for administrative discretion will remain, just as it does in decision areas not affected by significant uncertainties. Attempts to eliminate discretion would result in excessive prescription and removal of the flexibility needed to take into account the circumstances of each case.

Despite the threshold of threat being 'serious or irreversible damage to the environment' in the IGAE and in most Australian legislation, Gullett (2006) identifies two divergent trends in rulings on the threshold for application of the principle in Australian case law. In several merits reviews of fisheries management decisions, the Administrative Appeals Tribunal accepted the existence of uncertainty about the impacts of commercial fishing as sufficient to trigger the threshold for applying precaution in decision-making, although there was no evidence of a threat of serious or irreversible damage (Peel 2005; Gullett 2006). In contrast, in merits reviews of development decisions, courts have required credible evidence of 'serious or irreversible damage' in order to satisfy the threshold of threat (Gullett 2006).

In determining what evidence of harm will satisfy the threshold, it appears that the courts have required more rigorous evidence in small-scale planning matters where the issues and uncertainties are seen as fairly straightforward. In natural resource management decisions, involving more complex issues, large information gaps, high levels of scientific uncertainty, and the potential for serious and long-lasting damage in large ecosystems, the courts have accepted less-objective evidence of threat as sufficient to satisfy the threshold test. Gullett concludes that 'no clear rule can be discerned from the cases', with decisions being context specific (2006, p. 194).

Unpredictability creates uncertainty and costs for businesses and others subject to precautionary decisions. As Gullett notes, although the precautionary principle is not a 'rigid rule', a threshold has been expressed in Australian legislation and 'some legal meaning must be ascribed to it so that the principle cannot be a complete shield for public decision makers and a blanket excuse for arbitrary action in the infinite number of environmental issues where uncertainty exists' (2006, p. 199). Decision makers and those affected by the decisions would benefit from access to guidelines that specify the nature and amount of evidence required to satisfy the threshold in different contexts. For example, evidentiary requirements may vary according to the level of uncertainty (such as where credible evidence demonstrating a potential hazard is unavailable) or the potential for large negative consequences (such as the catastrophic outcomes of climate change predicted by some scientists).

5. Implementation guidelines

Many of the shortcomings of the precautionary principle result from a failure to place its application within a framework of good regulatory practice. Scientific uncertainties and the potential for serious, irreversible or even catastrophic harm do not exempt precautionary decision-making from normal standards of good regulatory practice. Without a full assessment of the costs, benefits, and risks of alternatives, arbitrary invocation of the precautionary principle risks substituting one type of damage to the environment and human health with other unforeseen environmental and public health damage (see section 3 and the examples given in Cross 1996; Goklany 2001; Lieberman and Kwon 2004; PPP 2005). At the same time, substantial economic and social costs may be incurred, potentially leaving society worse off.

Questions that remain problematic under most formulations of the principle include (Wills 1997; Harding and Fisher 1999; Marchant and Mossman 2004; Cooney 2005):

- How to treat conflicting or incomplete scientific information and opinion
- How to evaluate uncertainties and incorporate such evaluations into decision-making
- How to choose ‘between different courses of action or conservation strategies which may each pose risks, of different sorts and over different timescales’ (Cooney 2005, p. 12)
- How to balance competing interests and address distributional consequences

Internationally, increasing attention has been devoted in recent years to developing guidelines to apply the precautionary principle. Little critical attention has been given to these frameworks in Australia (Fisher and Harding 2006).

The guidelines considered below are those developed by the European Commission (EC) in its 2000 *Communication from the Commission on the Precautionary Principle* (EC 2000) and the US Office of Information and Regulatory Affairs within the Office of Management and Budget (OIRA 2003).

These sets of guidelines for applying precaution in regulatory decision-making are assessed against criteria for good regulatory practice (adapted from Argy and Johnson 2003), that is, regulations should be:

- The minimum necessary to achieve desired objectives
- Not unduly prescriptive
- Accessible, transparent and accountable
- Integrated and consistent with other regulation and international obligations
- Communicated effectively
- Proportionate to the problem and set at a level that avoids unnecessary costs
- Enforceable

The focus is on identifying whether the guidelines help to ensure that decisions (including decisions to take no action or to defer action until more information is available) will be efficient, cost-effective, and appropriate. Guidelines by the UK Government's Inter-Departmental Liaison Group on Risk Assessment (ILGRA 2002), and those recently released by the Precautionary Principle Project (PPP 2005) are discussed in Peterson (2006).

The European Commission's 2000 Communication places the precautionary principle within the existing framework of risk analysis (EC 2000; Loefstedt 2004). The stated aim is to establish guidelines for applying the principle and to 'avoid unwarranted recourse to the precautionary principle, as a disguised form of protectionism' (EC 2000, p. 3). Decisions must be based on scientific risk assessments and satisfy the following criteria:

1. Scientific evidence of risk – 'Before the precautionary principle is invoked, the scientific data relevant to the risks must first be evaluated.' (EC 2000, p. 14).
2. Proportionality – '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.' (EC 2000, p. 18) Decision-makers must consider less-restrictive alternatives that make it possible to achieve an equivalent level of protection.
3. Non-discrimination and consistency – 'Comparable situations should not be treated differently and different situations should not be treated in the same way.' (EC 2000, p. 4).
4. Examination of costs and benefits – The overall costs (including noneconomic considerations) of action and inaction must be compared. An economic cost-benefit analysis should be undertaken where possible (EC 2000, p. 19).
5. Examination of scientific developments – Precautionary measures should be maintained as long as the scientific data are inadequate, imprecise, and inconclusive, and as long as the risk is considered too high to be imposed on society (EC 2000, p. 5).
6. Assignment of responsibility for producing scientific evidence – While there will often be a reversal of proof, where the proponent of an activity must provide reasonable evidence of safety, 'such an obligation cannot be systematically entertained as a general principle' (EC 2000, p. 21). In some cases, there will be benefit in research funded by the public.

The guidelines developed by the European Commission demonstrate many features of good regulatory practice. In requiring formal assessments of costs and benefits, risk calculations, and a clear statement of the assumptions used in decision-making, the EC guidelines should improve the transparency, accountability, and consistency of decision-making. In addition, application of these guidelines – by placing constraints on the way the precautionary principle is to be incorporated into decision-making – modifies the practical effect of moderate and strong versions of the principle. The guidelines may

effectively 'weaken' more stringent statements of the principle and thereby avoid some of the associated problems (real or perceived). The guidelines require that the type of precautionary regulation adopted should be the least restrictive regulation needed to achieve the desired outcome, in order to avoid imposing unnecessary costs on society and on those directly affected.

The reversal in the evidentiary burden envisaged in the guidelines has the potential to detract from the quality of regulatory decision-making if applied indiscriminately. However, the guidelines state that proponents of new products, technologies, and processes will be required to prove that regulation is not justified only in cases where a reversal in the burden of proof is judged to maximise benefits to society. Reversal of the evidentiary burden is not proposed to apply across the board to all regulatory decisions. This limit on the reversal of the burden of proof may reduce potential negative impacts. In addition, the standard of proof required to be demonstrated by proponents of an activity is important in determining the economic and social impacts of reversing the burden of proof. While the standard of proof is not defined in the EC guidelines, the target of a high, but not zero, level of protection suggests that the standard of proof adopted in each case is likely to require a reasonable degree of certainty.

The US has also developed guidelines for the application of precaution in regulatory decision-making. While the US Government denies the existence of a 'precautionary principle' (Graham 2004), the Office of Information and Regulatory Affairs states:

The United States employs precautionary approaches throughout the process of risk assessment and management so that the overall level of precaution in a given regulatory decision is appropriate. (OIRA 2003, p. 54)

The US view is that precaution can only be sensibly applied within a framework of risk management (Graham 2004). Decision making that incorporates precaution must be:

1. Based on an assessment of costs and benefits, and targeted towards government objectives – 'When Federal decision-makers decide the appropriate level of precaution in a specific decision, they need to consider . . . factors such as technological and economic feasibility, or more holistic benefit-cost balancing, including considerations of countervailing risks, depending on the statutory requirements to protect the public and the environment, and improve societal welfare' (OIRA 2003, p. 62).
2. Transparent and accountable – 'new Office of Management and Budget (OMB) guidelines for regulatory analysis require agencies to support rulemakings with formal probabilistic analysis of the key scientific and economic uncertainties regarding costs and benefits' (OIRA 2003, p. 59).
3. Based on scientific evidence – 'decisions about how to respond to a potential hazard are intended to be made after – and are informed and guided by

- a scientific risk assessment that is grounded in the weight of the scientific evidence’ (OIRA 2003, p. 53).
4. Subject to review and flexible enough to deal with new information – ‘the ability to modify policies as scientific understanding grows is critical to the appropriate application of precaution. The information collection, risk assessment, and risk management phases are not static’ (OIRA 2003, p. 57).

Like the EC guidelines, the US guidelines demonstrate many of the features of good regulatory practice. There is an emphasis on weighing the costs and benefits of regulation to the community, through formal risk assessment and cost–benefit analysis. Regulations incorporating precaution must be performance- and outcomes-focused, transparent, and accountable, and targeted at achieving statutory objectives. They are open to review and modification when new scientific information becomes available.

Although the US guidelines do not specifically mention a reversal in the burden of proof, some US regulations impose a requirement on proponents of new products, technologies, or processes to prove why approval to market or use the product, technology or process should be granted. For example, requirements for premarket approval prevent the sale or use of certain products, such as food additives, medicines, medical devices, and pesticides, unless they are proven to meet specified safety requirements. Mandatory operating permits prevent the operation of hazardous waste facilities, nuclear power plants, fishing activities, trade in endangered species, and other business activities without some prior demonstration of safety or the absence of significant environmental damage (CEC 2003; Vogel 2003). The standard of proof adopted is generally ‘reasonable certainty’.

There appear to be significant areas of agreement between the US and EC guidelines for implementing the precautionary principle. Some commentators have argued that the USA and Europe are converging in their approaches to applying precaution (Wiener 2003; Christoforou 2004; Loefstedt 2004). Differences remain in the weight placed upon formal scientific and quantitative assessments compared to more qualitative risk assessments, the treatment of uncertainty, and the types of risks considered most serious (Vogel 2003; Wiener 2003; Christoforou 2004).

6. Conclusions

A common misconception is that the precautionary principle requires action or a certain type of action. In fact, internationally accepted definitions (‘weak’ or less restrictive formulations) are about decision-making processes – they neither prescribe action nor any particular action. This paper argues that less restrictive formulations of the precautionary principle are generally to be preferred to stronger versions. Weak formulations can serve as a useful reminder to decision-makers that inaction is not necessarily the optimal response to uncertainty. They provide greater guidance to decision-makers on

thresholds for action. In addition, definitions incorporating 'cost-effectiveness' or 'assessment of the risk-weighted consequences of various actions' provide a legal backing, as well as explicit incentives, for decision-makers to take into consideration the costs, benefits, and risks of alternative responses to uncertain hazards. Weak versions thus provide greater legal support for the application of implementation guidelines advocated in this paper. Most official versions, including Australian government statements of the principle, fall into the weak category.

The precautionary principle is, and will remain, challenging to apply. Decision-makers must make judgements or assumptions about the range of possible outcomes, the effectiveness of various options to address the problem, and the assumed probabilities attached to the range of outcomes. Subjective judgements of this nature are unavoidable when there is genuine uncertainty. Decisions will also need to be made about what level of risk society is prepared to accept in various contexts.

Although applying precaution will always involve some degree of subjectivity, the development of clear guidelines for applying the precautionary principle nevertheless has major benefits. Placing the principle within the context of good regulatory practice helps to ensure that decision-making is transparent, consistent, and accountable; that it uses all relevant information; that costs, benefits, and risks are identified, assessed, and compared; and that measures are targeted at, and proportionate to, the problem. This decision-making framework will help avoid many problems potentially arising from application of the principle, including the risk of perverse outcomes, over-reaction to trivial risks, and misuse as a rent-seeking (or protectionist) measure.

Without guidelines, Australian applications of the principle may suffer from a lack of clarity about implementation procedures, leading to inconsistencies, uncertainties, and legal challenge to environmental and natural resource management decisions. A challenge for agricultural and resource economists is to contribute to the development of guidelines for precautionary decision-making in the environmental and natural resource management area.

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