The Cautious Society? An Essay on the Rise of the Precautionary Culture

The Precautionary Principle or Striving for Ignorance

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This essay is the result of a scientific co-operation of both authors –on their own accord- on the subject of the Precautionary Principle. It is an elaborate extension of the Dutch HAN-report on the Precautionary Principle [Risico's van Preventie: het Voorzorgprincipe Nader Bekeken; Risks of Precaution: the Precautionary Principle Scrutinised; ISBN 90-76548-08-0].

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Executive Summary

Why do many (political) discussions come to a standstil when the Precautionary Principle is invoked? A general fear for accepting risks within our society? This report contains three parts. In part one we offer a critique of the Precautionary Principle (PP) as a policy instrument. In part two we illustrate our critique with several examples of detrimental implications of the use of the PP. In part three we offer an historical sketch of how modern Western society has developed three distinct types of dealing with *damage and disgrace* over the last two centuries.

In this executive summary we focus mainly on the content of part one while we add some references to cases we discuss in part two. In this respect this report is part of a recent and growing body of scientific literature, which is critical of the PP. We offer also a critique of the way the European Commission intends to apply the PP. We end with a brief explanatory historical sketch of the so-called *guilt*, *risk* and the *precautionary* culture.

A critique of the Precautionary Principle

Principle 15 of the *Rio Declaration* on the Precautionary Principle reads:[1]

> 'Principle 15
> 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.'

The PP suffers from serious flaws with regard to its logical and rational quality, its legal quality and its moral quality. First, there are problems with the logical and rational quality. Because one authoritative formulation of the PP is lacking, it is unclear what its exact meaning is. This problem is enhanced because every formulation of the PP is ambiguous and can therefore be interpreted in a number of ways. One central ambiguity exists with regard to what science and technology can offer. On the one hand the PP is inspired by a very sceptical view. It is stressed, for instance, that it often takes science a very long time to get the facts right, whereby risks to society are introduced by technology. On the other hand application of the PP often results in utopian demands on science and technology: science is expected to deliver today the conclusive knowledge about the world of tomorrow. Finally, the PP makes more than half blind. It encourages a very partial asymmetric view of reality by focusing only on certain risks one wants to avoid. Therefore it promotes irrational behaviour by the assumption that the costs of avoidance are zero, which is clearly not the case.[2] Moreover, this asymmetry is enhanced by the fact that those who invoke the PP - the policymakers - do not need to adhere to it themselves despite the fact that any human intervention holds uncertainties for the future.[3]

Second, there are problems with the legal quality. We may start with the logical and rational problems mentioned above. A legal principle, which suffers such problems, does not qualify as a sound part of the law, which must have a clear and unambiguous meaning and discourage irrational behaviour. Furthermore, the reversal of the 'burden of proof' results in very steep unequal outcomes for innovators and their critics. Whereas critics are not under any serious obligation to substantiate their allegations, the innovators are often faced with enormous costs. In fact this legal flaw of inequality is also a flaw in economic rationality. It involves the moral hazard of inviting critics to act as 'free riders'. This problem becomes worse as the burden of proof is increased or made absolute. In cases where innovators are required to give proof of no harm, they are given an impossible task. This amounts to a serious legal problem because a duty to do the impossible can never be legally binding. Finally, the application of a legal principle differs from the application of a rule, in the sense that it requires a counter principle. In the application of the PP such a counter principle is absent. It is not surprising that the PP is often used not as a principle but, instead, as a rule. By critics, politicians and judges alike, generally the PP is summarised as the rule of thumb: *When in doubt? Don't!*

Third, the PP is morally flawed. We have already mentioned the moral hazard of inviting opponents of innovation to act as free riders, who can have their desired collective goods without paying for them. The utopian attitude toward science and technology causes moral problems because it encourages people to think that a society free from danger and damage can actually exist and is -with the implementation of the PP- within reach. In this sense the PP clearly belongs to the broader precautionary culture, which entails the view that those in charge of society, economy and science have the duty to prevent all damage, irrespective of cost. It encourages people therefore to become moral free riders by forgetting their own responsibilities. One version of the free rider problem with the PP is that it encourages a NIMBY mentality. Cost-benefit analysis is often criticised for comparing the costs of some to the benefits of others. The PP, however, does not seem to be doing any better. In the case of GMOs, affluent European citizens try to avoid very small potential risks with the result that poor citizens in developing countries have to forgo very reel opportunities for the quantitative and qualitative improvement of their food.[4]

The EC and Precautionary Principle

A critical appraisal of the *Communication on the Precautionary Principle* by the *European Commission* reveals that the *Commission* implicitly adheres to the view that unsubstantiated fears for the high level of safety, which the EU aims for, may lead to a temporary precautionary measure, which *normally* will be a *ban*.[5] It is *not* the scientific substance of the fears that trigger the ban, but the political decision that what is feared offers a serious threat to the high level of safety. Such temporary bans may continue *indefinitely*, as these bans are not bound by time but by scientific progress. However, even when fears are proved to be unfounded as a result of clear and uncontested scientific facts, the ban may be continued as new questions can

always be asked. Science therefore is in essence presented, as just one of many 'readings' of the world, suggesting that no amount of experimentation or evidence would ever suffice to determine the outcome of an issue.[6] Again the question of the safety of GMO foodstuffs is a case in point. Another example is the ban on phthalates.[7] Against the backdrop of this evaluation it is unlikely that such precautionary policies will be acceptable to international bodies like the WTO.

Transforming the Precautionary Principle?

In view of all the problems mentioned above, it is absolutely essential that the PP be transformed. However, we need to keep in mind the basic insight that informed the early development of the PP: we should not wait to take preventive measures until there is a full scientific consensus on the *causal* links with regard to *documented* serious damage. This appears to be the gist of the early formulations, which gradually has been turned upside down to mean that precautionary measures are in order even if there is a scientific consensus on the fact that *no documented* adverse effects exist. We have shown that this development in the meaning and application of the PP has led to irrational, unlawful and immoral consequences.

We believe that two rather simple criteria can be introduced to salvage the PP from its most serious flaws. The first criterion should be that substantial empirical scientific evidence is needed before the PP can be invoked at all. A 'science-first' approach is imperative in order to tackle issues properly and refrain from irrationality.[8] This seems to be in line with the original intentions of those who 'invented' the PP. The second criterion is that the application of the PP should always be *symmetrical*. As the PP is *uncertainty-driven* a symmetrical application of the principle would mean that every activity that is proposed in a policy controversy should be placed under the same set of decisional criteria and the same burden of proof. *In other words: those who invoke the PP must adhere to it themselves.* A broad cost-benefit analysis -including risk-risk analysis- is needed in which the costs and the benefits of all concerned and of both doing and banning are considered. In this sense our proposal implies a continuation of the long existing trend of internalising external costs.

A brief history of the cultures of damage and disgrace

In this paragraph we summarise the historical development of three distinct types of dealing with damage and disgrace. During the nineteenth century we can observe a prevalence of what we might call a *guilt culture*. Here the dominant moral guideline for each citizen was to be careful and take appropriate preventive measures. In principle everyone was expected to carry the economic, social and moral costs of their own lack of careful prevention.

By the end of that century a new approach came to the fore, which was to gain dominance in the industrial society during the twentieth century. In this *risk culture* the dominant moral guideline is that ultimately damage cannot be avoided. It

became to be considered a 'normal' aspect of life, which was not in itself objectionable. However, damage could only be normal as long as it was compensated for. Such compensation was not an individual responsibility, but a task for communities of risk. Within the risk culture four main aspects can be distinguished: *calculability*, *formal responsibility for damages* coupled to *formal entitlement to compensation*, and *cost-effective prevention*. If we can calculate (assess) future occurrences logically or on the basis of historical data we can also estimate the total damage to be expected. To be able to compensate for that damage we need to set up an insurance scheme. Relative to compensation for damage and the related insurance payments we can calculate which preventive measures are most likely the most cost-effective. Insurance schemes show a combination of social, economic and legal aspects. People do want to secure their life chances and thus try to make arrangements for the future. Economical development depends on this kind of security, which allows for more reliable cost-benefit calculations. Historically speaking an important side effect of the economic rationality of insurance were more safe working conditions for industrial labourers. Cost-effective investments in safer work conditions were not only to the benefit of employers but also to the benefit of employees. The invisible hand of capitalistic self-interest thus promoted proletarian life chances.

Insurance also makes very clearly to what extent we think the future can be controlled within a risk culture. If our experiences from the past allow us to predict future negative occurrences, they also allow us to take preventive measures. But these measures need to be cost-effective.
In other words, we do accept damage in the future when it is more economical to compensate for that damage, then it is to take further preventive action or to stop with the original activity from which the damage results. This is the key aspect of risk culture in which we take damage to be an unfortunate side effect of activities that on the whole are valued positively.

Our contention is that the risk society as Beck and others picture it gives rise to a *precautionary culture*. This precautionary culture differs from the risk culture of industrial society in a number of important respects. For instance, where *risk* culture distances itself from individual moral guilt, it is re-introduced by *precautionary* culture. However, where in *guilt* culture it was assumed that the victim himself was to blame, in *precautionary* culture we assume that those in charge of industry and especially governmental officials are to blame. This is because risk culture has developed the idea that damage is primarily not due to individual carelessness but should be seen as undesired side effects of industry, economy or any other social system. This lesson is retained in precautionary culture, but the idea that some damage is unavoidable and acceptable is no longer held as valid. *In precautionary culture people feel that all damage can be predicted and should be avoided by precautionary action.* Where risk culture took some damage for granted and prevented damage only to the extent that it was cost-effective, in precautionary culture the avoidance of damage comes first, *whatever the cost*. When precaution fails this leads first to a moral public outcry against those officials who

have forsaken their duty to avoid risks (and must be punished) and second to a claim of full compensation.

Although risk culture is still dominant in many spheres of social life, it is with regard to environmental issues and new technologies that precautionary culture first comes to the fore.[9] However, as our society and especially our economy is still based on science based innovation, the effects of the precautionary culture on the introduction of new technologies will be ever increasing. The PP in its present form offers the critics of our technological society the ultimate instrument to block increasingly more innovations. If this trend continues it will have serious economic, social and political repercussions. We could envision a scenario, which leads to the *cautious society*. Such a society would be risk-averse and economically stagnant. It knows increasing social tensions and aggravating political struggles.

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1 Introduction

1.1 Preamble

The *HAN* foundation (stichting Heidelberg Appeal Nederland, *HAN*) was established within the Dutch scientific community in 1993. The *HAN* foundation is an independent non-profit making alliance of scientists and science supporters. Its aim is to ensure that scientific debates within the public and political arena on e.g. environmental, agricultural, biotechnological and food-safety issues are properly aired, and that decisions which are taken and action that is proposed are founded on sound scientific principles. Members are accepted from all walks of life and all branches of science. The *HAN* foundation has at present over 1200 donors, including almost 200 professors. Our primary role is to contribute to the scientific debate itself. Our second role is to provide an independent voice to the media, the general public and the educators, and by doing so, the *HAN* foundation aims to provide a balance on scientific issues. One of the activities of *HAN* is to conduct scientific research at the request of third parties. *HAN* only performs such research, supported by an independent scientific supervisory committee. To ensure that the study is executed in an independent fashion *HAN* has the right to publication regardless of the outcome of the research.[1]

Roel Pieterman is not affiliated to *HAN*. He was asked to be a contributor to this essay because of his interest in, and his research of, the precautionary culture and the Precautionary Principle from a sociological perspective.[2] This essay is partly an extension, partly a translation of the *HAN* study on the Precautionary Principle.[3]

1.2 Introduction

During the last three decades of the twentieth century we have seen an ever-increasing influence of *Non Governmental Organisations* (*NGOs*) especially those, which promote the interests of the environment or of consumers. In the Western world the 'green movements' have led to new 'green parties' and to the 'greening' of already existing parties. This influence -amongst others- has led to social and political changes, which have had their effects on developments in science, technology and economy.

It is by now common to note that industrial society has changed into risk society. In this report we deal with some essential cultural aspects of these social changes and focus especially on one legal expression: the Precautionary Principle (PP). We feel that the cultural changes, which at first remained within the environmental domain, are now effecting more and more aspects of social life including the scientific enterprise. There is not only a widening of the circles of influence, but also radicalisation of that influence. This is very clear with regard to the application of the PP. At first we found rather cautious wordings of this principle. In 1976 for instance we find cautious wording on what we might call a *Vorsorg*:[4]

> 'Environmental policy is not fully accomplished by warning off imminent hazards and the elimination of damage which occurred. *Precautionary environmental* policy requires furthermore that natural resources are protected and demands on them are made with care.'

Recently, however, the *European Commission* has adopted a point of view, which we shall show to be very extreme indeed. For the last few years it is not difficult to find examples where the PP is applied as the rule of thumb: *When in doubt? Don't!* In these changes we see a clear cultural trend: the rise of a precautionary culture.

This radicalisation and widening influence of precautionary culture (in conjunction with part of green thinking) constitute a fundamental change in Western culture. Modern society resulted from the combined influence of a political, an economic and an intellectual revolution. The French Revolution, the Industrial Revolution and the Enlightenment have led to democracy, prosperity and rationality. By undermining the rationality of modern society, precautionary thinking poses threats to democracy and prosperity as well. If the present rise of a precautionary culture continues we are likely to witness social changes. *We may move beyond the risk society into the cautious society, which will show strong signs of risk-aversion, of anti-technological attitudes, of economic stagnation and of political instability.*

If we want to avoid the risks of such a development we have to reconsider our appreciation of contemporary green thinking as portrayed most prominently by institutionalised environmental organisations (*NGOs*) and of the PP in particular. This report is part of a recent and growing body of literature, which aims at an extensive and fundamental critique of the PP.[5] However, we place this critique in a wider framework by analysing the long-term trend in a major theme of political culture in modern Western society, namely the theme of *damage* and *disgrace*.

Our main questions and conclusions are presented in the executive summary. Next, we offer our critical analysis of the PP, which we conclude with some suggestions to counter its most serious flaws. Third, we discuss some examples of policies based on the PP, which show the PP to be applied as the rule of thumb: *When in doubt? Don't!* Finally, we offer our analysis of the long-term trend in modern culture with regard to the theme of damage and disgrace. We summarise this analysis with a typology that distinguishes between a *guilt* culture, a *risk* culture and a *precautionary* culture.

2 The Precautionary Principle or Striving for (Selective) Ignorance

2.1 Introducing the contradiction

Spring 2000 the Clinton administration in the United States (US) reaffirmed its *science-first* approach to the regulation of food and feed developed by modern biotechnology.[6] Despite some more stringent formalities, which were in practice already adhered to, no change in policy, occurred. Especially where labelling is concerned, the government stressed that it would see to it that any voluntary labelling would be truthful and not misleading.

At the other side of the Atlantic, the regulatory approach is different indeed. The European Union (EU) has recently adopted a new *Directive* for the deliberate release of genetically modified organisms (GMOs) in the environment.[7] But already in the previous one, which was in force since 1990, the so-called Precautionary Principle (PP) was the fundamental legal instrument. This principle is gaining importance in the world, where regulations are concerned regarding human health and the environment; e.g. the *Biosafety Protocol*. In the EU, the PP has led to a restrictive regulatory regime and in fact only 18 GMOs are formally approved either for further testing or for commercial purposes.[8]

This situation is very different from the one in the US; where for some crops about half of the volume is a genetically modified variety. In the US GMOs are regulated by the same rules as are new foodstuffs, which result from more conventional breeding techniques. This means a GMO can be –and often is– classified as *generally recognised as safe* (GRAS). Such a classification is impossible in the EU, where a maize variety is awaiting approval despite the fact that it is a result of a normal cross between two GMOs, which are already approved.[9]

The above-described example serves as an introduction to the international political and judicial complexity, which entails the implementation of the PP. It is a principle of international law, which was first developed during the 1970s and 80s but became more and more important during the 1990s. Its status as a firmly established principle of international law is still hotly debated as shown above. The precise content and meaning and therefore the best way to formulate the principle is also still a matter of intense dispute. To take precautionary measures is not a new phenomenon. On the contrary, it is defined and institutionalised in modern day society in e.g. insurance companies and lawmaking. However, precaution has become a centralised theme within environmental issues, especially when scientific knowledge concerning a specific (environmental) risk is wanting or even lacking.

The point we want to make is that the PP -in its present formulations and uses- is fundamentally flawed. In part this has to do with the ambiguous formulation of what precaution is, as e.g. defined in the 1987 *London Declaration* about the protection

of the North Sea:

> 'In order to protect the North Sea from possibly *damaging effects of the most dangerous substances,* a precautionary approach is necessary which may require action to control inputs of such substances *even before a causal link has been established by absolute clear scientific evidence.'*

In 1992 a similar idea is formulated in *Principle 15* of the *Rio Declaration* of the *United Nations*, which holds that:[10]

> '… 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.'

It is this formulation that is considered the most authoritative among the many formulations of the PP that can be found nowadays.[11] These formulations raise questions, which are hard, if not impossible, to answer. For instance, how do 'possibly damaging effects' relate to 'the most dangerous substances'? In other words, imperfect or even absent scientific knowledge of certain chemical compounds cannot result in a definitive description of those compounds. The *uncertain* and the *definitive* cannot be combined in one and the same chemical compound. How can we come up with preventive action 'even before a causal link has been established' let alone establish if such actions are 'cost-effective' or not? What is 'absolute clear scientific evidence' or 'full scientific certainty'? It is clear that with the PP, *causality* -the very basis of the successfulness of the scientific method- is circumvented. In other words, in the implementation of precautionary risk management policies, *causality* is no longer required. The necessity therefore, to scientifically trace potential risks of human activities, is greatly reduced. As causality has cleared the field of (precautionary) policymaking, it is no longer certain on what grounds risks are prioritised, researched and tackled. A politicisation of science is a result of this: politics have become a strong steering mechanism in scientific research, and scientific results need to be incorporated into policymaking. This mutual dependency is best illustrated in the founding of the *Intergovernmental Panel for Climate Change* (*IPCC*) where science and politics have closed ranks on a highly controversial scientific topic with far-reaching political implications.

The PP carries a profound ambiguity towards scientific knowledge. On the one hand it is stated that such knowledge is never complete and certain, the ultimate ground for the implementation of the PP. (In one or two decades time science will undoubtedly have developed new and surprising insights.) On the other hand one of the primal effects of the Principle is the reversion of the burden of proof to the developers of new technologies.[12] They have to prove that those technologies are 'absolutely safe'. Even if this demand is not made explicitly, invoking the PP single-mindedly means 'securing a safe future'. So a very high level of scepticism with regard to what science cannot do, goes hand in hand with a very high level of

confidence regarding what science is supposed to deliver. *This ambiguous stance is not paradoxical but outright contradictory.* Furthermore, such a stance automatically results in blocking any type of innovation, as innovations always carry uncertainties. No amount of scientific experimentation will ever result in certainty.[13] Omniscience, as inherently requested by the PP is an unattainable goal which empirical science, by definition, cannot deliver. Consistent application of the PP will therefore result in a complete societal and scientific stagnation, a goal clearly *not* envisaged in the Western society.[14] This means that any sensible precautionary construction needs to be stringently limited. However, limiting criteria have not yet been developed, for obvious reasons.[15]

2.2 A European version of precaution

As the European Union has decided to make the PP the linchpin of its policies with regard to the protection of human health and the environment it is important to take a closer look at the *Communication from the Commission on the precautionary principle*,[16] which it considers to be 'a full-fledged and general principle of international law'. We shall concentrate here on the role science is to play according to the *Commission*:[17]

> 'The precautionary principle is not defined in the Treaty, which prescribes it only once - to protect the environment. But in practice, its scope is much wider, and specifically where preliminary *objective scientific evaluation, indicates* that there are *reasonable grounds* for concern that the *potentially dangerous effects* on the environment, human, animal or plant health *may* be inconsistent with the high level of protection chosen for the Community.'

Subsequently, we read that:[18]

> 'Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty.'

Where the first point is full of terms, which allow a wide array of interpretation indeed (see the terms in italics), the second one seems stricter. However the question arises to what degree of certainty the dangerous potential has to be 'identified'.

The *Commission* makes two relevant remarks. First, there should be a scientific evaluation which is 'as complete as possible' and second, the decision of what is an acceptable risk to society is 'an eminently political responsibility':[19]

> '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 scientific uncertainty. Decision-makers need to be aware of the degree of uncertainty attached to the results of the evaluation of the available scientific information. Judging what is an "acceptable" level of risk for society is an

> *eminently political responsibility.* Decision-makers faced with an unacceptable risk, scientific uncertainty and public concerns have a duty to find answers. Therefore, all these factors have to be taken into consideration.'

The elaboration of the first point makes it very clear that much leeway is granted to decide that the science is done 'as complete as possible'. However, the *Commission* continues:[20]

> 'A scientific evaluation of the potential adverse effects should be undertaken based on the available data when considering whether measures are necessary to protect the environment, the human, animal or plant health. An assessment of risk should be considered where feasible when deciding whether or not to invoke the precautionary principle. This requires reliable scientific data and logical reasoning, leading to a conclusion which expresses the possibility of occurrence and the severity of a hazard's impact on the environment, or health of a given population including the extent of possible damage, persistency, reversibility and delayed effect. *However it is not possible in all cases to complete a comprehensive assessment of risk, but all effort should be made to evaluate the available scientific information.* Where possible, a report should be made which indicates the assessment of the existing knowledge and the available information, providing the views of the scientists on the reliability of the assessment as well as on the remaining uncertainties. If necessary, it should also contain the identification of topics for further scientific research.'

When deciding whether or not to invoke the PP, the *Commission* says, 'an assessment of risk should be *considered* where *feasible'*. And although they agree that 'all effort should be made to evaluate the available scientific information', they also stress that the decision not to wait for additional information 'is bound up with a less theoretical and more concrete perception of risk':[21]

> 'Before the precautionary principle is invoked, the scientific data relevant to the risks must first be evaluated. However, one factor logically and chronologically precedes the decision to act, namely identification of the potentially negative effects of a phenomenon. To understand these effects more thoroughly it is necessary to conduct a scientific examination. *The decision to conduct this examination without awaiting additional information is bound up with a less theoretical and more concrete perception of the risk.'*

Indeed, the PP can be invoked 'even if this [potential] risk cannot be fully demonstrated':[22]

> 'The precautionary principle is relevant only in the event of a potential risk, even if this risk cannot be fully demonstrated or quantified or its effects determined because of the insufficiency or inclusive nature of the scientific data.'

Here we encounter the second point, which holds that risk management –among other things: the decision about acceptable risk– is *eminently political*. *So it turns*

out that invoking the PP is a political decision about acceptable risk in the light of the high level of protection deemed necessary. The scientific basis for this decision can be very thin indeed as the provisional nature of precautionary measures 'is not bound up with a time limit but with the development of scientific knowledge':[23]

> 'Hence, … measures adopted in application of a precautionary principle when the scientific data are inadequate, are provisional and imply that efforts be undertaken to elicit or generate the necessary scientific data. It is important to stress that the provisional nature is *not bound up with a time limit but with the development of scientific knowledge.'*

This approach holds the risk of side-tracking the scientific risk assessment methodology altogether. Pointing 'the precautionary finger' to any kind of technological, or indeed human activity, can be done in the absence of any real scientific evidence. The absurdity of such a position becomes painfully clear when applied to criminal justice. Any court of law would immediately see through an attempt by the State to convict in the absence of any indicting evidence. Likewise, any civil court would throw out any tort case where the complainant would not offer any proof of damage.

In their comments the *Commission* also stresses that a precautionary measure may be based on a less objective appraisal and that the European Community is entitled to prescribe the level of protection it deems appropriate. Finally it is important to know what kind of measures the *Commission* considers appropriate. They remark that a wide range of initiatives is available going from a legally binding measure to a research project or recommendation. *However, when discussing the necessary proportionality of measures, this proportionality does not refer to the risk but to the chosen level of protection.* In that context it is added that a total ban *may not* be a proportional response to a potential risk in all cases. We conclude from this formulation that a total ban *is* a proportionate measure in *most* cases in relation to the chosen level of protection deemed necessary. And indeed the *Commission* states that only in *some* cases, the right answer may *not* be to act or at least not to introduce a legally binding measure.

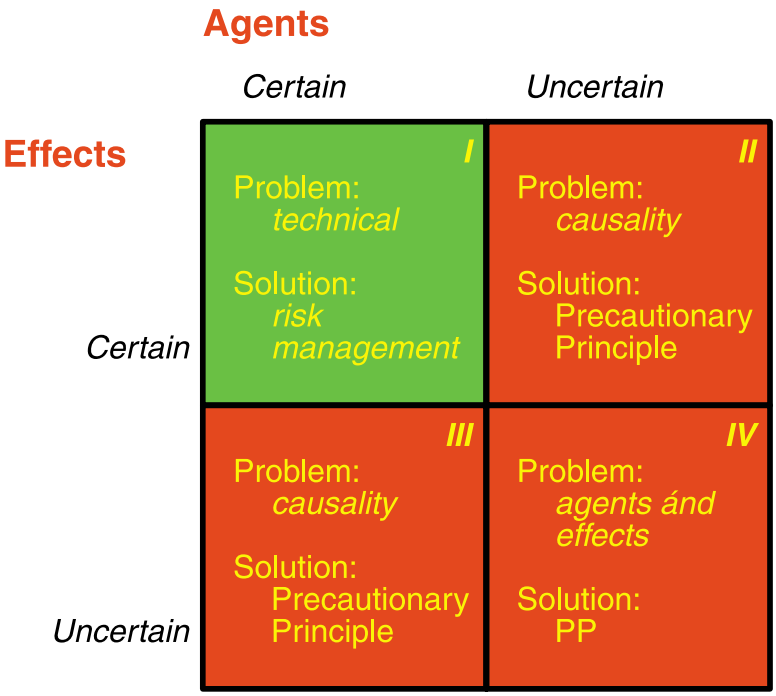
So it turns out that invoking the PP is a political decision about acceptable risk in the light of the high level of protection the EU wants to secure for its citizens, animals, plants and environment. The scientific bases for such a decision can be virtually absent, as only preliminary indications of potential dangers can be considered enough reasonable ground. This is underlined in the report of the *European Environment Agency* (*EEA*) *Late lessons from early warnings: the precautionary principle 1896-2000*:[24]

> 'As has been pointed out in discussing monitoring, it is in no way precautionary to persist in restrictions of the wrong agent. *However, the precautionary principle applies as much to uncertainties over agents as to those over effects.* If a broad-based retrospective process raises scientific uncertainties or ambiguities about the grounds

for targeting a particular agent, the precautionary principle may nonetheless be invoked, entirely legitimately, to defend continued action on this agent, until such uncertainties are resolved.'

Indeed, what the *EEA* is suggesting here can be depicted in the following figure:

Figure 2.2.1 Agents, effects and the Precautionary Principle



PP: Precautionary Principle

This approach by the *EEA* of precaution is a radicalisation of the application of the PP and highlights the ambiguous stance towards scientific knowledge. Indeed, it seems that the envisioned approach by the *EEA* is a prejudiced approach in which scientific knowledge is not deemed adequate to illuminate cause and effect with certainty no matter how elaborate the scientific enterprise. In other words the *EEA* delineates a world where a scientific clarification of any cause and effect relation is highly unlikely, so that the situation depicted in quadrant I in figure 2.2.1 is most equivocal. The ultimate consequence of this line of reasoning is that the PP can be implemented at any given moment for any given of situation.

Despite the fact that the *EEA* report defends the view that precaution is not anti-scientific, this approach does carry nothing but an anti-rational slant of real

world issues, which scientific research and factual knowledge cannot cure. If there are uncertainties over agents ánd effects, it is infeasible to correlate both. The folly of this approach of the PP becomes clear as *-ad absurdum-* any agent can be targeted by the PP as it can be related to any undesirable effect. The prejudiced aspect comes in view when we realise that only technology seems to be in focus as the binding element between agents and effects and the ensuing uncertainties. *As technology is science-driven, the relativistic view of knowledge -part and parcel of the precautionary culture- makes technology especially prone to the PP (vide infra).* At what point resolution is reached through scientific method between agents and effects therefore remains unclear and unresolved in the *EEA* report, despite an elaborate -yet at some points strongly biased- recount of twelve case studies on environmental and human health issues. In chapter 3 of our essay we shall elaborate on one particular example discussed in the *EEA* document where the selected scientific material clearly leads to a bias in favour of the PP in the translation: *When in doubt? Don't!*

It is important to note that the *Commission* stresses that a precautionary measure may be based on a less objective appraisal. Referring to the 'example set by other Members of the *World Trade Organization*' the *Commission* claims that the European Community is entitled to prescribe the level of protection it deems appropriate. Further, precautionary measures typically are expected to be bans. These may last indefinitely as they are bound up with the development of scientific knowledge, which may forever be *regarded* as 'too uncertain' as is shown by the approach envisioned by the *EEA*. Indeed, one of the conclusions of the *Commission* is that provisional measures shall 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', opening the door to an irrational future of risk management with a disregard of scientific knowledge altogether.[25]

2.3 The asymmetry of precaution

The question arises whether to accept a legal principle, which in effect makes impossible demands? The answer is simple enough: such a principle has no place in the legal systems that uphold the rule of law. This means that the reversal of the burden of proof -a key aspect of the principle- must never lead to a demand to prove that some activity will not lead to any damage on any time scale and under any circumstance. The rhetorical demand for 'evidence of no harm' has no place in the 'real world'. 'No evidence of harm' is as far as science (or any other type of human scrutiny) can go. This evidence, as part of the ungoing human endeavour, is in constant review, as it should be. The success of the scientific effort is highly dependent on this constant retrospection.[26] In case of an unlimited reversal of the burden of proof the PP is a loose political canon with far-reaching consequence for economic and scientific advances.[27]

Second, there is a frequently overlooked logical problem, which is simple and straightforward. *Those who invoke the principle must adhere to it themselves*. As

Cross notes poignantly:[28]

> 'Applied fully and logically, the precautionary principle would cannibalize itself and potentially obliterate all environmental regulation. Environmentalists would apply the principle to chemicals and industries, but why not apply it to environmental regulations themselves? According to the burden of proof approach, advocates of regulation would be required to demonstrate to a certainty the absence of counterproductive effects on health resulting from the effects of the regulation itself. The practical consequences of regulation are so uncertain that advocates typically could not meet this burden, and the precautionary principle would preclude further regulation.'

This means that if opponents of a certain activity demand proof of absence of damage they are themselves under the obligation to prove that the policy they propose does not cause any harm. In general a mutual application of the principle would mean that every activity that is proposed in a policy controversy -e.g. allowing a GMO into the market or barring it from the market- should be placed under the same set of decisional criteria and the same burden of proof. As the implementation of the PP is *uncertainty*-driven and therefore touching both the decision-maker and the policy-target a so-called *symmetrical application* is essential in order to do full justice to the principle.

At present the PP is invoked when people want to make sure that some risk will not come into this world. In doing so, the question disappears whether proceeding with the activity is worse than not-proceeding. And it clearly should not. Two points from the debate about GMOs can make this clear. First, in the *Biosafety Protocol* the PP is enshrined to prevent degradation of biodiversity whereby GMO technology is targeted for precautionary measures. However, it can be plausibly argued that it will be precisely the development of this very technique, which will prevent such degradation. *If* GMOs can bring higher yields, especially from land, which is now not suitable for agricultural purposes, then we have to use less of the valuable soils.[29] And second, *if* GMOs can bring higher yields in a quantitative and qualitative sense, then more mouths can be fed. The *United Nations Human Development Report 2001* signals this problem of Third World under-nourishment:[30]

> 'European consumers who do not face food shortages or nutritional deficiencies see few benefits of genetically modified foods; they are more concerned about possible health effects. Undernourished farming communities in developing countries, however, are more likely to focus on the potential benefits of higher yields with greater nutritional value; *the risks of no change may outweigh any concerns over health effects.'*

The above shows that the PP is fundamentally asymmetrical on multiple levels in its formulation and application. Potential damaging effects of some activity is selected as something that has to be avoided. This does not allow us to review the potential benefits of that activity and weigh them against the costs. Potential risks of a certain activity are therefore given more weight in the decisional process than the potential benefits. Indeed, when discussing the introduction of GMOs in the environment and

its resultant uncertainties an effective precautionary approach should be *When in doubt? Do!* in order to enter a learning process. *Trial without error* is a utopian perspective on innovation.[31]

Precaution and *negligence* are the different sides of the same medallion. Graham *et al.* show that implemented risk reduction strategies concerned with only one or a limited set of target risks result in the introduction of other (related) risks.[32] Risks of a certain activity carry a number of abstruse interactions seldom acknowledged by decision-makers. These interactions are, however, quite relevant in the formulation of risk reduction strategies by policymakers. The ensuing situation where risk reduction strategies such as the PP introduce countervailing risks are mostly regarded as an irrelevant externality. A number of reasons can be identified why that is so:

- *Tunnel vision*: The many ministries and research centres, which the Western world is endowed with, have a specific core business resulting in the fragmentation of decision-making into specialised roles with bounded oversight responsibilities. This results in a fragmented mono-thematic approach of all kinds of policy themes. Integration of different themes has therefore a low priority. Media attention, political importance, current scientific funding may result in the over-exaggeration of certain risks. It is therefore not surprising that different policies concerned with one issue differ wildly in cost effectiveness. Tengs *et al.* e.g. showed that the median environmental policies concerned with environmental toxin control are a factor 150 less effective per life-year saved than the median medical program.[33] Spending $100 million per year on control of benzene emissions at rubber tire manufacturing plants might save one life-year over a 200-year period (i.e. $20,000 billion per life-year saved). The same $100 million, if invested in automobile airbag technology, is expected to save 2,000 life-years every year (or $50,000 per life-year saved)!
- *The omitted voice*: The absence or even ignoring stakeholders during policymaking could lead to a disproportionate attention to well-organised lobby-groups (*NGOs* of environmental organisations, industries, and etceteras). Moreover, in a democracy the development of specific policies concerning a certain target risk is largely defined by the constituency of the particular decision-maker.[34] The advantages of a reductionist policy solution directed at the specific democratic backbone of the concerned decision-maker by far outweigh the costs involved in a full-scale analysis of the issue. The introduction of countervailing risks as a result of the proposed target risk reduction strategy is regarded as non-relevant externalities.[35] For society as a whole, however, a full-scale analysis of the specific issue is relevant. Chances are that in such a set-up all the relevant stakeholders are involved during policy making. However, when all the countervailing risks of a certain reductionist policy are spread over a large number of different sub-populations within a given society chances are that only the well organised lobby-groups will have a say in the matter as the countervailing risks will remain invisible for the decision-makers.
- *Heuristics*: Heuristics are relatively primitive and simple decisional strategies in order tot reduce complex mental tasks to orderly proportions. Another words for this is 'problem-sizing'.[36] When one is confronted with an overwhelming amount of infor-

> mation some sort of condensation process takes place resulting in prioritisation of information. The issue is downsized into mentally digestible chunks. This downsizing is more or less a subconscious process and frequently (but not always) results in a misinterpretation of reality.[37] The *Delaney Clause,* a policy devised to regulate the risks of synthetic food-additives in relation to carcinogenesis is an example of a heuristic approach of reality. Resulting research efforts concentrate primarily on carcinogenic characteristics of synthetic compounds in foodstuffs. The overwhelming amount of natural carcinogenic compounds in foodstuffs is ignored.[38] Other non-carcinogenic toxicological effects of compounds are also disregarded. Another heuristic is the Precautionary Principle.

Page makes this epistemological lopsidedness explicit:[39]

> 'When a regulator makes a decision under uncertainty, there are two possible types of error. The regulator can overregulate a risk [*false positive, authors*] that turns out to be insignificant or the regulator can underregulate a risk that turns out to be significant. If the regulator erroneously underregulates [*false negative, authors*], the burden of this mistake falls on those individuals who are injured or killed, and their families. If a regulator erroneously overregulates, the burden of this mistake falls on the regulated industry which will pay for regulation that is not needed. This result, however, is fairer than setting the burden of uncertainty about a risk on potential victims.'

The claim put forward here is that the consequences of a false-positive policy (overregulating a risk that turns out to be insignificant) only costs money. However, a false-negative policy (under-regulating a risk that turns out to be significant) costs lives. To err on the side of safety therefore needs to be preferred, as Page remarks. An asymmetrical outcome of regulation, as Page claims, therefore is in need of an asymmetrical policymaking instrument. This fits perfectly well with the PP as Wildavsky observes:[40]

> 'The precautionary principle is a marvelous piece of rhetoric. It places the speaker on the side of the citizen -I am acting for your health- and portrays opponents of the contemplated ban or regulation as indifferent or hostile to the public's health. *The rhetoric works in part because it assumes what actually should be proven, namely, that the health effects of the actions in view will be superior to the alternative. And this comparison is made favorable in the only possible way -by assuming also that there are no health detriments from the proposed regulation.* The rhetoric seems to present a choice between health and money or even suggests health with no loss whatsoever, for a tangential presumption is that industry will find a better and a cheaper as well as safe way.' Something (*health*) is gained with nothing lost (*no adverse health effects from the bans or regulations*).'

The question is whether this risk-asymmetry is a reality. As put forward by Tengs *et al.* among others, this is not the case, on the contrary.[41, 42, 43] The assumption put forward by Page, and institutionalised within the PP, that an asymmetry of consequences of policymaking exists in general, is untenable. To err on the side of

safety as a means of safeguarding human health and the environment can prove to be a counterproductive strategy. With that, the general notion that the PP is an effective risk reduction strategy must be regarded as non-valid.

The PP, until now, is implemented regarding potential risks resulting from technological innovations such as biotechnology. Policymaking itself, despite the uncertainties that go with it, is exempt from the PP. As shown above, this is not a logical approach at all. Summing up all forms of asymmetry with regards to the PP:

- *Epistemological*: risks outweigh advantages
- *Political*: over-regulation is preferable to under-regulation
- *Scope*: applicable to the 'economy' only (policymaking is exempt)
- *Applicability*: biotechnology, *yes*; organic farming, *no*
- *Historical*: only 'new' technologies 'are prone' to the application of the PP

Above-mentioned asymmetries carry characteristics with a distinct political ideological message. Regarding the applicability of the PP it is clear that despite the presence of uncertainty profiles e.g. for both organic farming and biotechnology the former is exempt from precautionary risk management policies for political reasons whereas biotechnology is fiercely under scrutiny.[44] Furthermore, it is not clear whether the choice of banning a certain innovative technology will not be inherently more problematic -e.g. the introduction of risks of a status quo- than choosing a less stringent and more open approach towards innovations. The *United Nations Human Development Report 2001* signals this very problem in relation to the development of genetically modified organisms (GMOs) and Third World under-nourishment.[45] The *When in doubt? Do!* approach would be precautionary here.

The risks of barring innovations are barely looked closely at, as the apparent self-evidence of the PP does not invite to do so. This makes the PP a counterproductive risk management instrument highly prone to political opportunism. The above described appraisal of the PP and the current implementation strategies leave very little room for a successful rationalisation process as proposed by Graham, despite the fact that the PP is *alive and well* in current policymaking.[46] However, we will discuss Graham's proposals, as they seem the only viable option away from the anti-rational sentiments the PP carries.

2.4 Conclusions

All in all we conclude that the PP in its present state suffers from many serious -even fatal- problems. These problems are of a logical, theoretical, moral, social, political and economic nature. First of all, a consensus on one authoritative formulation is lacking although the formulation of the 1992 *Rio Declaration* is used most often. Second, the status of the PP as a full-fledged principle of international law is still debated. Where the *Commission* of the EU claims it *is* such a principle, the US government prefers the phrase 'precautionary approach'. Third, at best the PP is

formulated in an ambiguous fashion. The *Rio Declaration*, for instance, circumvents adequate proof of causality although it speaks of cost-effective measures. Forth, the PP is ambiguous in its attitude towards science and technology. On the one hand much emphasis is placed on the fact that scientific knowledge sometimes is wrong and/or incomplete and takes a long time to take on some definitive form through consensus building. On the other hand science is expected to deliver today the conclusive knowledge about the world of tomorrow. Fifth, in some of its applications the PP is simplified to the rule of thumb: *When in doubt? Don't!* Here the reversal of the burden of proof, which often results from invoking the PP, implies that some activity or product is allowed only when it is proven that no risks are attached to it. Where this is the case, the PP has irrational implications, which we consider to be immoral. We maintain that such a principle hardly qualifies as a valid part of law. Sixth, the PP is applied in a one-sided, asymmetric fashion in which policy decisions become too narrow-minded by focussing only on the possibly damaging effects that have to be avoided. For instance, no effort is made to broaden the scope to include possible benefits. Therefore, the PP is heavily tilted in favour of the critics. Analysis of the point of view of the *European Commission* has made it clear, that the PP can be invoked on the flimsiest of preliminary evidence. The preliminary bans, which follow from the chosen high level of protection, will last 'forever' because the guarantee of something being risk free can -by definition- never be given. In the reversal of the burden of proof omniscience is implicitly expected from science.

As the PP is *uncertainty-driven* a mutual application of the principle would mean that every activity that is proposed in a policy controversy –e.g. allowing a GMO into the market or barring it from the market– should be placed under the same set of decisional criteria and the same burden of proof. In the Dutch case of drilling for gas in the *Waddenzee* this would mean that those who oppose it are under the obligation to prove that not drilling does not cause any damage. But without the possible additional supply of gas from the *Waddenzee* other gas fields have to be exploited at a higher rate and it is more than likely that this will cause extra damage for those living near those fields. As is the case in other instances of cost-benefit struggles, many times those who get the benefits are not the ones to carry the costs. If invoking the PP has this kind of effect, it can be accused of advancing NIMBY attitudes.[47]

Given this evaluation it would be best to do away with this principle altogether. Unfortunately, its ever-growing popularity does not make that a viable strategy. It is this kind of consideration that leads Graham to the conclusion that the PP should be brought on a refinement path.[48] We suggest the following measures.

First, we should always remember that there is no such thing as harmless (non-) action. Zero risk games cannot be played. Second, the enhancement of life chances of all people should be our goal. The Hippocratic oath 'do-no-harm' should be the driving force of society, as it entails more than just a selective approach of the PP.[49] Third, we should try to take as many options and interested parties into account

when we do our cost-benefit analyses, which include risk-risk analysis.[50] And fourth, we should demand a broad consensus among scientist with regard to the probable damaging effects before we are allowed to invoke the PP. Because invoking it in situations where a vast majority agrees on the probability of damage is something quite different from invoking it in situations where a vast majority agrees on the absence of that probability. *And finally, we should demand -for pressing logical reasons- that those who want to invoke the PP are thereby under the obligation to adhere to it themselves.* Especially, by demanding this *symmetrical* application the outcome might very well be a return to the more classic cost-benefit analysis, probably broadened with more factors being taken into account, including risk-risk analysis. This would fit into the long trend in economic affairs of internalising external costs. For that reason, as the *National Research Council* remarked, 'science first' should be thé policymakers maxim:[51]

> 'Reliable technical and scientific input is essential to making sound decisions about risk. Scientific and technical experts bring indispensable substantive knowledge, methodological skills, experience, and judgement to the task of understanding risk.
>
> … Good scientific analysis is neutral in the sense that it does not seek to support or refute the claims of any party in a dispute, and it is objective in a sense that any scientist who know the rules of observation of the particular field of study can in principle obtain the same results. …'

It seems to us that the attempts the EU is making to frame much of its regulatory system around the PP in its present amorphous structure is unacceptable both from a scientific, legal and a moral standpoint. We further believe that the PP is part of the development of a much wider anti-rational trend in our present world. This means the abandonment of the treasure of knowledge, which human society has successfully delved for since the Enlightenment. Consciously or otherwise, this is a 'death-wish'.[52] As Durodié observes:[53]

> '…Science [is presented] as just one of many 'readings' of the world, suggesting that no amount of experimentation or evidence would ever suffice to determine the outcome of an issue, …'

Gellner's assertion that such a relativistic approach towards 'serious' scientific knowledge -as is done by the precautionary culture- holds a nihilistic future, is a stern warning at the decision-maker of today.[54] We are not talking here about eschewing food additives or colouring matter, but an implicit return to primitivism.[55] We feel that this trend needs to be countered if we want to maintain the major advantages modernity has delivered: democracy, law, justice, science, economic growth, public and environmental health. In this chapter we have tried to formulate a number of suggestions to alleviate the flaws of the PP.

3 Examples of the Application of the Precautionary Principle

3.1 Introduction

In this chapter we give a few examples of policies, which have been guided by the PP and which have resulted in a *de facto* ban on a certain activity, product or technology. First, we discuss a Dutch case where the *EC Habitat Directive* and its strong wording of the PP are of direct importance. Second, we discuss the case of the EU regulation of biotechnology in food. Third, we explain the EU regulation of antibiotics in animal feed with regard to the problem of resistance. And finally, we explain why a world-wide ban on DDT will not solve a real problem but, instead, will cause one for developing countries, which suffer from malaria. Here the effects of banning DDT and GMOs will have similar negative effects.

These examples can be regarded as taking up the challenge of the *European Environment Agency* who stated in their report on the PP that:[56]

> 'The case studies are all about 'false negatives' in the sense that they are agents or activities that were regarded at one time as harmless by governments and others, at prevailing levels of exposure and 'control', until evidence about their harmful effects emerged. But are there no 'false positives', where action was taken on the basis of a precautionary approach that turned out to be unnecessary? It was felt necessary to include such examples, but despite inviting some industry representatives to submit them, and discussing these in some detail, no suitable examples emerged. …
> The challenge of demonstrating 'false positives' remains: possible candidates that have been mentioned include the ban on dumping sewage sludge in the North Sea, and the 'Y2K millennium bug'.'

With these examples below we will show that the examples of false positives do exist. Likewise, as the precautionary culture is fundamentally ambiguous towards scientific knowledge it is expected that the amount of false positive examples will increase. The ultimate consequence of this stance is that within the precautionary culture false positives *cannot* exist because of the impossible demands on scientific knowledge. However, we shall show that in the antibiotics case discussed by the *EEA*, reference to scientific material in the *EEA* report is narrowed down to 'case-carrying' proportions thus underlining the epistemological lopsidedness of the precautionary culture: *Better be safe than sorry*. In this particular instance this resulted in a bias on two levels: a political and a scientific. Of course, within the scientific discourse, it is not done to wilfully omit essential scientific knowledge, which changes the outcome of the discussion at hand. This boils down to a fallacy of exclusion.

We are confident that the challenge of the *EEA* can be met. Those in favour of the PP are fond of citing the asbestos example to show that what at first was seen as a

panacea later turned out to have serious negative side-effects. We have several comments on this tack. First, it is impossible to have today the knowledge of tomorrow. If we keep waiting for tomorrow's knowledge, we shall be waiting forever. Moreover, historical understanding of risks that now in retrospect would have qualified for precaution, specifically refers to scientific knowledge that was not available then. However, such historical examples are in essence not valid because the implementation of the PP is geared to the future, so one cannot refer to current scientific knowledge on the past risk in question. The history of the risks posed by technologies and the scientific knowledge and understanding of them that we have *now*, does not teach us anything about possible occasions for implementing the PP. Second, although we agree that cases like asbestos should make us careful with the introduction of new technology, we would like to point out that other examples can be given, which point in the opposite direction. In many instances products have been deemed dangerous on flimsy grounds and without any positive evidence being produced later on.[57] One documented example is the ban on phthalates.[58] Below, we discuss other examples.

Third, we stress that the *EEA* challenge is as one-sided as the application of the PP itself.[59] Based on our appeal to apply the PP in a symmetrical fashion, the challenge holds not only that examples of false positives are given –which we do– but also, that the *EEA* proves that in the cases, which they mention, money was spend in an optimal cost-effective way.[60] In other words, we challenge the *EEA* to show how the policies they defend, have generated a greater increase in the quality of life and environment than could have been accomplished with other –less precautionary– policies. Can the *EEA*, for instance, show that the BSE regulation does *not* have a staggeringly poor ratio of money spent, human lives saved and animal life unnecessarily terminated?

3.2 The Waddenzee or the search for natural gas

The *Waddenzee* is an ecosystem in the North Sea between the islands north of the Dutch mainland and that mainland itself. The *Habitat Directive* in which we find a very strong wording of the PP governs developments in that area. During the 1990s the Dutch government issued several permits to (test) drill for gas in that area, which were consequently and successfully opposed in court. This was so even though; as the Court said in one verdict, besides visual damage (a spoilt picturesque view) there was no apparent damage. Finally the *NAM* (*Nederlandse Aardolie Maatschappij; Dutch Oil Company*) was ordered to come up with an extensive study of al the short and long term effects of drilling in that area. This report was scrutinised by international experts and deemed to be of the best possible scientific level. Its conclusion was that exploitation of the gas field over a period of four or five decades would have no or negligible damaging effects.[61]

Of course the environmental groups that had opposed drilling were not satisfied and they succeeded in mobilising public opinion once more. And although the government first seemed ready to base its decisions on the report the political

parties in the main parliamentary body were almost unanimous in following the criticism. Invoking the PP time and again they stressed that not all uncertainty about negative effects had been removed by the report. In other words, they concluded that it was not scientifically proven that no damage would occur. And until such proof was delivered they asked the government not to allow any drilling. The *Dutch Parliament* put forward a motion in relation to the drilling issue, which states the following:[62]

> 'The House, having heard the debates, noting that absolute certainty and conclusive guarantees can never be given in advance that subsidence resulting from gas extraction will not result in permanent harm to the essential qualities of the Waddenzee as a wetland; is of the opinion that no more drilling may take place for testing or extraction purposes; requests that the government incorporate this opinion into the Key National Planning Decision (PKB).'

In its most recent policy statement on the *Waddenzee* the government has clearly chosen for this approach as the motion of the *Dutch Parliament* was adopted:[63]

> 'As long as there remains any uncertainty or doubt about possibly long-lasting damage to the Waddenzee … the cabinet will not issue any new permits for (test) drilling …. The coming years shall be used to find out if the remaining uncertainties can be removed about the possibility to comply to watertight conditions.'

Note the absurdity of the chosen formulation of the decision of the cabinet of ministers, which lies in the allurement to an omniscient character of science ('any uncertainty or doubt'). An impossible world of (omni) science is drawn, typical of the precautionary culture making for a relativistic view of knowledge incapable of settling any dispute.

3.3 Biotechnology in the food-chain

Discussions about the potential for beneficial and harmful effects of genetically modified foods (GM-food) have been vehement over the last decade. Such foods have been stigmatised as *Frankensteinfood* or 'genetic hazards' by opponents.[64] And proponents have called those opponents, in turn, 'anti-biotechies' or 'Luddites'. What we shall do here is look at recent scientific reports on this matter in order to structure the discussion on the general precautionary approach of biotechnology and its viability.[65]

We start off with a report by a *Working Party of the Nuffield Council on Bioethics*.[66] We choose this report for several reasons. First, in the UK the debate has been extremely fierce. Second, the report deals with all the points that are raised by the critics. And third, the report takes sides in the factual controversy on the basis of the existing scientific evidence, adding greatly to the value of the analysis of the *Nuffield Council*.[67] The executive summary of the report starts with the following statements:

> 'The introduction of genetically modified (GM) crops has become highly controversial in the UK and some other parts of the world. The principal objections concern possible harm to human health, damage to the environment and unease about the 'unnatural' status of the technology. The Working Party has therefore examined the ethical issues which are raised by the development and application of GM plant technology in world agriculture and food security. Its perspective on GM crops has been guided by consideration of three main ethical principles: the principle of general human welfare, the maintenance of people's rights and the principle of justice. Some of these considerations, such as the need to ensure food security for present and future generations, safety for consumers and care of the environment have been straightforward and broadly utilitarian. Others, stemming from the concern that GM crops are 'unnatural', have been more complex.
>
> The Working Party accepts that some genetic modifications are truly novel but concludes that there is no clear dividing line which could prescribe what types of genetic modification are unacceptable because they are considered by some to be 'unnatural'. It takes the view that the genetic modification of plants does not differ to such an extent from conventional breeding that it is in itself morally objectionable. … The Working Party does not believe that there is enough evidence of actual or potential harm to justify a moratorium on either GM crop research, field trials or limited release into the environment at this stage. Public concern about the introduction of GM crops has led to calls for bans on GM food and moratoria on plantings. The Working Party concludes that all the GM food so far on the market in this country is safe for human consumption.
>
> … The application of genetic modification to crops has the potential to bring about significant benefits, such as improved nutrition, enhanced pest resistance, increased yields and new products such as vaccines. The moral imperative for making GM crops readily and economically available to developing countries who want them is compelling. The Working Party recommends a major increase in financial support for GM crop research directed at the employment-intensive production of food staples together with the implementation of international safeguards.'

The greatest concern of the *Nuffield Council* concerning GM-foods is to make good on the promise of delivering substantial benefits to the poor in the Third World. The *United Nations* has recently made this same point in their *Human Development Report* (2001).[68] The *UN* makes a plea to the rich in the First World to take the needs of the poor in the Third World into account when deciding on policies related to GM-food. *When in doubt? Do!* seems the obvious morally responsible precautionary response here.[69]

In the study *Biotechnology and Food*, McHughen points out that 'modern biotechnology greatly benefits the quality and quantity of food, human and animal health, and the environment'. Unfortunately –he continues– 'misinformation and misunderstanding … make it difficult for consumers to make informed assessments'. With regard to the public concern he mentions that 'three hundred

million North American consumers have been eating several dozen GM foods grown on hundreds of millions of acres since 1994, with no documented adverse effects'. Not surprisingly he concludes that 'the technology is safe'.[70]

These reports are in line with the 1987 conclusions of the *American National Academy of Science* (*NAS*) that, first; 'there is no evidence of the existence of unique hazards either in the use of rDNA techniques or in the movement of genes between unrelated organisms'. And that, second, 'the risks associated with the introduction of rDNA-engineered organisms are the same in kind as those associated with the introduction of unmodified organisms and organisms modified by other means'.[71] The *NAS*, together with the *National Research Council*, has recently commissioned an evaluation of *Genetically Modified Pest-Protected Plants: Science and Regulation*.[72] The report is clearly a response to the growing public concern in the US. As the first assigned task, the committee reviewed the 1987 *NAS* white paper that came up with three pivotal conclusions:

> '*Point 1*: There is no evidence that unique hazards exist either in the use of rDNA techniques or in the movement of genes between unrelated organisms.
> *Point 2*: The risks associated with the introduction of rDNA-engineered organisms are the same in kind as those associated with the introduction of unmodified organisms and organisms modified by other methods.
> *Point 3*: Assessment of the risks of introducing rDNA-engineered organisms into the environment should be based on the nature of the organisms and the environment into which it is introduced, not on the method by which it was produced.'

The committee reviewed the above principles in light of its knowledge of the underlying scientific processes involved in conventional and transgenic breeding. Especially the third conclusion is relevant for the policy of the EU. The *NAS* concluded that the focus of the risk assessment should lie with the *properties* of a genetically modified organism and *not* the *process* by which it was produced, in line with the third conclusion of the 1987 *NAS* white paper. Furthermore, the committee agreed on points one and two of the 1987 *NAS* white paper that the potential hazards and risks associated with the organisms produced by conventional and transgenic methods fall into the same general category. As the *NAS-NRC* 2000 report discusses toxicity, allergenicity, effects of gene flow, development of resistant pests, and effects on non-target species are concerns for both conventional and transgenic pest-protected plants. This committee found no strict dichotomy between, or new categories of, the health and environmental risks that might be posed by transgenic and conventional pest-protected plants (points 1 and 2), and recognises that the magnitude of risk varies on a product by product basis (point 3). The *NAS-NRC* 2000 committee firmly concludes that it is not aware of any evidence that foods on the market are unsafe to eat as a result of genetic modification. And with regard to possible negative impacts on the environment they found that the transfer of either conventionally bred or transgenic resistance traits to weeds potentially could provoke problems, but such problems have not been observed or adequately studied.[73]

To these scientific reports which are not directly related to concrete political decisions, we can add the point of view of the scientific committees that have given their opinion in several procedures under *Council Directive 90/220/EEC*.[74] Under this *Directive* 18 GMOs have been approved for the EU either for tests or for release on the market. A further 14 have been awaiting approval since 1998 when a moratorium came into effect.[75] Especially instructive is the procedure –which led to the moratorium– for the approval of a Bt-maize variant produced by Ciba-Geigy started in 1995 by France. Because of differences of opinion between the *Commission*, the *Regulatory Committee*, several national governments and the *European Parliament*, three scientific committees had to give their opinion several times. In all cases they deemed the product safe.[76] In the end the *Commission* formally approved it. However, two countries –Austria and Luxembourg– have since unlawfully but successfully opposed this approval.[77]

From all this we may conclude that the GM-food presently on the market is safe and that the regulatory framework in the United States for allowing new products on the market is adequate. There is room for improvement, but especially with regard to testing food produced by conventional breeding techniques.[78] As far as environmental problems are expected to occur they do not seem to be different from the same problems stemming from conventional crops. So far, the widespread use of GM crops in the US has not shown any especially negative effects.

If we compare this conclusion to the present regulatory framework in the EU it is hard to avoid the conclusion that it is much too restrictive and precautionary. The recently (March 12, 2001) adopted *Directive 2001/18/EC* of the *European Parliament* and the *Council for the Deliberate Release into the Environment of Genetically Modified Organisms* –which replaced the older *Council Directive 90/220/EEC*)– states in points 6 and 8 of the preliminary considerations that 'the precautionary principle should be and has been taken into account in drafting the *Directive* and must be taken into account when implementing it'. In Article 4 it places the member states under the general obligation 'in accordance with the precautionary principle, [to] ensure that all appropriate measures are taken to avoid adverse effects on human health and the environment'. However strict this *Directive* may be, at least four member states –France, Greece, Luxembourg and Denmark–[79] have said they would veto any proposal to allow a GMO into the EU. The restrictive, even hostile approach of the EU towards biotechnology differs strikingly -on a scientific, political and societal level- from the US, which revolves around the role science and the implementation of the PP.[80]

3.4 Resistance against antibiotics

The third example deals with antibiotics used as growth promoters (antibiotic growth promoters: AGPs) in animal feed.[81] This example is added for a number of reasons, despite the fact that precaution in relation to non-curative use of antibiotics in animal rearing altogether seems reasonable. First of all, it shows that singular concentration on the risks of activities and products such as AGPs impedes a review

of potential benefits of that activity and weigh them against the costs. Secondly, and more importantly this example shows that scientific knowledge is not used to the fullest in the review of the potential risks imposed by AGPs, on the contrary. In the antibiotic case study done by Edqvist and Pederson in the *EEA* report, only scientific material that highlights the risks of the use of AGPs are referred to; a fallacy of exclusion.[82] This makes for a strong *a priori* bias towards a ban. Moreover, the way Edqvist and Pederson treat this case has serious implications for other products and processes. It shows that any product or process is prone to a biased precautionary review -with the aid of selected scientific reports- possibly resulting in a ban.

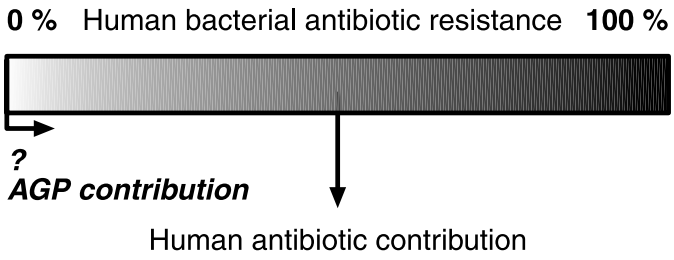
Antibiotics, when added to the feed, decrease the time and the amount of feed needed to reach slaughter weight. Furthermore, less feed is required by the animals, resulting in lower excretion of manure, the animals stay healthy and shed less pathogenic zoonotic organisms.[83] It has been shown, however, that the use of antibiotics for this goal selects for resistant bacteria in animals.[84]

Some of the growth promoters used in feed are structurally related to antibiotics used in human medicine. Their mode of action on bacterial cells can be identical (or highly comparable). Resistant bacteria found in animals might in this way be resistant to antibiotics used in human medicine. This is called cross-resistance. The concern was in the EU that resistance, as found in animals treated with growth-enhancing antibiotics, might spread to humans. This spread might add to the already widespread existence of bacterial resistance within humans resulting from human use of antibiotics. The reasoning behind this is simple and straightforward, albeit highly tentative:

> Bacteria in the animal gut and faeces contain resistant bacteria, caused by the use of antibiotics as growth promoters in livestock feed, which might be transferred to humans in one way or the other. Those resistant bacteria might themselves be a human health threat or they might transfer their resistance to other bacteria capable of colonising the human gut. Virulent resistant strains might cause illness not easily treated by known antibiotics.

In other words the human gut might be colonised by resistant bacteria previously present in animals. The second possibility is the transfer of resistance determinants from bacteria previously present in animals to human bacteria commonly present in the gut or to human pathogens. If resistance in the animal is due to the use of antibiotics in the feed, mixing anti-microbials with feed could in theory contribute to the emergence of serious infections in man. In a simplified manner, the risk issue concerning AGP use and human health can be depicted as follows, keeping in mind that any type of use ('presence') of antibiotics will result in the rise of resistant bacteria, whether in man or animal:[85]

Figure 3.4.1 Human bacterial antibiotic resistance and its sources



The risk assessment thus revolves around the question to what extent -if at all- the use of AGPs in animal rearing contributes to bacterial antibiotic resistance already present in humans.

It should be noted that most AGPs are active against Gram-positive bacteria and not against Gram-negative bacteria.[86] Antibiotics that are active against Gram-negative bacteria are usually not active against Gram-positive bacteria and vice versa. Examples of Gram-negative bacteria are *Escherichia coli* and *Salmonella typhimurium*. An example of a Gram-positive bacterium is *Staphylococcus aureus*. The antibiotics under discussion here are active against the Gram-positive bacteria group. The antibiotics resistance transfer issue is thus limited to the Gram-positive bacteria group when discussing the relevant AGPs. Hummel *et al*. studied the effect of the usage of the antibiotic nourseothricin as a swine feed additive in former East Germany. Resistance to this antibiotic was found in *E. coli* strains isolated from pigs, as well as with farm related people, healthy people and people with urinary tract infections. The emergence of resistance in animals was clearly due to the use of nourseothricin. Also it was shown that resistance (or resistant bacteria) to this antibiotic was spread from animals to humans. In the discussion on AGPs, this example is frequently referred to as an example of resistance transfer from animals to humans disregarding the fact that *E. coli* is a zoonotic Gram-negative organism. This example therefore bears no relation to the AGPs discussed here.[87]

The antibiotic growth-enhancer avoparcin caused the largest concern as it is structurally related to vancomycin, the 'last-resort' antibiotic in human medicine. Vancomycin resistant *enterococci* (VRE) -the micro-organism of concern here in relation to the use of vancomycin and possibly the structurally related avoparcin- can be a problem for immuno-compromised patients who have a severe disease or have been surgically operated. Also people who are wounded by an accident or carry medical devices like catheters have shown to be prone to infections caused by VRE.[88] In hospitals, the majority of VRE are isolated from patients in intensive care units and other specialised wards.[89] Later it appeared that not only patients with clear symptoms of infection carried VRE, but also other patients in the hospital and people on admission to the hospital.[90] This indicated that the problem was not solely a hospital matter. It was found that within community people VRE was also

present. These bacteria were also detected in sewage, waste water, animals and meat. Do these bacteria arise in humans and subsequently spread or are bacteria or resistance genes transferred from other sources to humans adding to the resistance of human bacteria?[91]

Resistance transfer for avoparcin from feed-animals to humans might render vancomycin useless possibly resulting in numerous deaths as a result of non-treatable infectious diseases. Avoparcin was banned in the EC in January 1997. Denmark decided to ban avoparcin already in 1995 as a result of a report of the *Danish Veterinary Laboratory* (*DVL*).[92] In January 1996 Germany was the second country to ban avoparcin. The decision of the *German Federal Institute for Consumer Health Protection and Veterinary Medicine* to ban avoparcin was partly based on the Danish study mentioned here.

The *Scientific Committee on Animal Nutrition* (*SCAN*) -as an independent scientific body designed to advise the *European Committee* on issues related to additives in animal feed- concluded in a review of the Danish report that the *DVL* did not present evidence that the use of avoparcin as a growth-promoting agent caused disease in man or that existing diseases in animals or man increased or worsened notably.[93] So, *SCAN* concluded that there was no evidence that the use of avoparcin in animal feed presented a risk for human health. Indeed, hitherto, the use of AGPs in animal rearing did not show deteriorating human health as a result of infectious diseases caused by resistant bacteria. Use of *human antibiotics* díd result in the rise of resistant human bacteria. The following table serves to illustrate this point:[94]

Table 3.4.1 Vancomycin resistant enterococci (VRE) infections in relation to vancomycin and avoparcin use

	USA	**UK**	**Denmark**
VRE infections in humans	++++	+	0
Avoparcin (AGP)	0	+++	+++
Vancomycin (kg in 1996)	11 279	320	60

Use of avoparcin in animal rearing did not compromise the human therapeutic use of vancomycin, as the above-depicted table clearly shows. The *European Commission*, however, decided to ban the use of avoparcin by January 1997 as a precautionary measure, based on the argument that the risk for human health could not be ruled out. Indeed, such a conclusion is by definition derived from the fact that no amount of scientific experiments will be sufficient to exclude with absolute certainty a certain risk related to the use of AGPs. Moreover, other AGPs were banned within the EC without any scientific foundation whatsoever.[95] The HAN

foundation was asked by *FEDESA* to review the risks related to the use of AGPs.[96] A comprehensive review of all relevant literature showed that the envisaged risks were negligible. With this statement we explicitly do not confuse 'no evidence of harm' with 'evidence of no harm' as referred to a number of times in the *EEA* report on the PP.[97] Indeed, here the *EEA* implicitly refers to an anti-rational approach of scientific capabilities, as in 'real world' science 'evidence of no harm' can never be given, no matter how elaborate research efforts are designed.

The here presented assessment stands in stark contrast with the case study presented in the *EEA* report mentioned above.[98] One of the conclusions Edqvist and Pederson draw is that:[99]

> 'In the last few years substantial scientific evidence has shown that the use of antimicrobial growth promoters in food animals contributes to the problems of antimicrobial resistance in humans. This has *most convincingly been shown* for vancomycin-resistant enterococci.'

However, they also conclude that:

> 'Although the widespread use of antimicrobials in human medicine undoubtedly is of more importance for the emerging antimicrobial resistance problems, this cannot justify ignorance of *potential* human health risks related to the use of antimicrobials in food animals. The continuous use of antimicrobials in feed is one of the major sources of overuse and misuse of antimicrobials in animal farming.'

Both authors state that resistance transfer from animals to humans has been *most convincingly shown* for vancomycin-resistant *enterococci* and that the use of antimicrobials in food animals is a *potential human health risk*. That is a contradiction in terms, as scientific proof of resistance transfer does not make for a potential risk. Moreover, here they make no reference to any scientific study, which of course could have easily been done taking into account their firm assertion. Reference by Edqvist and Pederson to the *DVL* report as a demonstration of transference of animal VREs to humans *without* explicitly mentioning the critique of the *SCAN* analysis mentioned above is telling. Indeed, the *DVL* report did not contain any scientific proof of 'real world' resistance transfer from animals to humans. The specific reference in the *EEA* report that real world conditions are accounted for in any appraisal is especially of importance in this particular case -although in the opposite direction- as the *DVL* report referred to the transference of resistance genes *under laboratory conditions*.[100] Laboratory conditions can hardly be regarded as 'real world' conditions.

Edqvist and Pederson further deliberate the Danish ban of the streptogramin virginiamycin as a feed additive in 1998 under a safeguard clause. Again they omit the highly critical remarks made by *SCAN*, which was asked to review the scientific material on which the Danish government based its ban. *SCAN* concludes the following:[101]

> '… 1. no new evidence has been provided to substantiate the transfer of a streptogramins or vancomycin resistance from organisms of animal origin to those resident in the human digestive tract and so compromise the future use of therapeutics in human medicine
>
> 2. the development of vancomycin resistance amongst *E. faecium* and methicillin-resistant strains of *Staphylococcus aureus*, …, are evidently a cause for concern. However, the data provided in the Danish report does not justify the immediate action taken by Denmark to preserve streptogramins as therapeutic agents of last resort in humans.
>
> 3. as survey data … failed to detect a single case of VRE, as Denmark has amongst the lowest incidence of MRSA in Europe and North America, and as coagulase-negative staphylococci remain sensitive to vancomycin, there are no clinical reasons to require the introduction of streptogramins as human therapeutics in Denmark now or in the immediate future. …

In countries that permitted the use of streptogramins in both animal production and human medicine, notably France and the USA, the use of pristinamycin (a human therapeutic antibiotic) has not been compromised by the use of virginiamycin as a growth promoter.

For Edqvist and Pederson the antibiotics issue ultimately boils down to the following:[102]

> 'As the risks involved are of uncertain magnitude, the decisions on risk management are particularly difficult. The risk can obviously not be excluded with certainty, nor can it be determined as acceptable. In a climate of uncertainty it is preferable to show caution. In this situation decision-making needs to involve precaution, particularly when it is unacceptable, inhuman and unethical to wait for ultimate proof, when human fatalities could be involved.'

Edqvist and Pederson come to a banal and trivial conclusion, which can be drawn for any case, not just this one: no amount of scientific research will ever result in certainty. The conclusion presented here in the *EEA* report is not in need of any scientific deliberation. It could do well without ten pages of scientific reviewing, whether or not biased in nature. Furthermore, both authors revert to fallacy of an appeal of motives in place of support. They regard not invoking the PP as unacceptable, inhuman and unethical. Of course this is beside the point as it has very little to do with the scientific discourse at hand. Again the uncertain description of the issue stands in stark contrast with the earlier mentioned quotation where 'substantial scientific evidence has shown that the use of anti-microbial growth promoters in food animals contributes to the problems of anti-microbial resistance in humans'. Moreover, the ambiguous stance towards scientific knowledge is made comprehensively explicit in this example with specific reference to the fact that 'the risk can obviously not be excluded with certainty'. It is telling that even with a narrow and

biased selection of scientific material such a meagre conclusion is drawn. This biased case study presented in the *EEA* report casts serious doubt on the rest of the case studies and its ensuing conclusions.

The presented example clearly shows that within the EU a permanent ban is regarded an appropriate response in relation to the level of protection considered necessary. Furthermore, scientific knowledge presented to political bodies at their own request did in this case -just like in the case of the *Waddenzee*- not play a significant role in the final decision-making process. Indeed, it seems that the use of the PP contributes to the striving towards selective ignorance. The *EEA* case study on this issue is a case in point.

3.5 1,1,1-Trichloro-2,2-bis(4chlorophenyl)ethane (DDT)[103]

Like asbestos, DDT was once seen as very positive resource for humans in their struggle to improve the quality of their lives. And like asbestos, it is now considered by most to be a menace against that same quality. Unlike asbestos, however, which indeed causes a very destructive kind of cancer, the case against DDT is very weak at best. Present urgency for a world-wide ban on DDT, therefore, will not improve the quality of life anywhere. On the contrary, with certainty it will deteriorate that quality in the poor, malaria ridden quarters of this earth.

DDT was first synthesised in 1874 but it was only in 1940 that Paul Mueller in Switzerland discovered its effectiveness against mosquitoes. After contact with DDT insects die within six month, without any apparent toxicity to humans. In 1948 Mueller received the Nobel Prize for this discovery. In Western countries DDT was mostly used as an insecticide to spray crops. In much smaller quantities it was used in other countries to fight malaria. In 1970 the *National Academy of Sciences* of the United States declared:[104]

> 'In little more than two decades, DDT has prevented 500 million human deaths due to malaria, that would otherwise have been inevitable.'

DDT helped the global malaria death rate to drop from 1 780 per million in 1930 to 480 in 1950 and further down to 160 in 1970. This tremendous contribution to the quality of human life, however, has vanished since then from the memory of the citizens of wealthy countries. Those citizens consider DDT to be a very dangerous substance, which rightly is banned. What caused this remarkable change in appreciation? The story starts in 1962 with the book *Silent Spring* by Rachel Carson, who targets pesticides in general and DDT in particular as the source of much harm to the environment and also as dangerous to human health. In the course of the 1960s DDT was effectively branded as a carcinogen and as a danger to wildlife, especially birds of prey. Ten years after Carson's book was published, the *Environmental Protection Agency* banned the use of DDT in the United States, despite the fact that two months earlier a judge in a case, which lasted for seven months, declared that 'the uses of DDT under the regulations involved here do not

have a deleterious effect on freshwater fish, estuarine organisms, wild birds, or other wildlife'.[105]

Several critical remarks are in place here. First of all, the only real negative effect was the resistance that certain insects appeared to develop. However this was due to the massive spraying of DDT on crops. So there was good reason to regulate this use of DDT, as most other pesticides for that matter. Second, the scientific evidence that supported the ban was very thin and questionable. For instance, one study that seemed to show that DDT would cause eggs of quail to be thinner than usual, was later criticised because the birds were fed with food that contained much less calcium than their normal diets. The original research was later repeated with diets that contained adequate calcium levels and the eggs turned out normal too. Another indication that there was no problem was the fact that in the heydays of DDT, contrary to the allegations, in the United States populations of birds of prey were on the increase. For instance between 1941 and 1960 the number of bald eagles increased from 197 to 891. And at Hawk Mountain the population of osprey grew from 191 in 1946 to 630 in 1970.[106]

Concerning the allegation that DDT is a carcinogen, even now there is no clear evidence. Although some studies did suggest this negative impact, such effects have not been confirmed despite several efforts to replicate the studies. Although there is no doubt that DDT causes tumours and changes in the liver in various types of rodents but not in some other animals it is not clear how that relates to carcinoma in humans.[107] Another purported effect is the estrogenic activity of DDT. Again this effect has never been demonstrated. Also, on the issue of the possible estrogenic effects of organochlorines in general, we have to remember that the ratio of *natural* to *synthetic* estrogens is in the order of 40 000 000 to 1.[108] So any estrogenic effect from synthetic chemicals is literally drowned in the chemical surroundings of natural occurring estrogenic compounds.

We have to conclude from this that the case for banning DDT is very thin indeed. The purported negative impacts are virtually non-existent while the favourable effects are abundantly clear. While it is unnecessary to reintroduce DDT in the Western countries that have banned it, it would cause many human deaths to declare a world-wide ban. Goklany concludes very carefully that:[109]

> 'The fact that the public health effects of DDT are disputed indicates that even if they are real, they are probably not of the same order of magnitude as either the 300 million malaria cases or the 1.1 million deaths due to malaria in 1999 – or they are delayed.'

He adds to this that the use of DDT against malaria is of a very different nature then the use as an insecticide. Spraying against malaria occurs indoors and needs much smaller quantities.

A world-wide ban on DDT could easily lead to in ten years time to 150 million additional cases and to 550,000 deaths.[110] One reason for this is that there is no

suitable alternative. This is so for two reasons. First, DDT is cheaper than any alternative. This, of course, is of great importance in developing countries that have many problems and few resources. Second, DDT is much more effective than any alternative means. Third, most alternatives, especially the more effective ones, are more toxic for humans. In effect then, a world-wide ban of DDT would compel developing countries to use more expensive, less effective and more dangerous means to fight malaria. Sri Lanka is a case, which may illustrate the effects of such a change in policy. In 1948 (then) Ceylon counted 2.8 million cases of malaria, which number was reduced to 17 (!) in 1963. However, after spraying stopped in 1964 that number began to rise again to 2.5 million in 1969.[111]

The present situation according to the United Nations' *Human Development Report* of 2001, is that since May 2001 a treaty of the *United Nations Environmental Programme* bans the manufacture and use of DDT for all purposes. However, an exception is made for public health issues because of its advantages in fighting malaria. Yet despite this exception, some donor agencies and governments will not funds its use. Here it is clear that –parallel to the GMO case in the EU– this Western attitude in fact increases the hardship of poor people on developing countries, again showing the morally flawed qualities of the PP.[112] In conclusion we like to cite Goklany's balanced summary:[113]

> 'In summary, a one-size-fits-all global ban on DDT use now or in the foreseeable future, despite its claim to be precautionary, would in fact be incautious because it is likely to add to the numbers of malaria deaths. … In developed countries, a ban on DDT [now] makes sense. On the other hand, in countries where malaria is an ongoing threats, indoor spraying of DDT ought to be encouraged until it is phased out automatically, if and when equally safe and cost-effective substitutes are available and have been accepted and adopted by the beneficiaries of indoor spraying in the developing world. Such an approach would avoid "silent springs" in the developed countries without silencing people in malaria-prone developing countries.'

4 Trends in the Culture of Damage and Disgrace

4.1 Introduction

In 1986 Ulrich Beck coined the concept of the risk society.[114] By now this concept is common currency even outside the field of social scientists. Beck's basic idea is that industrial society has developed to such an extent –in the First World!– that the distribution of scarce goods is no longer the primary social problem. The main problem, Beck claims, is the distribution of the technological risks that are also a product of the industrial system of production as the commercial exploitation of scientific knowledge. It is this problem that the fundamental social struggles are fought about in the risk society. One of the effects of this change in the subject of social struggle, Beck predicted, is that people will increasingly demand the politicisation and democratisation of the worlds of science and industry.

Some fifteen years later there is little doubt that Beck -and others with similar ideas-[115] came up with some very insightful observations and predictions. Major problems in today's Western society centre on safety and security. In the sense that we still worry a lot about our possessions and our jobs we continue to live in industrial society. But it is true that major worries have come to the fore, which centre not so much on our wealth but on our health. Here we encounter a theme that Giddens has explored in his book *Modernity and Self-Identity: Self and Society in the Late Modern Age*.[116] Life politics becomes a major task that people in late modernity have to deal with. We have to think of the future and who we want to be. In the light of this project we constantly re-evaluate the present and the past. Life at the individual and at the social level truly becomes reflexive in late modernity.

This opening up of the future as something to think –and to worry– about today has contributed to changes in our ways of thinking about risks. In fact, we believe that the more the risk society –as Beck sees it– develops, we shall see the development of a new culture around the eternal theme of *damage and disgrace*. If industrial society knew a risk culture, then risk society will have a precautionary culture. In this study we want to give an historical account of the changes in our cultural appreciation of damage and disgrace.

We distinguish three ideal types of such a culture that each has left traces in our modern legal systems. Historically first is the concept of *guilt*. Tort law in nineteenth century has worked with this concept which lost much of its currency only in the second half of the twentieth century. By the end of the nineteenth century it was mainly the settlement of damages due to accidents in the industrial workplace that caused problems for this legal framework. It was here that the *concept of risk* became of great importance. This concept is the pivot of our *second ideal type*. The *third ideal type* has developed gradually during the last decades of the twentieth century. A focus on the –far– future and an intention to prevent damage are the

centre pieces of this new culture, that we would like to call a *precautionary culture*, in contrast to the first two types that we may call a *guilt* culture and a *risk* culture.

We offer these concepts as ideal types in the Weberian sense that they are conceptual constructions, which are supposed to serve as heuristic analytical tools.[117] However, we do also believe that the basic elements of these constructions belong to everyday social life in modern Western society, which is industrialised ánd democratic. It is important in that respect that all three central sociological concepts –*guilt, risk and precaution*– are also very important legal concepts and as such part and parcel of legal doctrines.

Although guilt culture belongs to the typology of cultures of damage and disgrace, we shall not treat it extensively. The classical liberal view it contains and which fitted very well the early modern societies of the nineteenth century is in many ways alien to our present day society. However, the central moral lesson of the guilt culture should be remembered. This lesson –that citizens should be responsible for and bear the consequences of their own actions– still is important for our present day moral thinking. The relevance of this lesson has become more limited as our society is increasingly based on expert knowledge and has become more and more complex.

We start, therefore, with the development of the risk culture, which led to new legal concepts and practices that contrasted strongly with those of the guilt culture. While risk culture gained prominence in the course of the twentieth century, it was also increasingly criticised. We discuss this critique with regard to the diminishing confidence in scientific knowledge. We focus on the central theme in this critique – stressing the relationship between knowledge and politics. This critique gained influence and helped the development of a precautionary culture. We conclude this chapter with a discussion of the characteristics of this new cultural type of which the PP is the crucial legal aspect.

4.2 The risk society: development and characteristics

Risk has become an everyday term and accordingly it has lost most of its specific meaning. In its everyday use, for instance, there is hardly any difference between risk, danger and expected damage. If we want to understand what risk culture is, we have to be more precise. Actual damage no longer has anything to do with the chance of its occurrence. Danger should be taken to refer to damage, which is immanent and very likely. In a typical Dutch context we can say there is always the risk of a flooding, but it is not very often we face that danger.[118]

The concept of risk -apart from its many definitions[119]- carries three specific characteristics, which can be classified as follows:[120]

- Chance (probability)
- Consequences (which are negatively valued)
- Controllability

It's important to mention here that the concept of risk is not to be confused with risk parameters such as mortality or morbidity. A risk parameter is a condensation of the *total risk* of a certain process or product in order to make things measurable and comparable or e.g. to set standards for insurance companies. Risk parameters are to be regarded as different dimensions of the concept of risk.

The first two aspects are part of a more or less quantitative approach of risk calculations whereas the third aspect is more related to the psychology of risk, meaning risk in relation to a perceived decline of controllability.[121] The *frequentistic* (statistical), *logical* and the *personal* approach are three interpretations of the aspect of *probability*. The *first* one is used the most *if* historical statistical data are available to extrapolate the associated risk. Mortality rates of traffic accidents in a country are an example of the frequentistic interpretation of probability as data can be used to extrapolate to future mortality rates in relation to e.g. infra-structural development of cities. The *second* interpretation makes use of the physical, chemical and/or biological characteristics of the system under scrutiny. These characteristics give clues to the definition of specific risks involved. The evolution in time of weather patterns is an example of this approach of probability. The *personal* interpretation of probability has to do with the *belief* of a certain expert whether or not a certain situation or process posses a risk to people or the environment (or both) within a certain timeframe. At some stage, the process of risk characterisation (hazard identification, exposure assessment, risk assessment) is dependent on expert judgement. In order to guarantee the rationality of expert judgements several experts are usually involved in the process of risk characterisation.[122] Psychological research has shown that *controllability* -more so than *probability*- is a key aspect in the description of risk.[123] Maximising controllability is regarded as optimising risk reduction. The *perception of risk* is closely related to this aspect of the concept of risk.[124]

We distinguish four main aspects of risk culture: *calculability*, *formal responsibility for damages* which is coupled to *formal entitlement to compensation*, and *cost-effective prevention*. If we can calculate (assess) future occurrences logically or on the basis of historical data we can also estimate the total damage to be expected. To be able to compensate for that damage we need to set up an insurance scheme. Relative to compensation for damage and the related insurance payments we can calculate which preventive measures are most likely the most cost-effective.

As long as the old Roman style numbers were used it was impossible to talk about risk in our present sense, because the necessary calculations could not be performed. Modern day concepts of calculations and statistics could not be developed with such a numerical system. It was only in 1654 that Blaise Pascal and Pierre de Fermat laid the foundation for the probability theory that was needed to develop the modern

concept of risk. According to Bernstein this new conceptual device created a historical watershed:[125]

> 'What is it that distinguishes the thousands of years of history from what we think of as modern times. The answer goes way beyond the progress of science, technology, capitalism and democracy. …
>
> The revolutionary idea that defines the boundary between modern times and the past is the mastery of risk: the notion that the future is more than a whim of the gods and that men and women are not passive before nature. Until human beings discovered a way across that boundary, the future was a mirror of the past or the murky domain of oracles and soothsayers who held a monopoly over knowledge of anticipated events. …
>
> The ability to define what may happen in the future and to choose among alternatives lies at the heart of contemporary societies. Risk management guides us over a vast range of decision-making, from allocating wealth to safeguarding public health, from waging war to planing a family, from paying insurance premiums to wearing a seatbelt, from planing corn to marketing cornflakes. …'

It was this device that the kings of the *Ancien Régime* used to calculate their future population with regard to their military and financial needs. But *probability* also and most importantly led to the development of insurance schemes, first of all with regard to shipping, life insurance and fire insurance.[126]

Insurance schemes show a combination of social, economic and legal aspects. People do want to secure their life chances and thus try to make arrangements for the future. Economical development depends on this kind of security, which allows for more reliable cost-benefit calculations. Furthermore, the legal back-up guarantees even more certainty for people with their social and economic needs. To insure oneself has become a standardised and routine part of our modern way of life, which is of crucial importance for us to plan ahead or, in Giddens' terms, to be involved in our life politics. Historically speaking an important side effect of the economic rationality of insurance were more safe working conditions for industrial labourers. Cost-effective investments in safer work conditions were not only to the benefit of employers but also to the benefit of employees. The invisible hand of capitalistic self-interest thus promoted proletarian life chances.

Insurance also makes very clearly to what extent we think the future can be controlled within a risk culture. If our experiences from the past allow us to predict future negative occurrences, they also allow us to take preventive measures. But these measures need to be cost-effective. *In other words, we do accept damage in the future when it is more economical to compensate for that damage, then it is to take further preventive action or to stop with the original activity from which the damage results.* This is the key aspect of risk culture in which we take *damage* to be an unfortunate side effect of activities that *on the whole* are valued positively. Some people may die in car or aeroplane accidents or in hospital ORs but we do not want

to give up driving, flying or surgery. So at least some remaining damage is taken for granted in risk culture as long as it is possible to compensate for it. In this sense compensation is the standard reaction and comes first. Preventive measures are taken only when they cost less in relation to the compensation scheme.

Insurance compensates for damage in a way, which is fundamentally different from a *guilt* culture. In such a culture the victim sees damage as the result of a lack of precaution. Normally, therefore, victims are expected to bear their own losses and learn from the experience. To suffer damage is thus seen as a moral lesson at the individual level. Compensation for this lack in the quality of precaution would only lead to further moral decay as it takes a way a sense of responsibility of the victim. Therefore the law puts up strong barriers for those who seek compensation from others. Only when the victim is not to blame at all and the damage is completely the result of moral wrongs of some guilty other, then -and only then- that guilty party is liable for the damage.

Risk culture, on the other hand, no longer uses the idea that damage is the result of moral wrongs, which can be contributed to a guilty individual. Damage is primarily seen as the unavoidable side effect of some useful activity. This way of thinking is clearly developed with regard to accidents in the industrial workplace during the last decades of the nineteenth century.[127] The social, economic and political changes of that time facilitated a crucial cultural change in the way people thought about *damage* and *disgrace*. For industrial accidents the private law was no longer deemed suitable and so one of the first public laws –in the Netherlands the *Industrial Accidents Law* of 1901– came about. Within the framework of this public law questions of individual guilt of employees or employers were hardly relevant any longer. An insurance scheme of formal compensation based on formal responsibility was institutionalised. The employer was considered to be in the best position to decide about the cost-effective optimum of compensation and prevention and to incorporate the extra costs in the prices of his product or the payment of his employees.

Risk culture shares the early modern optimism of the Enlightenment because it shows great trust in scientific knowledge as a reliable tool to predict and control the future. The development of industrial technology, which created specific risks in the working place, continued to be valued because of the scarce goods that were produced. As long as the price paid for those goods exceeded the costs of prevention and of compensation nothing stood in the way of progress. To reach a cost-effective optimum of compensation and prevention the institution of insurance was developed. We can see insurance as a form of social, economic and also political technology, which is also based on scientific knowledge and used to increase our control over the future. Both forms of technology have dominated the twentieth century and together they produced the welfare state, which came under increasing attack during the seventies. These attacks had much to do with disappointments and doubts about our technological abilities that were coming to the fore. Early modern optimism gradually eroded – although only on the surface –

and was replaced – in explicit public debate – with the scepticism of late modernity. We have to understand Beck's ideas about risk society in this context, one in which the changes in our appreciation of scientific knowledge are crucial. The development of a precautionary culture – as a critique of risk culture – cannot be understood without taking due cognisance of this crucial change. This is the subject of the next section.

4.3 Late modern relativism: the interdependence of knowledge and power

Post-modernity as a theory about the nature of late modern society is clearly the most relativistic position about the value of scientific knowledge in the early modern sense.[128] However, even ignoring this theoretical position and sticking to the more classical epistemological points of view of e.g. Popper it becomes clear that all knowledge nowadays is regarded as a product of social processes, the scientific method being one of them.[129] The belief in the possibility of objective knowledge, which is eternally true, is discarded. Today, the belief of an inter-subjective knowledge under constant scrutiny, discussion and revision is held. What we hold to be true today can (and probably will) be revised tomorrow. According to Gellner this epistemological position -the possibility of revision of scientific standpoints- has always been present in modern culture and accounts for its success, although he makes it quite clear that 'serious knowledge is not subject to relativism'.[130] Modern man in Western society has to forego the possibility of believing in any eternal truth.[131] As Gellner puts it:[132]

> '… It [the cognitive ethic of the Enlightenment; *authors*] requires the breakup of data into their constituent parts, and their *impartial* confrontation with any candidate explanatory theories. It shares with monotheistic exclusive scriptural religion the belief in the existence of a unique truth, instead of an endless plurality of meaning-systems; …. It shares with hermeneutic relativism the repudiation of the claim that a *substantive,* final and definitive version of the truth is available. It is, however, separated from it by refusing to endorse, as equally valid, each pre-Enlightenment, socially enmeshed , cognitive cocoon of meanings. Only a *procedure,* but no substantive ideas, is absolutized. …'[133]

Searle makes the useful distinction between purely natural phenomena (e.g. a stone), artefacts (e.g. a knife) and social institutions (e.g. marriage).[134] The historical trend in the development of human society is that artefacts and institutions have become more and more important for the fate of humans whereas natural phenomena have become less important. More and more it is social reality which dominates our human existence. This social reality is constantly (re)constructed and in this construction *knowledge* –moral, political, legal or scientific– is the central feature. Today the artefacts and institutions created by humans in the interest of humans present the most visible risks to humans, albeit arguably not the most important. Therefore, risks have to be understood as *created* as well. They normally involve natural phenomena (e.g. snow), artefacts (e.g. ski slopes) and institutions (e.g. 'avalanche watchers'). Even the most natural of dangers like storms, floods and

earthquakes are no longer seen as 'just' natural phenomena. They are considered to fall under human scrutiny and prediction if seldom under human control. In this sense our human environment is almost entirely considered to be social, whether or not that is justifiable. It is in this socialised environment that knowledge and power come together.

The production and application of knowledge is never free from social relationships. This is an old sociological theme that is directly relevant for the way people respond to dangers and damage. In this sense we may speak of the politics of danger, which is a prominent theme in the work of Mary Douglas. In her essay on *Risk and Justice* she writes:[135]

> 'Cultural theory starts by assuming that a culture is a system of persons holding one another mutually accountable. … From this angle, culture is fraught with the political implications of mutual accountability'

That is why every culture needs -as Douglas states- a common forensic vocabulary with which to hold persons accountable. It is this vocabulary which allows certain claims of justice and danger as rhetorical resources for all parties. On this fulcrum concepts of liability and tort are continuously at stake.

According to Douglas the discourse of risk is our modern, rational and technical variant of such a forensic language in which politics and knowledge are very much intertwined. Together with Aaron Wildavsky she developed a conceptual schema of ideal types to elaborate on the cultural nature of risks.[136] In order to know what we hold to be most dangerous we have to ask what we hold to be most precious. The ultimate evil is that which threatens the ultimate good most. First there is the *hierarchical* position in which the ultimate goods are *law and order* at the national and international level. Peace and stability are valued highly and war, crime and other forms of social or political upheaval are considered to be the worst dangers. Second there is the *individualistic* position in which the basic value is the *free development by all individuals of their potential*. Civil liberty has to be secured and privileges, rigid regulation and economic downfall have to be prevented. The third position is *egalitarian*. Here the social good is *human equality* and brotherhood and living in harmony with nature. From this point of view government, industry and science are dangerous social systems, which are estranged from everyday life.

Douglas and Wildavsky suggest that we should view discussions about risks as political struggles between adherents of all these points of view. For instance, those who want to promote law and order will want to develop strong political, legal and military systems, which from the egalitarian point of view are precisely the things to fight against. People promoting individualistic values will be opposed both by hierarchists –who value stability and regulation over development and freedom– and by egalitarians, who value equality and homogeneity over social, political, economic and cultural differentiation. In such a context the question which risks do exist and deserve priority becomes very complicated to answer. This, however, does not mean

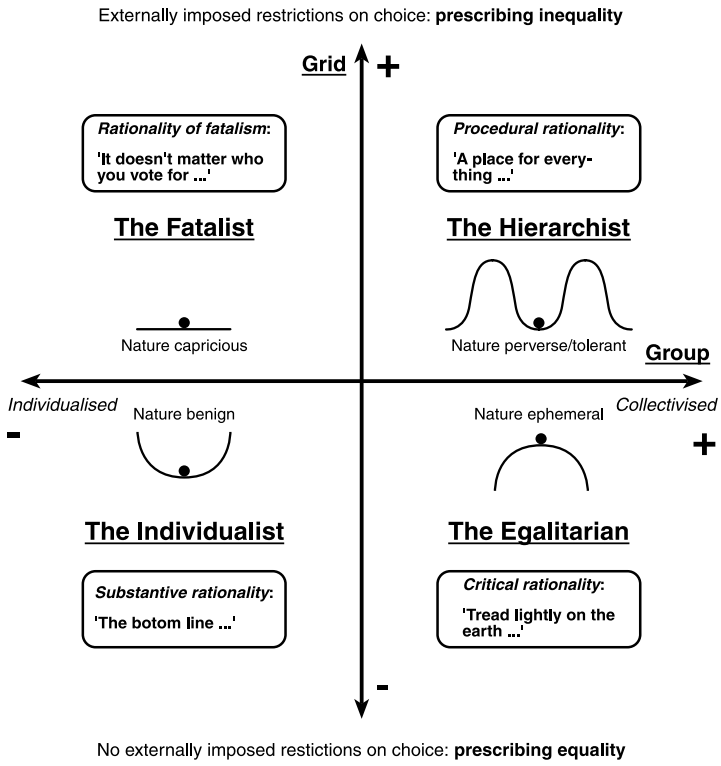
that 'anything goes' relative to the taken standpoint, on the contrary.[137] Serious knowledge, such as the dose-response relation of inhaled anthrax spores,[138] is beyond any relativistic critique, as was shown by the recent tragic events in the United States.

Cultural Theory comprises of four rationalities of which three of those have been discussed above. It explains risk ranking in relation to political and societal positions. At the level of public policy the main dangers can be grouped into four classes:

- *Foreign affairs*: the risk of foreign military attack or intrusion; war; terrorism; loss of influence, prestige and power
- *Internal affairs*: failure of law and order; internal societal and political collapse; (senseless) violence; white collar crime
- *Pollution*: abuse of technology; environmental degradation; loss of biodiversity
- *Economics*: loss of prosperity; unemployment; poverty; hunger

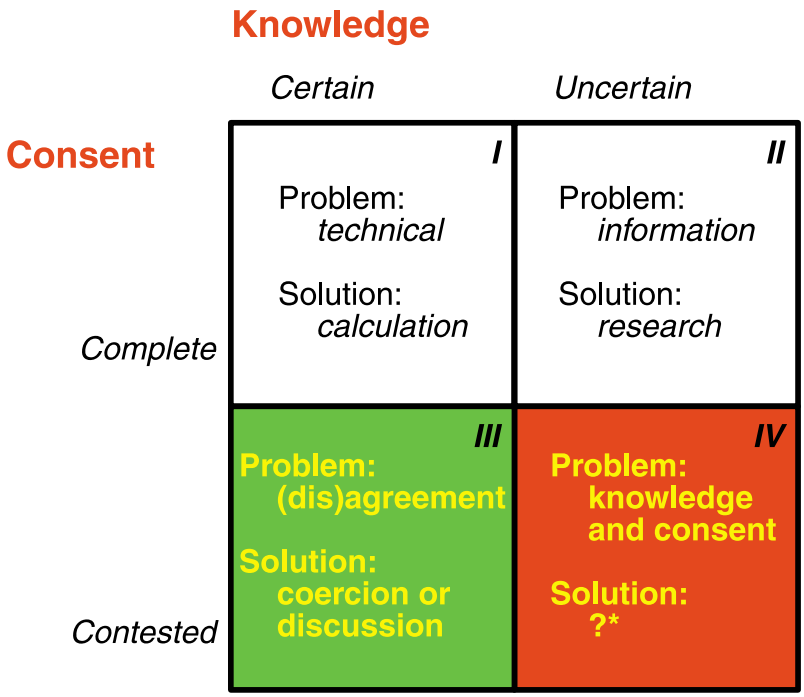
Within a so-called *group-grid* construction, the *common values-common fears* relationship with images of nature can be depicted as follows:[139]

Figure 4.3.1 Group-grid representation of Cultural Theory



In a world full of dangers, and considering the different viewpoints one can take, no one person can know more than a fraction of those dangers that abound. To believe otherwise is to believe that we can know everything. Yet even if we did, it would still be necessary to agree on some kind of ranking of risks. In the absence of complete knowledge, and in the presence of disagreement between scientists and laymen alike (see above), how are we to zero in on any particular portfolio of dangers? To put matters into prospect, risk should be seen as a joint product of *knowledge* about the future and *consent* about the most desired prospects.[140] The chart depicted below is an illustration of the relation between knowledge and consent:

Figure 4.3.2 Four problems of risk



(**: Precautionary Principle?*)

When *knowledge* is *certain* and *consent comprehensive* -societal objectives are agreed upon and alternatives are known together with the relative probability of occurrence- then a problem within this frame (I) is of a technical nature and solutions are found in calculations. In the situation where *knowledge* is *certain* but *consent* is *contested* -different ideas exist concerning the way to go within society- then the solution is more discussion (e.g. the 'polder model' so much revered in the Netherlands; see frame III). When this proves to be unworkable, coercion in the

form of e.g. legally binding legislation is the other option. In the case where *complete consent is hampered by a lack of knowledge*, the problem of risk is defined as a deficit of information (frame II). The solution to this specific risk problem is scientific research.

Douglas and Wildavsky describe the situation depicted in frame IV -where consensus is wanting on both accounts- as follows:[141]

> 'The last situation [*frame IV; authors*], in which knowledge is uncertain and consent is contested, is precisely how any informed person would characterise the contemporary dilemma of risk assessment.'

Within this specific risk-problem-frame (IV) science and politics are closely interwoven, as both are in need of each other in the search for solutions. This makes the scientific community vulnerable for political opportunism resulting in a politicisation of science. Rip has analysed the relation between science and politics in discussions about risks. His work –which is in line with that of Douglas and Wildavsky– leads him to two conclusions. Firstly and not surprisingly he finds that scientific agreement is more likely among participants who adhere to similar normative views. His second conclusion is more interesting. He claims that scientific agreement is more 'robust' when it has been reached by discussion between participants who represent more diverse normative points of view. The more robust the scientific knowledge, the more difficult it is for newcomers to the discussion to break the consensus and renew the struggle about facts and explanations. Rip speaks of 'empirically controlled normativity'. His research into the development of science leads him to the conclusion that the construction of scientific facts and the authoritative application of values are two consequences of one process: increasing robustness. It is this goal that guides scientific experts in their everyday practices.[142]

Rip presents two other important points. First of all, acceptance of a certain construction of scientific facts does not have to be based on consensus. For different reasons opponents may give up the fight against a dominant view. One reason why industry sometimes accepts governmental norms based on disputed science is that at least the case is settled officially and uniform standards are in place for everyone. Predictability of governmental decisions and equality of treatment are valuable to captains of industry who might care less about scientific accuracy. Rip's second point is that wherever the same parties meet each other time and again in similar discussions, 'second order robustness' is likely to arise. By this he means the institutionalisation of the struggle that facilitates the creation of first order robustness: the agreement on facts and values.[143] All kinds of legally regulated procedures can be regarded in this sense as politically generated second order robustness.

This view that questions about scientific fact are related to questions of normative agreement goes squarely against the early modern idea of the separation of science and politics, which just like the separation of law and politics was one of the basic

tenets of the Enlightenment. Both ideas have been criticised from the outset, but it was only during the twentieth century and especially in the second half that they came under increasing attack. Of course lawyers as well as scientists try to salvage as much of the separation as possible, because only then can they feel secure in their own discipline. But as soon as the public takes an active interest, professionals are fighting a losing battle. This is Beck's point about science and industry becoming more politicised. With the erosion of the separation of science and society we witness erosion of the authority of science and scientists as well as government and industry as far as they are dependent on science. By now famous cases like smoking and asbestos have taught the public that scientists can make wrong ascertains and that government and industry have strong interests in denying established adverse effects of products that are important to them. The recent cases of BSE in the United Kingdom and the contamination of blood in France have added scandal to scepticism. Under these circumstances it is relatively easy for pressure groups to qualify some activity or product as a huge risk, especially when there is much unknown and *ipso facto* uncertain. In such cases the predicted actual damage will typically only come about in the distant future -if at all-, which renders these predictions impossible to falsify. For scientists this means an easy disqualification. For policymakers, however, such disqualification is less easy to do, because they have to cope with public opinion. And for the public, unfalsifiable threats are unrefuted (actual) treats! This is exactly the situation in the cases we discussed in the last chapter.

4.4 The rise of the precautionary culture

The rise of the precautionary culture is strongly related to so-called 'green thinking', which found its way to the centre of power in politics in the 1970s. Bramwell, in her study on the ecological movement in the twentieth century, analyses the development of green thinking and its impact on the Western society.[144] She shows how two distinct strands of ecology merged in the early 1970s. First, there is the classic strand, which arose in the late nineteenth century and is 'an anti-mechanistic, holistic approach to biology', deriving from the German zoologist, Ernst Haeckel. The second strand was a new approach to economics called energy economics. This focused on the problem of scarce and non-renewable resources. *It is the combination of the intensely conservative moral and cultural ecological critique with the full apparatus of quantitative argument that has rendered ecologism the powerful force it is today*.[145] Bramwell notes how two influential international reports gave ecologism intellectual and political status. First, in 1972 Barbara Ward and Rene Dubos presented a report to the *United Nations World Conference on the Human Environment*. It argued that man had to replace family or national loyalties with a sense of allegiance to the planet. It preached imminent doom through man's technological capacity. Second, the *Club of Rome* was founded in 1972. It too prophesied imminent global catastrophe, unless resource use was curbed, and resources shared. These two reports coincided in time with the oil crisis of the early 1970s, which gave them economic credence and social support. *The fusion of green values with resource fears had taken place.*[146]

In *Risk and Culture* Douglas and Wildavsky add some explanations for the question why green thinking gained so much support during the 1960s and 1970s in the United States of America. They point out that religious sectarianism has always been a prominent feature of American culture. They also stress the importance of the civil rights movement. The economic and educational boom together produced a cohort of articulate, critical people with no commitment to commerce and industry. Because the more the means of production are ideas rather than things, the less the hierarchical organisation of production appears essential.[147]

The more the green movement gained influence, the more the ecological ideal op sustainability became important. Sustainability stresses our present human responsibility towards the relation of future generations to their environment.[148] The political acceptance of sustainability led to the development of the PP as the legal core of environmental policy. Some earlier formulations of the PP can be found in European treaties, but in 1992 the *Ministerial Declaration of the UN Conference on Environment and Development* –known as *the Earth Summit*– adopted the PP as *Principle 15*.

Indeed, ecological risks both in relation to nature and human health are at the centre of the precautionary culture. Precaution and sustainability are both sides of the same medallion and have by the very nature of their semantics global implications. The need for rules or principles of management is inherent to the intergenerational aspects of the vision of sustainability. Irreversible environmental loss or damage and uncertainty about future needs requires a 'safe minimum standard of natural capital', according to which the overall stock of environmental resources and carrying capacity should not be allowed to diminish over time.[149]

Central is here the image of pollution of nature as a whole. Pollution as a cultural rather than a technical concept implies categories dividing the moral from the immoral and sustains a vision of the good society, which is small and egalitarian. Impurities in the physical world or chemical carcinogens in the human body are in this sense directly traced to immoral large-scale hierarchical forms of economic and political power. We may sympathise with such values without believing that cultural relativism prevents an examination of the implications of their credo. Not only the hierarchical or the individualistic views of the good life but also the egalitarian credo is in need of scrutiny. Douglas and Wildavsky, for instance, have shown that a radically consistent application of the egalitarian perspective in modern society would lead to consequences, which contradict its primary values. In their final analysis the egalitarian perspective brings about the big political, military and police structures egalitarians abhor. In order to save the world for future generations egalitarians are prepared to go a long way. Douglas and Wildavsky end on a gloomy note, which goes well with our critique of precautionary culture and the PP:[150]

> '[Technological r]isk, like worldliness, is an ideal target for criticism. It is immeasurable and its unacceptability is unlimited. … Since the sources of risk are virtually infinite in number, subject only to the fertility of the mind, there is no limit on what can be spent on eliminating them.'

Our contention is that the risk society as Beck and others picture it gives rise to a precautionary culture, which in important respects differ from the risk culture of industrial society. For instance, where risk culture distances itself from individual moral guilt, it is re-introduced by precautionary culture. However, where in guilt culture it was assumed that the victim himself was to blame, in precautionary culture we assume that those in charge of industry and especially governmental officials are to blame. This is because risk culture has developed the idea that damage is not due to individual carelessness but should be seen as undesired side effects of industry, economy or any other social system. This lesson is retained in precautionary culture, but the idea that some damage is unavoidable and acceptable is no longer held as valid. In precautionary culture people feel that all damage can be predicted and should be prevented by precautionary action. Where risk culture took some damage for granted and prevented damage only to the extent that it was cost-effective, in precautionary culture the prevention of damage comes first, whatever the cost. When prevention fails this leads first to a moral public outcry against those officials who have forsaken their duty to prevent it (and must be punished) and second to a claim of full compensation. Together, as Bramwell poignantly noted, with the fusion of green values and resource fears, in the spotlights of mass media and with the help of powerful scientific imagery, Western society was expedited towards its ideal of zero-risk.[151]

Thus, the ideal now is a harm free society where all can live secure in perfect health and reasonable wealth. In this sense precautionary culture involves a radicalisation of the ideas of prediction and control that were first developed by risk culture. However, there is a contradiction here. On the one hand precautionary culture puts enormous trust in what science can do, but on the other hand it shows all the signs of late modern scepticism in science. This irresolute attitude can be shown very nicely by an analysis of the PP, which is the legal pivot of precautionary culture. *If precautionary culture is to become dominant and the PP is to be applied to more and more domains in the sense of When in doubt? Don't!, then we risk a change from the risk society to the cautious society.*

We have offered a fundamental critique of that culture, the PP and the way the *European Commission* proposes to use it. We have shown that the precautionary approach suffers from fundamental logical, legal and moral flaws, thereby hindering fundamental scientific advances in many fields of expertise and its societal spin-offs. As an illustration and elaboration of this critique we have given a number of examples of policy decisions and practices governed by the PP and its failure to resolve in a symmetrical fashion. In summary we offer a typology of guilt culture, risk culture and precautionary culture as three distinct ways of dealing with questions of damage and disgrace.

Scheme 4.4.1 Three 'damage and disgrace' cultures

	Guilt culture	**Risk culture**	**Precautionary culture**
Perspective in time regarding damage	Past	Near future	Distant future
Damage and prevention	Damage can be prevented by careful personal action	Damage is an unfortunate side effect of systems which can never fully be prevented	Damage is a negative effect of systems which could and should be prevented
Moral reaction to damage	Your 'own fault'; carry your own burden	'Bad luck' for which no one is to blame and which should be compensated	'Damage is a disgrace' for which someone has to pay
Who is to blame	The victim	Nobody	The controllers of our social and economic systems
Who pays for the damage	The guilty party (as a rule the victim)	All those related to the damaging activity by paying a small premium	Every member of society who contributes to the public funds
Damage magnitude	Relatively small individual instances	Relatively large at the aggregated level	Catastrophic and irreversible[152]
View on the victim	Morally suspect	Rightful member of the risk collective	Victim of negligence
Role of probability	Irrelevant	Crucial	Marginal
Nature of risks involved	Irrelevant	Relatively big chances	Very small chances
View on prevention and precaution	Precaution and prevention are everyone's personal moral duty	Compensation comes first; prevention needs only to be done at a cost-effective level	Precaution is the moral duty of the controllers of society and industry
Relevance of *science*	Limited relevance of reliable causal explanations	Crucial relevance of reliable predictions	Limited relevance of knowledge tainted by culture and interests

References

1 The following HAN studies have been published (ISBN numbers are respectively: 90-76548-02-1, 90-76548-01-3, 90-76548-04-8, 90-76548-05-6, 90-76548-06-4, 90-76548-03-X, 90-76548-08-0):

- Nitraat en volksgezondheid: een Overzicht
- *Nitrate and Public Health: an Overview*
- Fosfaat in Nederland: een Nutriënt in Surplus
- Gewasbescherming: een Toxicologisch Perspectief
- *Emergence of a Debate: AGPs and Public Health*
- Normering en Risico in Wetenschappelijk Perspectief
- Risico's van Preventie: het Voorzorgprincipe Nader Bekeken

Apart from the above mentioned reports scientific articles were published as well:

- Hanekamp, J.; Bast, A.; Schuiling, R.; Donze, M. *Nitraat Enkele Kanttekeningen. H_2O,* **1999**, *21,* 22-23
- Hanekamp, J.; Bast, A.; Schuiling, R.; Donze, M. *De Nitraatdiscussie: Nog een Stap. H_2O,* **1999**, *24*, 41-42.

See www.stichting-han.nl for more information.

2 See his insightful and illuminating work on the PP: Pieterman, R. *Weg met het voorzorgbeginsel? Een rechtssociologische cultuurkritiek. Nederlands Juristenblad*, **2001**, *22*, 1023-1029 [Away with the Precautionary Principle? A judicial and sociological critique.]
Pieterman, R. *Afscheid van risico? Niet zonder gevaar! Recht der werkelijkheid*, **2001**, *1*, 35-63 [A farewell to Risk? Not without danger!]

3 Hanekamp, J.C. *Risico's van Preventie: Het Voorzorgprincipe Nader Bekeken*, **2001**, *HAN*, Zoetermeer [*Risks of Precaution: The Precautionary Principle Scrutinised.*]

4 See the website of the Danish Ministery of Environment: www.mem.dk/faktuelt/fak15_eng.htm; italics added.

5 See e.g. Goklany, I.M. *The Precautionary Principle. A Critical Appraisal of Environmental Risk Assessment.* **2001**, Cato Institute, Washington D.C.
Rethinking Risk and the Precautionary Principle. Morris, J. (ed.), **2000**, Butterworth-Heinemann, Oxford, UK.
Journal of Risk Research Special Issue: the Precautionary Principle, **2001**, *4(2).*
Stone, C.D. *Is There a Precautionary Principle? Environmental Law Reporter,* **2001**, 10789-10799.

6 White House Briefing Room, May 3, 2000; http://vm.cfsan.fda.gov/~lrd/whbio53.html.

7 *Directive 2001/18/EC*, drawn up in collaboration with the European Parliament, was introduced March 12, 2001. Until then, since 1990, *Council Directive 90/220/EEC* was in force.

8 *Facts on GMO's in the EU. Memo/00/43*, **2001**, Brussels, see Annex I.

9 *Facts on GMO's in the EU. Memo/00/43*, **2001**, Brussels, see Annex II.

10 Willums, J.; Golüke, U. *From Ideas to Action. Business and sustainable development. The greening of enterprise 1992*, **1992**, ICC Publication No: 504.
11 Graham, J.D. *Decision-analytic refinements of the precautionary principle. Journal of Risk Research*, **2001**, *4(2)*, 127-141.
12 For instance Wilson described 7 aspects which are considered part and parcel of the precautionary culture (http://www.gdrc.org/u-gov/precaution.html):

- *Proaction*: the readiness to take action in advance of scientific proof where inaction may be socially or environmentally costly
- *Cost-effectiveness of action*: to include in conventional CBA (cost/benefit analysis; *authors*) an examination of possible environmental costs and *a presumption* in favour of high environmental quality
- *Safeguarding ecological space*: leaving wide margins of tolerance in environmental capacities
- *Awarding the environment intrinsic value*: the grant of natural rights which may well challenge conventional views of the humans/nature relationship
- *Shifting the onus of proof*: imposing a duty of care on those who intend to develop the environment
- *Futurity*: a recognition that the future is uncertain, but that it needs to be given due weight
- *Paying for ecological debt*: an implication that past ecological exploitation should be compensated

Proponents such as Wilson articulate the PP in an abstract hypothetical fashion, not in the 'real world', and fail therefore to identify and analyse the consequences of proposals such as described above. Stone e.g. notes that the precautionary principle has been put forth 'in so many versions, often with cognate phrasing, as to belie the pretensions of the definite article.' As the precautionary principle advances into law, Stone argues, 'it is increasingly frustrating that there is no convergence either as to what it means, or as to what regions of action (environment, public health), it is supposed to apply. One would hope that the necessary clarification would come, in first instance, from the principles advocates, primarily in the environmental nongovernment organizations, (ENGO) community. But the advocacy literature is not consistently illuminating.' See Stone, C.D., note 5, p. 10 789 and 10 790. L. Bergkamp of Hunton & Williams in Brussels is kindly acknowledged for drawing our attention on the issues put forward by Stone.
13 Bodansky, D. *The precautionary principle in US environmental law.* In: *Interpreting the Precautionary Principle*, O'Riordan, T.; Cameron, J. (eds.), **1994**, Earthscan, London.
14 See note 2.
15 Marchant, G.E. *The precautionary principle: an 'unprincipled' approach to biotechnology regulation. Journal of Risk Research*, **2001**, *4(2)*, 143-157.
16 *Communication from the Commission on the Precautionary Principle.* Commission of the European Communities, **2000**, Brussels.
17 See note 16, p. 2; italics added.
18 See note 16, p. 3.

19 See note 16, p. 3; italics added.
20 See note 16, p. 13; italics added.
21 See note 16, p. 13; italics added.
22 See note 16, p. 13.
23 See note 16, p. 11; italics added.
24 *Late lessons from early warnings: the precautionary principle 1896-2000.* **2001**, European Environment Agency, Environmental issue report No 22, p. 181; italics added.
25 See note 16.
26 Gellner, E. *Postmodernism, Reason and Religion.* **1992**, Routledge, London, UK.
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28 Cross, F.B. *Paradoxical Perils of the Precautionary Principle. Washington and Lee Law Review*, **1996**, *53*, 851-925.
29 Adler, J.H. *More Sorry than Safe: Assessing the Precautionary Principle and the Proposed International Biosafety Protocol. Texas International Law Journal*, **2000**, *35*.
30 *Human Development Report 2001. Making new technologies work for human development. United Nations Development Program (UNDP)*, **2001**, Oxford University Press, New York, Oxford.
31 Wildavsky, A. *Trial and error versus trial without error.* In: *Rethinking Risk and the Precautionary Principle*. Morris, J. (ed.), **2000**, Butterworth-Heinemann, Oxford, UK, p. 22-45.
32 *Risk vs. Risk. Tradeoffs in Protecting Health and the Environment*. Graham, J.D.; Wiener, J.B. (eds.), **1995**, Harvard University Press, Cambridge, Massachusetts, London, England. Graham *et al.* define the notion of risk tradeoffs as follows:

> 'Though the term "risk tradeoff" may not be familiar to many people, the phenomenon is commonplace in human decisionmaking, reflected in such familiar adages as "out of the frying pan and into the fire" and "the cure is worse than the disease". The general problem is that efforts to combat "target risk" can unintentionally foster increases in "countervailing risks". Many kinds of countervailing risks are commonly known by the terms "side effects" (medicine), "collateral damage (military tactics), or "unintentionally consequences" (public policy*). Unless decisionmakers consider the full set of outcomes associated with each effort to reduce risk, they will systematically invite such risk tradeoffs. …'*

Grahem *et al.* illustrate the tradeoffs issue with the aid of the prohibitive pesticides control in the US. They describe the inter-relatedness of environmental issues such as the use of pesticides and environmental policies as follows:

> 'When examining the risks and benefits of a pesticide, … revoking the registration of the pesticide will eliminate the associated risks to human health and the environment. However, this would be true only if no pesticide replaced the banned compound and the target pest spontaneously disappeared. In practice, either the pest flourishes, with associated damages to crops and potentially to humans; or a different pesticide or alternative pest-control method, with its own risks and benefits,

is used in place of the banned product. Yet the current approach to pesticide regulation has not made it a practice to consider such countervailing risks or to weigh the relative risks of all likely pest control scenarios. …

The use of substitute pesticides can cause countervailing risks in many ways. First, new health risks can occur if the substitute pesticide is itself potentially carcinogenic, or if it has the capacity to cause other adverse health effects ….

Second, the pests do not just disappear when a pesticide is banned. The pest itself, if not adequately suppressed by the substitute pesticide, may be responsible for direct risks to human health …. Third, when a substitute pesticide is less effective at controlling the target pest, or acts against fewer pests at a time, farmers may respond by increasing the overall use of pesticidal products (or by selecting plant strains with higher levels of natural pesticides), with potentially adverse implications for human health and wildlife. Finally, restricting pesticides may generate indirect but important risks to the health of farm families and food consumers. If substitute pesticides are less effective or more expensive than the banned products, crop yields may be constrained and the prices of critical foods, especially fruits and vegetables, may rise significantly ....

By curtailing the essential nutritional intake of lower-income families, increased food prices can cause health risks that potentially outweigh the health benefits of avoided exposure to pesticides residues.'

33 Tengs, T.O.; Adams, M.E.; Pliskin, J.S.; Safran, D.G.; Siegel, J.E.; Weinstein, M.C.; Graham, J.D. *Five-Hundred Life-Saving Interventions and Their Cost-Effectiveness. Risk Analysis*, **1995**, *15-3*, 369-389.

34 Sapolsky, H. *The Politics of Risk. Daedalus*, **1990**, *119-4*, 83-96.

35 Sapolsky puts is as follows (note 34):

'Government policies add to the confusion of risk. There are contradictory statements about particular risks and inconsistent rankings among them. This is not because agencies lack the capacity to establish coherent programs. Each usually has a long-term policy agenda from which it would prefer not to deviate. Most are closely linked to a profession which has predictable norms and predictable goals. That policies are contradictory within and between jurisdictions, and that they may change as does the calendar, is due to our structure of government and the fact that the agencies are subject to political masters who must respond to public pressures in order to retain office.

Convinced that they must appear willing to alleviate every product or environmental fear as it arises, officials make no effort to pursue consistent, carefully designed policies toward health risks. Whatever the scare of the day, officials stand ready to formulate quickly congressional testimony, briefing papers, news releases, and programs that demonstrate their unsurpassed commitment to protecting the public. Dare they hestitate, and an ambitious congressman armed with staff and a

subcommittee will leap forward to take their place in front of the cameras.'

36 Tversky, A.; Kahneman, D. *Availability: A Heuristic for Judging Frequency and Probability. Cognitive Science*, **1973**, *5*, 207-232.
37 *Judgement under Uncertainty: Heuristics and Biases.* Kahneman, D.; Slovic, P.; Tversky, A. (eds.), **1982**, Cambridge University Press, New York.
38 Ames, B.; Gold, L.S. *Paracelsus to parascience: the environmental cancer distraction*, *Mutation Research*, **2000**, *447*, 3–13.
39 Page, T. *A generic view of toxic chemicals and similar risks. Ecology Law Quarterly*, **1978**, *7*, 207-244.
40 Wildavsky, A. *But is it True? A Citizen's Guide to Environmental Health and Safety Issues*, 3rd ed., **1997**, Harvard University Press, Cambridge, Massachusetts and London, England.
41 See note 33.
42 Graham is quite adamant on this point as he states that:

> 'The United States spends more than $1 trillion each year on medical services of all kinds, and serious questions are being raised about whether these health care dollars are well spent. Meanwhile, spending to regulate toxic substances such as chemicals and radiation is the subject of less public scrutiny. In fact, many federal laws discourage or even prohibit regulators from weighing the benefits and costs of toxin controls. This perverse outcome reflects the influence of advocacy groups that are demanding protection against all environmental toxins, regardless of how small the risks are or how great the costs of regulation might be. Recently, the annual rate of increase in toxin control spending has actually outstripped the annual rate of increase in health care spending.
>
> 'The result? Billions of dollars are being spent to eliminate trivial risks to health and safety based largely on speculative fears that man-made sources of chemicals and radiation are important causes of human cancer. If this same money were spent effectively, it could save 60,000 lives each year and thereby add 600,000 life-years to the life expectancy of the American people. (A "life-year" saved is a statistical measure of how much a lifesaving program increases the life span of a target population.)
>
> For example:
>
> - Spending $100 million per year on control of benzene emissions at rubber tire manufacturing plants might save one life-year over a 200-year period (i.e., $20,000 billion per life-year saved). The same $100 million, if invested in automobile airbag technology, is expected to save 2,000 life-years every year (or $50,000 per life-year saved)!
> - Spending $100 million per year on control of routine low-level releases of radiation from nuclear power plants might save one life-year each year. But the same amount of investment in cervical cancer screening and treatment is expected to save 2,000 life-years every year.

Overall:

- The median medical program costs $19,000 per year of life saved; the median injury prevention program costs $48,000 per year of life saved; and the median toxin control program costs $2.8 million per year of life saved.
- Put another way, the median toxin control program costs 58 times more than the median injury control program (per year of life saved), and 146 times more than the median medical program.'

Graham, J.D. *Comparing Opportunities To Reduce Health Risks: Toxin Control, Medicine and Injury Prevention. National Center for Policy Analysis*, **1995**, NCPA policy report no.192; see http://www.ncpa.org/studies/s192/s192.html.

43 It is estimated that 60 000 American lives are lost as a result of misdirected environmental toxin control programs.

44 See for a thorough discussion of this subject: *Genetically modified crops: the ethical and social issues. Nuffield Council on Bioethics*, **1999**, Latimer Trend & Company Ltd, Plymouth.

45 See note 30.

46 See note 11.

47 NIMBY is a somewhat dated acronym for Not In My Back Yard.

48 See note 11. The refinements Graham proposes are of a decision-analytic nature and address three complications: '(1) situations where the exposures to be reduced or prevented may have beneficial as well as hazardous consequences; (2) situations where the protective action itself will create potential hazards; and (3) situations where targeted research investments, coupled with delay of protective action, are likely to support wiser decisions than prompt protective action.'

49 Margolis, H. *Dealing with Risk. Why the Public and the Experts Disagree on Environmental Issues.* **1996**, The University of Chicago Press, Chicago, London.

50 See note 32.

51 *Understanding Risk. Informing Decisions in a Democratic Society.* Stern, P.C.; Fineberg, H.V. (eds.), **1996**, National Research Council, National Academy Press, Washington, D.C.

52 Bramwell, A. *Ecology in the 20th century. A history*, **1989**, Yale University Press, p. 248.

53 Durodié, B. *Plastic panics: regulation in the aftermath BSE.* In: *Rethinking Risk and the Precautionary Principle*. Morris, J. (ed.), **2000**, Butterworth-Heinemann, Oxford, UK, p. 161.

54 See note 26, p. 49-50.

55 See note 52.

56 See note 24, p. 12-13.

57 Compare Lieberman, A.J.; Kwon, S.C. *Facts versus Fears. A Review of the Greatest Unfounded Health Scares of Recent Times.* **1998**, American Council on Science and Health.

The American Council on Science and Health tells us that it summarises 'some of the most noteworthy …. unfounded health scares based on questionable, hypothetical, or

even nonexistent scientific evidence'. The EEA all too easily -without any scientific comment- dismisses this report which mentions, among other cases: DDT, Cyclamates, Nitrites, Saccharin, Three Mile Island, Alar, Electric Blankets and cellular phones.

Especially the case against nitrite (NO_2^-) has become a historic one. Human exposure to nitrite is limited, but nitrate (NO_3^-) is ubiquitous through food (especially vegetables) and drinking water. *In vivo* nitrate can be reduced to nitrite, the culprit in question. Deemed as carcinogenic via nitrosamines and the cause of infant methaemoglobinaemia from nitrate reduced to nitrite *in vivo*, both risks of nitrate/ nitrite exposure are proved to be unfounded by intense scientific research -spawning a comprehensive corpus of scientific literature- spanning more than 50 years. Moreover, it has become clear from recent scientific research that nitrite -via nitrate- is an essential ion in human physiology. The concentration of invading pathogenic micro-organisms in the gastro-intestinal tract are kept low with the aid of nitrate, which is recycled and concentrated in the saliva.

Saliva is the major internal source of nitrite formed by nitrate reduction; the mouth cavity contains bacteria that are capable of reducing nitrate to nitrite. Approximately 25% of the nitrate present in the human body is secreted by the salivary glands. And of this secreted nitrate 20% is reduced to nitrite in the mouth cavity. In total, therefore, 5% of the exogenous and endogenous nitrate is reduced to nitrite. At an average daily nitrate intake of 143 mg NO_3^- this amounts to 7.2 mg NO_2^- per person per day. Further reduction under acidic conditions to nitric oxide and peroxynitrite explains the strong anti-microbial activity of nitrate in the mouth and the stomach. These beneficial effects of nitrate are not in vogue yet.

The present nitrate standard for drinking water, which in essence only anticipates the risk of infant methaemoglobinaemia, does not incorporate these new findings and has become obsolete. It has been shown in the 1980s that infant methaemoglobinaemia is not caused by nitrate exposure but primarily related to gastro-intestinal infections. Any precautionary approach in relation to the exposure of nitrate is therefore inappropriate and ignores newly discovered scientific facts.

See e.g. L'hirondel, J.; L'hirondel, J.-L. *Nitrate an Man. Toxic, Harmless or Beneficial?* **2002**, CABI Publishing, UK.
Hanekamp, J.C. *Nitrate and Public Health: an Overview*. **1998**, Stichting HAN, Amsterdam.
Managing Risks of Nitrates to Humans and the Environment. Wilson, W.S.; Ball, A.S.; Hinton, R.H. (eds.), **1999**, Royal society of Chemistry, UK.

58 See note 53.

59 See note 28.

60 See e.g. *Risks, Costs and Lives Saved. Getting Better Results from Regulation.* Hahn, R.W. (ed.), **1996**, Oxford University Press, New York, Oxford.

61 *Integrale Bodemdalingstudie Waddenzee.* Marquenie, J.M., Gussinklo, H.J. (eds.), **1999**, Nederlandse Aardolie Maatschappij [Integral study on subsiding of the Waddenzee.]

See the overview article *Boren en Winnen* [*Drilling and Exploiting*] in the Dutch newspaper *NRC Handelsblad* of November 13, **1999**.

62 See note 2. The Dutch text reads:

> 'De Kamer, gehoord de beraadslagingen, constaterende, dat er nooit vooraf absolute zekerheid en sluitende garanties kunnen worden gegeven dat bodemdaling als gevolg van gaswinning niet leidt tot blijvende aantasting van de essentiële kenmerken van de Waddenzee als wetland; van oordeel, dat in het Waddengebied geen verdere proef- of winningsboringen mogen plaatsvinden; verzoekt de regering dit oordeel in de PKB Waddenzee op te nemen.'

63 *Derde Nota Waddenzee, Deel 1: ontwerp planologische kernbeslissing.* **2001**, p. 12. [Third Paper on the Waddenzee, Part 1: draft for a crucial planning decision as it was approved by the Council of Ministers January 19, 2001.] The Duth text reads:

> 'Zolang niet alle onzekerheden en twijfel over mogelijke blijvende aantasting van de Waddenzee, als gevolg van winning van diepe delfstoffen op locaties in het Waddengebied buiten de Waddenzee, in voldoende mate zijn weggenomen, zal het kabinet geen nieuwe vergunningen verlenen voor proefboringen naar en winning van dergelijke diepe delfstoffen. De komende jaren zullen worden benut om inzicht te verkrijgen in de vraag of de resterende onzekerheden over de mogelijkheid tot het voldoen aan sluitende voorwaarden kunnen worden weggenomen.'

64 Tait, J. *More Faust than Frankenstein: the European debate about the precautionary principle and risk regulation for genetically modified crops. Journal of Risk Research*, **2001**, *4(2)*, 175-189.

65 See e.g. Paarlberg, R.L. *Politics of Precaution: Genetically Modified Crops in Developing Countries.* **2001**, Johns Hopkins University Press, Baltimore and London.

66 See note 44.

67 In a comparable Dutch report, for instance, the author just represents the different points of view without evaluating them. See Jelsma J. *Van onhandelbaar tot onderhandelbaar risico. De introductie van genetisch gemodificeerde organismen in het milieu?* **1999**, Rathenau Instituut. [*From unacceptable to negotiable risk? The introduction of genetically modified organisms into the environment.*]

68 See note 30.

69 See note 31.

70 McHughen, A. *Biotechnology and Food.* **2000**, American Council on Science and Health, USA, New York. McHughen wrote his report for the American Council for Science and Health, which had it reviewed by sixteen scientists with different professional backgrounds and affiliations. The report is available from the website: http://www.acsh.org.

71 See note 70. McHughen refers to the 1987 *NAS* report *Introduction of Recombinant DNA-Engineered Organisms in the the Environment: Key Issues.*

72 *Genetically Modified Pest-Protected Plants. Science and Regulation. Committee on Genetically Modified Pest-Protected Plants; Board on Agriculture and National Resources; National Research Council*. **2000**, National Academy Press, Washington.

The report is available through the open book website of the *NAS*: http://www.nap.edu/openbook/0309069300/html.

73 The industry is very much aware of the problem of *resistance*. A documentary of the Dutch science program *Nooderlicht* [Northern light] showed the following example. When Bt-cotton was ready to be planted computer simulations indicated that resistance would occur within a period of five years. The same simulations, however, also showed that planting some 20% of conventional cotton next to the genetically modified variant could slow down this process to a period of fifty to seventy years. The mechanism is clear: the few insects that survive the Bt cotton have hardly any evolutionary impact on the many that thrive on the conventional crop (which is not harvested). Note: Bt refers to *Bacillus thuringiensis*, a bacterium which naturally produces a poison that is widely valued and used in agriculture especially among 'green farmers'. Bt-maize variants have been rDN-engineered to produce this poison. In this way it only kills insects that actually try to eat the crop while leaving other organisms alone, something which is impossible to achieve by spraying.

74 This *Directive* is repealed with the recent introduction of *Directive 2001/18/EC* of the *European Parliament* and the Council of 12 March 2001.

75 See notes 8 and 9.

76 The *Dutch Health Council* [Gezondheidsraad] recently deemed safe for consumption both a Bt-maize and a herbicide-resistant maize variant:
Herbicide-resistente mais (GA-21). Gezondheidsraad: Commissie Veiligheidsbeoordeling nieuwe voedingsmiddelen. **1999**, Gezondheidsraad publicatie nr 1999/1VNV.
Bt11-mais (pZO1502). Gezondheidsraad: Commissie Veiligheidsbeoordeling nieuwe voedingsmiddelen. **2000**, Gezondheidsraad publicatie nr 2000/02VNV.
These reports are downloadable from the website of the *Dutch Health Council* (http://www.gr.nl).

77 For an extensive account of what happened see: Stewart, T.P.; Johanson, D.S. *Policy in Flux: The European Union's Laws on Agricultural Biotechnology and their Effects on International Trade.* In: *Drake Journal of Agricultural Law*, **1999**.

78 Ames, B. N.; Gold, L. S. *Environmental Pollution, Pesticides, and the Prevention of Cancer: Misconceptions.* **1997**, *FASEB J. 11*, 1041-1052.

79 They did so at the *Environmental Council* of the EU (June 24, 1999) according to the Dutch government. See *Beleidnota Biotechnologie.* Parliamentary document for the Second Chamber no. 27428/2, **2000**, p. 14. [Policy Statement on Biotechnology.]

80 See note 15.

81 See for a comprehensice review on this issue: Bezoen, A.; Van Haren, W.; Hanekamp, J.C. *Emergence of a Debate: AGPs (Antibiotic Growth Promotors) and Public Health.* **1999**, HAN, Amsterdam.
See also: *The Use of Drugs in Food Animals. Benefits and Risks.* Committee on drug use in food animals; Panel on animal health, food safety, and public health; Board on agriculture, National Research Council; Food and nutrition board, Institute of medicine. **1999**, National Academy Press. Washington, D.C.

82 See note 24; p. 93-100

83 *Antimicrobial growth promoting substances: a scientific evaluation of the report of the Health Council of the Netherlands: Committee on Antimocrobial growth promoters.*

1998, TNO Nutrition and Food Research Institute, TNO report V 98.1204.

84 Aarestrup, F.M.; Bager, F.; Jensen, N.E.; Madsen, M.; Meyling, A.; Wegener, H.C. *Surveillance of antimicrobial resistance in bacteria isolated from food animals to antimicrobial growth promoters and related therapeutic agents in Denmark. APMIS,* **1998**, *106*, 606-622.

85 See Hanekamp *et al.*; note 81.

86 The plasma membrane of *Gram-positive bacteria* is surrounded by a thick cell wall, typically 250 Å wide, composed of peptidoglycan and teichoic acid. *Gram-negative bacteria* on the other hand have a more complex membrane system. Their plasma membrane is surrounded by a 30 Å wide peptidoglycan wall, which in turn is covered by an 80 Å outer membrane comprising of protein, lipid and lipopolysaccharide. Because of the different layered cell-wall structure of the Gram-negative bacteria in comparison to the Gram-positive bacteria, antibiotics against Gram-positive bacteria are mostly inactive against Gram-negative bacteria.

87 Hummel, R.; Tschäpe, H.; Witte, W. *Spread of plasmid mediated nourseothricin resistance due to antibiotic use in animal husbandry. Journal of Basic Microbiology*, **1986,** *26*, 461-466.

88 Weinstein, R.A. *Nosocomial infection update. Emerging Infectious Diseases*, **1998,** *4 (3)*, 416-420.

89 Bates, J. *Epidemiology of vancomycin-resistant enterococci in the community and the relevance of farm animals to human infection. Journal of Hospital Infections*, **1997,** *37*, 89-101.

90 Gordts, B.; van Landuyt, H.; Ieven, M.; Vandamme, P.; Goossens, H. *Vancomycin-resistant enterococci colonizing the intestinal tracts of hospitalized patients. Journal of Clinical Microbiology*, **1995**, *33 (11)*, 2842-2846.

91 Berends, B.R. *Een geïmplementeerd beschrijvend epidemiologisch model van het veterinair gebruik van met name tetracyclines ten behoeve van een kwantitatieve risico-analyse van de consumptie van varkensvlees.* **1997**, Vakgroep Voedingsmiddelen van Dierlijke Oorsprong, Faculteit der Diergeneeskunde, Utrecht University, VVDO-Rapport H9706.

92 *The effect of avoparcin used as feed additive on the occurrence of vancomycin resistant Enterococcus faecium in pig and poultry production.* **1995**, report from the Danish Veterinary Laboratory (DVL).

93 *Report of the scientific committee for animal nutrition (SCAN) on the possible risk for humans on the use of avoparcin as feed additive.* **1996**, SCAN.

94 Kirst, H.A.; Thompson, D.G.; Nicas, T.I. *Historical yearly usage of vancomycin. Antimicrobial Agents Chemother*, **1998,** *42(5)*, 1303-1304.

95 *Opinion of the scientific committee for animal nutrition on the immediate and longer-term risk to the value of Streptogramins in Human Medecine posed by the use of Virginiamycin as an animal growth promoter (produced at the request of the Commission in response to the action taken by Denmark under a safeguard clause to ban virginiamycin as feed additive).* **1998**, SCAN.

96 See note 81. The thoroughness of the *HAN* report was recognised on the 1999 *OIE* conference where the report was referred to in the final conference statement: *The Use of Antibiotics in Animals – Ensuring the Protection of Public Health. Summary and Recommendations from the European Scientific Conference*, 24-26 March, **1999**, in

Paris.
97 See note 24, p. 172.
98 See note 24.
99 See note 24, p. 97-98.
100 Noble, W.C.; Virani, Z.; Cree, R.G.A. *Co-transfer of vancomycin and other resistance genes from Enterococcus faecalis NCTC 12201 to Staphylococcus aureus. FEMS Microbiological Letters*, **1992,** *93*, 195-198.
101 See note 95.
102 See note 24, p. 98.
103 See note 57; Goklany and Morris, note 5.
104 *The Life Sciences: Recent progress and Application to Human Affairs, the World of Biological Research, Requirements for the Future, Committee on Research in the Life Sciences*, **1970**, National Academy of Sciences, Washington DC.
105 See Goklany, note 5, p. 13.
106 See note 57, p. 8.
107 See Goklany, note 5, p. 18.
108 Safe S. *Environmental and dietary estrogens and human health: is there a problem? Environmental Health Perspectives*, **1995**, *103*, 346–351.
109 See note 5.
110 See Goklany, note 5, p. 20.
111 See note 57, p. 9. Here Zanzibar is mentioned as another example where the prevalence of malaria among the populace first declined from 70 percent to 5 percent in 1964, only to rise again to between 50 and 60 percent.
112 See note 30, Box 3.2 on page 69.
113 See Goklany, note 5, p. 27.
114 Beck, U. *Risikogesellschaft: Auf dem Weg in eine andere Moderne*. **1986**, Suhrkamp.
115 For instance Anthony Giddens in his *Consequences of Modernity* (1990, Polity Press). In fact it was Giddens' publishing company that published the English translation of Beck's original German book in 1992.
116 Polity Press, **1991**.
117 Heuristics are relatively simple decisional or analytical tools in order tot reduce complex cognitive tasks or research targets to orderly proportions. Another words for this is 'problem-sizing'. As conceptual constructions, ideal types are not concepts with a descriptive content. They are logical constructs, which in historical and comparative research serve the purpose of aiding our understanding of developments and differences by allowing classification of specific social and cultural contexts in terms of different ideal types.
118 In fact our sea dikes are built in relation to the acceptable risk of one flooding in 10.000 years whereas for our river dikes we formally accept a risk of one flooding every 1000 years.
119 Vlek, C.A.J. *Beslissen over risico-acceptatie. Een psychologisch-besliskundige beschouwing over risicodefinities, risicovergelijkingen en beslissingsregels voor het beoordelen van de aanvaardbaarheid van riskante activiteiten*, **1990**, Nr. A90/10, Gezondheidsraad, Den Haag.
Vlek identified 20 different definitions of the concept of risk.
120 See note 119.

121 Slovic, P. *Perceptions of risk.* **1987**, *Science*, *236*, 280-284.
The Perception of Risk. Slovic P. (ed.), **2001**, Earthscan Publications Ltd, London and Sterling VA.
122 Goossens, L.H.J.; Cooke, R. M.; Steen, van, J. F. J. *Expert opinions in safety studies. Final report*, **1989**. Delft University of Technology, Faculty of Philosophy and Technical Social Sciences, Safety Science Group.
123 See note 119.
124 See note 121.
125 Bernstein, P.L. *Against the Gods. The Remarkable Story of Risk.* **1996**, John Wiley & sons, Inc. New York, Chichester, Brisbane, Toronto, Singapore.
126 See note 125, p. 89-92.
127 For Dutch developments see: Schwitters, R.J.S. *De risico's van de arbeid. Het ontstaan van de Ongevallenwet 1901 in sociologisch perspectief*. **1991**, Wolters-Noordhoff. [The risks of labour. The development of the Industrial Accidents Law of 1901]
128 For a fundamental critique of the radical relativistic standpoint see: Sokal, A.; Bricmont, J. *Intellectual Impostures. Postmodern philosophers' abuse of science.* **1998**, Profile Books.
129 Gellner makes it clear that relativism in its logical consequence results in nihilism (see note 26, p. 49-50):

> 'The author [Clifford Geertz] is impatient with those who, in his view, misunderstand the situation. For instance, he pokes fun at Ian Jarvie's excellent summary of relativism -'all assessments are … relative to some standard … and standards derive from cultures'- notwithstanding the fact that Geertz himself at the end of the essay explicitly embraces relativism precisely in this form, and notwithstanding the fact that Jarvie's derivation of nihilism from this position is altogether lucid and cogent.
>
> Jarvie's simple and unanswerable point is that if all standards are an expression of culture (and cannot be anything else), then no sense whatever can be ascribed to criticizing cultures as a whole. No standards can then conceivably exist, in terms of which this could ever be done. If standards are inescapable expressions of culture, how could a culture be judged? …
>
> Relativism does entail nihilism: if standards are inherently and inescapably expressions of something called culture, and can be nothing else, then no culture can be subjected to a standard, because (*ex hypothesi*) there cannot be a trans-cultural standard which would stand in judgement over it. No argument could be simpler or more conclusive. …'

130 See note 26, p. 95.
131 Gellner, E. *Conditions of Liberty. Civil Society and its Rivals.* **1996**, Penguin Books, London, UK.
132 See note 26, p. 84.
133 Gellner makes it clear that relativism is a non-functional pre-Enlightenment approach

of reality. Sokal and Bricmont show that relativism has little or no influence on the progress of scientific knowledge in the fields of e.g. physics despite its universal appeal. Moreover, relativism adds little to the scientific method and its efficacy. See note 26.
134 Searle, J.R. *The Construction of Social Reality*. **1995**, The Free Press.
135 This essay is reprinted in: Douglas M. *Risk and Blame*, **1992**, Routledge.
136 Douglas, M.; Wildavsky, A. *Risk and Culture. An Essay on the Selection of Technological and Environmental Dangers*, **1982**, Berkely University of California Press.
137 See note 26.
138 See for a reference work on zoonoses: *Zoonoses. Biology, Clinical Practice and Public Health Control.* Palmer, S.R.; Lord Soulsby; Simpson, D.I.H. (eds.). **1998**, Oxford University Press, Oxford, New York, Tokyo.
139 Van der Sluijs, J.; Schulte Fischedick, K. *Omgaan met onzekerheden in wetenschap voor (milieu)beleid een inventarisatie van theorieën en aanpakken*, **1997**, Rathenau Instituut, rapport nr. 97017 [Dealing with uncertainties in science for (environmental) policies. An inventory of theories and practices.]
140 See note 136, p. 5.
141 See note 136, p. 6.
142 Rip, A. *Risicocontroverses en verwevenheid van wetenschap en politiek*. In: *Kennis en methode*, **1992**, *16/1*, p. 63-80. [Risk controversies and the intertwining of science and politics.]
143 In fact this is a classical sociological point. See for instance: Dahrendorf, R. *Class and Class Conflict in Industrial Society*, **1959**, Stanford University Press. Especially his section on 'Group conflict and structure change' (p. 231-236) digs in to this subject.
144 See note 52.
145 See note 52, p. 4.
146 See note 52, p. 211-212.
147 See note 136, p. 152-173.
148 See e.g.: Starr, C. *The Ultimate Uncertainty-Intergenerational Planning. Risk Analysis*, **2000**, *20(6)*, 793-800.
149 Bramwell, A. *The Fading of the Greens. The Decline of Environmental Politics in the West.* **1994**, Yale University Press, New Haven, London.
150 See note 136, p. 184-185.
151 See notes 52 and 149
152 This magnification of damage is not due to the 'real state' of issues but is largely related to the problem of risk perception (see note 121). Fears of catastrophic consequences of the use of technology is mainly a contention of green politics which evolved in the 19th and 20th century. J.R.R. Tolkien -writer of the fantasy novel Lord of the Rings- is a primary 20th century example of the romantic protest against the advance of technology and its perceived evils (risks). See: Veldman. M. *Fantasy, the Bomb and the Greening of Britain. Romantic Protest, 1945-1980.* **1994**, Cambridge University Press.