WRR

SCIENTIFIC COUNCIL FOR GOVERNMENT POLICY

Uncertain Safety

ALLOCATING RESPONSIBILITIES FOR SAFETY

AMSTERDAM UNIVERSITY PRESS

Uncertain Safety

This report is a translation of WRR-report 82 *Onzekere Veiligheid. Verantwoordelijkheden rond fysieke veiligheid*, submitted on October 1, 2008, to the Dutch government and published by Amsterdam University Press, Amsterdam.

Translation: T. Brouwers

WRR

SCIENTIFIC COUNCIL FOR GOVERNMENT POLICY

Uncertain Safety

ALLOCATING RESPONSIBILITIES FOR SAFETY

Amsterdam University Press, Amsterdam 2009

Cover illustration: © John Wilkes / CORBIS

Cover design: Studio Daniëls, The Hague
Layout: Het Steen Typografie, Maarssen

ISBN 978 90 8964 181 6
e-ISBN 978 90 4851 150 1
NUR 754

© WRR / Amsterdam University Press, The Hague / Amsterdam 2009

All rights reserved. Without limiting the rights under copyright reserved above, no part of this book may be reproduced, stored in or introduced into a retrieval system, or transmitted, in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the written permission of both the copyright owner and the author of the book.

"The State, that's the dikes."

C.W. van der Pot and A.M. Donner 1977

CONTENTS

Executive summary 11

Preface 19

1 Introduction 21
1.1 Concerns about safety 21
1.2 Problem formulation 24
1.3 Limitations and structure of this report 26

2 Safety issues: A survey of the domain 29
2.1 Hazardous substances 30
2.2 Flood prevention 31
2.3 Infectious diseases 34
2.4 ICT and the internet 35
2.5 Food safety 37
2.6 Nanotechnology 39
2.7 Common denominators in safety concerns 41

3 The classical risk approach and the allocation of responsibilities 45
3.1 The classical risk approach 45
3.2 Risk assessment and risk management 46
3.2.1 Risk assessment 46
3.2.2 Risk management 47
3.3 Responsibility and risks 50
3.4 Government instruments and administrative problems 53
3.4.1 Legislation and regulation 54
3.4.2 Protective provisions 57
3.4.3 Risk communication 59
3.4.4 Supervision 60
3.4.5 Administrative problems of the classical risk approach 62
3.5 Measures taken by companies 65
3.5.1 Risk management and corporate security 65
3.5.2 Self-regulation 67
3.5.3 Inspection and enforcement 68
3.6 Initiatives of citizens and civil society 69
3.6.1 Activities of citizens and civil society 69
3.6.2 Government and individual responsibility 71
3.7 Limited room for reallocating responsibilities 72

4	**The classical risk approach under pressure**	75
4.1	Intrinsic problems of the classical risk approach	76
4.1.1	Separating risk assessment and risk management	76
4.1.2	The role of hidden normative assumptions	77
4.1.3	The limits of expertise	81
4.1.4	Known risks are not necessarily manageable risks	82
4.2	Changing external conditions: new challenges	83
4.2.1	New risks	83
4.2.2	Changing position of experts	85
4.2.3	High expectations, media and the perception of citizens	88
4.3	The emergence of a new risk approach	89
4.4	Foundations of the new risk approach	93
4.4.1	Risks are constructions	95
4.4.2	Uncertainty and risk	97
4.4.3	Safety and danger are connected	99
4.5	Four types of risk problems	100
4.5.1	Simple risk problems	101
4.5.2	Complex risk problems	101
4.5.3	Uncertain risk problems	102
4.5.4	Ambiguous risk problems	104
4.5.5	Additional comments	105
4.6	Conclusion: the limits of the social engineering perspective	107
5	**Normative aspects of the new risk approach**	111
5.1	Politics beyond the classical risk approach	111
5.1.1	Precaution: a simultaneously widely accepted and contested principle	112
5.1.2	Public participation	116
5.2	The need for a new normative perspective	119
5.3	Normative foundations of the new risk approach	122
5.3.1	The scope of the precautionary principle	126
5.3.2	Precaution concretized	127
5.4	The precautionary principle and the allocation of responsibilities	130
5.5	Precaution requires political organization	134
6	**Conclusions and recommendations**	139
6.1	Towards a future-proof safety policy	139
6.2	The new risk approach and the precautionary principle as a starting point for policy	142
6.3	Organizing precaution: the new risk approach	144
6.4	Legal instruments	146
6.4.1	Public-law measures	146
6.4.2	Private law measures	149
6.4.3	Independent judiciary	152

6.5 Institutional conditions: the role of politics, science and citizens 153
6.5.1 Science 154
6.5.2 Public participation 157
6.6 Precaution as constitutional task 161

References 165

Websites cited 177

EXECUTIVE SUMMARY

Background of this report

Governments, non-governmental organizations, businessmen and experts regularly voice concerns about safety and security issues. Often these concerns pertain to crime and terrorist threats. However, safety issues need attention as well. Although citizens of today's Western industrialized countries on average live longer and in better health than previous generations and the inhabitants of most other countries, flood prevention, food safety, the transport of hazardous substances, infectious diseases, the risk of new technologies and many other threats to public health and the environment call for ongoing alertness.

"Public interest in safety issues is substantial and this is likely to persist," the Dutch Cabinet wrote in its request for advice to the Scientific Council for Government Policy (WRR) that instigated the report at hand. The WRR was asked to study in particular how individual responsibility for safety issues can be strengthened in society.

The current high level of safety is a product of the efforts of many. Not only the government takes responsibility for safety issues; businesses and individual citizens do so as well. Moreover, in this area many non-governmental organizations are active, increasingly safety policies are developed in international arenas. Expertise plays a crucial role as many threats cannot be identified, or not on time, on the basis of only everyday experience. For example, the carcinogenicity of particular chemical substances can only be established through extensive and often time-consuming scientific research. At the same time, it is not possible to steer blindly on expertise. In weighing policy options not just technical aspects are relevant; normative issues and other considerations need to be taken into account as well.

Most policy problems that present themselves are highly domain-specific. For obvious reasons, flood prevention calls for other measures than the transport of hazardous substances. Still there are similarities among the various fields within the safety domain, as well as several generic problems. This report concentrates on these problems.

Structure of this report

For several decades now, safety policies have been based on what the WRR has called the *classical risk approach*. Its main feature is that based on scientific research, risks are identified in terms of chance and effect. Next it is decided whether preventive measures are deemed necessary. If the answer is positive, responsibilities for organizing risk reduction are allocated. Accordingly, the

classical approach has two distinct stages: risk assessment and management. At both stages scientific as well as political questions present themselves.

In its report, the WRR first explores the classical risk approach. Chapter 2 introduces the multifaceted character of the safety domain. Based on a variety of cases the WRR has subsequently analyzed how the government, companies, civil society and citizens deal with risks and take on, or are assigned, responsibilities for risk reduction. This is the subject of Chapter 3.

The WRR has explored to what extent the classical risk approach and the policies that emerge from it are future-proof. Chapter 4 analyzes intrinsic problems of the classical risk approach and the ensuing policies, and discusses a number of new challenges safety policy has to face.

Based on these analyses, the WRR concludes that the classical risk approach and the ways in which responsibilities for safety issues are allocated are insufficiently future-proof. However, the council also observes that in policy practices, as well as in the scientific world, a new risk approach has evolved that shows more promise.

The WRR argues that politicians should adopt this new risk approach and should flesh out its policy implications. This matter is addressed in more detail in Chapters 5 and 6.

Limitations of this report

The WRR report *Uncertain Safety* limits itself to issues around policies aimed at improving public safety. Issues of social or economic safety, defence policy or terrorism are not covered. In discussing public safety, generic, domain-transcending problems are central. This implies that in this report no claims are made on individual safety issues, such as heightening dikes or raising food safety standards. Furthermore, within the public safety domain, the WRR has opted to focus on issues of prevention, reduction or precaution. How the government acts or should act in times of crises and disasters is beyond the scope of this report.

A non-transparent policy domain

In the past few years both the government and various advisory bodies have addressed a number of generic problems tied to safety policy. This pertains first of all to administrative problems entailed by the classical risk approach. The approach itself is not subject to debate.

The countless regulations that have emerged over time have led to administrative and to financial problems, for the government as well as the business sector. Moreover, consistency of regulation is often a distant prospect. The domain as a whole is

characterized by a lack of transparency. This is not just the case in the Netherlands. Similar observations have been made elsewhere, for example in the UK.

The problems that follow from the complexity of regulatory regimes should not be underestimated. They present themselves in many guises – as lack of efficiency, transparency and options for control; as decreasing legitimacy; or in the form of 'blame games' played by administrators after a calamity has occurred. In response, various government publications have argued for more collaboration and more uniform policies.

Although this reaction is understandable, it should not be taken for granted that it is also the most sensible one. Safety issues cover a sizable domain marked by much intrinsic diversity. Often, they are interwoven with activities that play out in complex networks. No wonder this calls for complex arrangements that indeed may have a rather chaotic appearance. Complex, partly overlapping systems have evident drawbacks; they may however also have benefits. For instance, provided sufficient checks and balances are in place, such systems will also have more learning potential and flexibility than where uniformity reigns. In the view of the WRR, one-size-fits-all solutions should be regarded with suspicion. Reallocation of responsibilities in complex networks is not a zero-sum game. Transfer of responsibilities from government to society does not automatically imply reduction of tasks and burdens for the government. In fact, often the government will have to face new responsibilities. Moreover, the new freedom for companies that deregulation policies promise may come with substantial costs.

Ambitions to restructure the system may also fail because of the limited room for action that national politics in fact have in this domain. National states have had to surrender much of their sovereignty regarding many safety issues. Many risky activities take place in international networks; hence policy changes can only be realized in an international – e.g. EU – context. The political room for action is also limited by the dependence on expertise. In many cases, policies have already been anticipated in the way scientists have framed the problems.

The government plays a major role in safety policy issues while at the same time its room for action is limited. In the view of the WRR, discussions on the allocation of responsibilities regarding safety issues should be conducted against the backdrop of these facts of life.

Uncertainty as challenge: a new paradigm

The government's considerations are aimed largely at the administrative and institutional consequences of the classical risk approach. In the scientific literature and by part of the safety policy community, however, wider issues are discussed. Increasingly it is understood that the classical risk approach has serious limitations.

These limitations came to light when in recent decades policymakers and managers in both the public and private sector were confronted with unpleasant surprises that revealed they were operating in an environment over which they – and their best advisers – only had partial knowledge and control. In an era in which the industrial world assumed that infectious diseases were controllable, the outbreak of AIDS and SARS represented unexpected, serious new challenges. The BSE crisis raised serious doubts about food safety management. The climate problem has given rise to new concerns in a field that for quite some time had seemed manageable, i.e. flood prevention. In the field of new technologies, such as biotechnology or nanotechnology, time and again administrators discover that it is far from self-evident that they have sufficient knowledge of the risks. Public controversies emerged about many of these issues, which substantially complicated the policy processes.

In the current scientific literature on risk governance, such concerns and experiences have prompted the development of new theoretical views. It is acknowledged, for example, that aside from *simple* and *complex* risk problems, to which the classical risk approach is tailored, *uncertain* and *ambiguous* risk problems present themselves as well. These new types of risk problems are marked by uncertainties about the chance and/or extent of possible damage, or their divergent interpretations. It is increasingly recognized that these new types of problem call for a new approach.

Over the past few years a *new risk approach*, as it is called by the WRR, has primarily taken shape at an organizational level. In addition, it has become increasingly clear that *risk* is a patently more complex notion than previously assumed. The *new risk approach* therefore concentrates not on dealing with known risks, but on dealing with uncertainties. Such uncertainties should be translated as far as possible into objectified risks. Because complete translation is not always possible, a certain level of uncertainty will persist when it comes to weighing chances and taking decisions.

The new risk approach comes with special organizational demands. For instance, it requires prudence, which is expressed, among other things, in the willingness to consider problems from different social and disciplinary perspectives. Moreover, it is at odds with long-cherished managerial ideals. While in the classical risk approach a clear delineation of tasks and well-defined procedures for coordination are managerial virtues, in many respects they pose a danger regarding uncertain and ambiguous risk problems. Dealing with uncertainty calls for flexibility, diversity and room for early warners.

Although the new risk approach is often seen as a supplement to the classical approach, the WRR argues that it is justified to speak of a new paradigm. This does

not imply that the classical risk approach has become obsolete. It continues to be valuable, namely for policies aimed at simple and complex risk problems that come with little or no uncertainty. But seen from the perspective of the new risk approach, the classical approach becomes a special case, bound to problems that involve little or no uncertainty, rather than the overall standard of practice.

Precaution

The new risk approach is being developed in various sectors of society, while it is extensively discussed in the scientific literature. However, the political elaboration of this approach is still in its infancy. In the view of the WRR, a future-proof safety policy is in need of such elaboration.

The leading normative principle for the paradigm of the new risk approach is precaution. Over the past few decades this principle has been extensively discussed. At the same time, it has found its way into many international treaties and is seen by the European Commission as an 'essential policy instrument'. Likewise, the precautionary principle plays a role in the Dutch environmental policy. Frequently, however, the precautionary principle is conceived as a supplement to the range of measures offered by the classical risk approach. Interpreted along these lines, precaution is a radical form of prevention that only becomes relevant where a threat of substantial or irreparable damage presents itself while full scientific certainty is lacking. This interpretation, however, falls short, according to the WRR.

Within the paradigm of the new risk approach, 'precaution' refers to the awareness that uncertainties need to be taken seriously and that organizations should explicitly reflect this attitude. Where precaution is accepted as the normative principle, risk assessment and management processes will be geared to the early detection and discussion of uncertainties; when decisions are made, any remaining uncertainties will be explicitly taken into consideration.

The vulnerability of people, society and the natural environment demands a proactive approach to uncertainties. Formulated this way, the WRR argues, the precautionary principle reflects the normative basis of the new risk approach. This proactive approach can be developed in various ways: by instigating research; by arranging early warning systems; by explicitly engaging a variety of social and disciplinary perspectives in the considerations to be made; by developing policies aimed at reducing vulnerability; and by paying attention to resilience. In the view of the WRR, the precautionary principle is a principle that calls on people to act; it does not lead, as some critics fear, to inertia or a passive stance.

Adopting the precautionary principle implies extending the scope of the notion of responsibility. No longer can responsibility be limited to the foreseeable harmful

effects of actions. Instead, attention should be focused on the vulnerabilities present in the context at issue; actors have to take on responsibility because of their position in a vulnerable society. The perspective, in other words, is reversed from damage to vulnerability. The need to identify *potential* risks and to search actively for uncertainty and, where needed, take measures even if particular uncertainties will linger follows from this shift. Complete elimination of uncertainty is of course impossible. But this fact, the WRR believes, should not be used as an excuse for institutional inertia. Alertness to uncertainty in fact calls for initiative and innovation.

Recommendations

The WRR recommends the government to adopt the paradigm of the new risk approach and its associated precautionary principle as a basis for policy on safety issues. The precautionary principle needs to be implemented in both private law and public law provisions, as well as in institutional arrangements. In this way the obligations entailed by the principle for both the government and private actors can be substantiated.

As a public law elaboration of the precautionary principle, the WRR recommends incorporating provisions in the General Administrative Law Act that articulate specific public law obligations for actively dealing with uncertainty by the government in the safety policy domain. The WRR also points to the opportunities provided by new forms of regulation, in particular so-called 'open norms' and forms of supervision tailored to them. The council welcomes experiments with these new forms that have already been initiated. In its view, however, more evaluative research is needed in order to establish whether the promises of such forms of regulation and supervision are realized indeed.

The precautionary principle also deserves elaboration in private law. The WRR recommends including a formulation in the Netherlands Civil Code that promotes that in determining what is demanded by reasonableness and fairness, with regard to safety issues, the extent in which a legal entity, given its position in society, has adequately taken account of the vulnerability of people, society and the natural environment is being considered.

Furthermore, the WRR recommends reconsidering existing risk liability regulations in this light and promoting that where European directives apply, such as in product liability, they are formulated in correspondence with the precautionary principle as defined by the council. In addition, the council points to the possibility of introducing permit systems regarding new technologies that are suspected potentially to touch on public interests. These permits would have to include the obligation to pursue uncertainty actively. Where uncertainties linked to technologies leads to insurability problems, the council suggests

alternative ways of providing coverage for possible liability claims, which also have the advantage of promoting serious weighing of opportunity costs and possible damages.

Apart from legal provisions, precaution also requires institutional provisions. For an adequate safety policy, society should have of course sufficient levels of relevant knowledge and an adequate scientific infrastructure, while the government should have access to the relevant knowledge. The council observes that this requirement is less trivial than it may seem at first sight on account of the changes that in the past few decades have occurred in the scientific world. Science has become closely intertwined with private interests. But the independence of science is an essential precondition for the proper functioning of democracy. Therefore, the WRR recommends critical review of public-private cooperation with respect to research in the domain of safety issues.

The WRR also points to the new roles of experts who deal with uncertainties. Scientific researchers should be expected to disclose uncertainties that pertain to social or public interests. The council recommends study of whether this can be legally formalized as a standard linked to the profession of being a scientific researcher. Also in the educational system, more attention should be devoted to the responsibilities comprised in scientific research as a profession. In addition, it is crucial to have adequate whistleblower regulation.

To a large extent, safety policy is the domain of experts. However, counter-voices from outside of science are of vital importance as well. Non-experts may play a major role in the articulation of problems and the disclosure of uncertainties. According to the council, experiments with public participation need to be reviewed from this perspective. They will have a more productive social role if it is recognized more clearly that the purpose of articulation of problems is not to achieve consensus, but to identify issues about which there is insufficient knowledge or which require extensive normative debate. The WRR believes that parliament could play a more active role in articulating uncertain and ambiguous risk problems. In this light one might consider widening the potential of parliamentary enquiry and investigation as instruments.

Precaution as constitutional task

The WRR believes that in the decades ahead the policy around safety issues shall have to be developed within a new paradigm, the new risk approach, for which precaution provides the guiding normative principle.

Given its comprehensive character, it seems natural to formulate the precautionary principle as a general, binding effort. With this in mind, the WRR recommends that an adequate and engaging formulation of this principle be included

in the Constitution of the Netherlands and that efforts are made to have a corresponding formulation also adopted as the basis for EU policy. Thus, the Dutch government and the EU, would clearly and acutely establish that they adopt the basic tenet of the new risk approach – the obligation of a proactive approach where vulnerable systems and human lives are faced with uncertainties – as a binding effort in the domain of safety policy.

Traditionally, concern for safety has been one of the cornerstones of the legitimacy of states. By incorporating the precautionary principle in the constitution, government and politics would give a contemporary meaning to a traditional Dutch saying about the role of the state: "The State, that's the dikes."

PREFACE

This report has been prepared by an internal project group of the WRR, which at the time of the arrangement of the report, April 2008, included as members: G.H. de Vries, council member and chairman of the project group, and M. Boeckhout, P.J.H. van Leeuwe and I. Verhoeven (project coordinator), all on the WRR staff. The project was led by P. Winsemius, council member until he joined the Balkenende III Cabinet in September 2006. At earlier stages several other members of the WRR staff participated in the activities for this report: M. van den Brandhof, A. van den Brink, F.J.P.M. Hoefnagel (also project coordinator until the end of 2006), A.P. Jonkers and M. Sie Dhian Ho.

The analyses in this report are in part based on a study conducted by the RIVM at the invitation of the council and on case studies written by WRR staff:
- M. van den Brandhof, *Veelvoorkomende criminaliteit*, WRR web publication nr. 35.
- A. van den Brink, *Gevaarlijke stoffen*, WRR web publication nr. 36.
- F.J.P.M. Hoefnagel, *ICT en internet*, WRR web publication nr. 37.
- A.P. Jonkers, *Voedsel en geneesmiddelen*, WRR web publication nr. 38.
- P.J.H. van Leeuwe, *Waterbeheer en waterveiligheid*, WRR web publication nr. 39.
- A. Mensink, *Infectieziekten en veiligheid. Toekomstige uitdagingen voor maatschappij en beleid*, Bilthoven: Rijksinstituut voor Volksgezondheid en Milieu.

These studies can be found on the WRR website, www.wrr.nl.

The WRR is much indebted to the following individuals for their willingness to provide extensive commentary on earlier drafts of this report: H. Dijstelbloem (Rathenau Institute), R. van Est (Rathenau Institute), R.P. Hagendijk (University of Amsterdam), A.E.M. de Hollander (MNP), A. Mensink (CIB, RIVM), F.J.H. Mertens, professor of Public Administration and Safety Studies (TU Delft), A. Nelis, Director of the Centre for Society and Genomics (Nijmegen University). M. Scheltema (Utrecht University, and former WRR chairman), J. Spier (Solicitor General, High Council of the Netherlands), E. Vos, professor of European Law (Maastricht University), B.F. van Waarden, Professor of Policy and Management (Utrecht University), and B. Walhout (Rathenau Institute).

1 INTRODUCTION

1.1 CONCERNS ABOUT SAFETY

Citizens of today's Western industrialized countries lead remarkably safe lives. They live on average longer and in better health than previous generations and the inhabitants of most other countries. Governments, NGOs, businessmen and scientific experts nevertheless have repeatedly voiced concerns about our safety. Much attention goes to crime and terrorist threats. But the concern for risks pertaining to health, the environment and society that are linked, among other things, to industrial activities and new technologies, to lifestyles and foodstuffs, to climate change and new infectious diseases, attracts much attention as well. This report focuses on the political issues and public policy problems that such risks entail.

The concerns that are expressed vary widely. A study conducted by several large financial and academic institutions on the initiative of the World Economic Forum (2007) may serve as an example. It discusses 23 global risks that according to the authors will present themselves to the international community in the decade ahead with a likelihood of more than 1 per cent. They involve threats that will have catastrophic effects indeed, if they occur. The anticipated losses and damages are estimated to range from several thousands to over a million deaths, and between ten and one thousand billion dollars per incident. The nature of the dangers identified varies widely. Apart from economic risks (such as a hard landing of the Chinese economy and a dramatic fall of the dollar due to the deficit on the US balance of payments) and geo-political security issues (such as international terrorism and the proliferation of weapons of mass destruction), the World Economic Forum study points to a wide range of safety issues. In this context, it mentions various environmental problems and climate change, as well as pandemics and technological calamities such as a large-scale collapse of the information infrastructure and risks connected with the introduction of nanotechnology. The chances that these calamities will occur in the next ten years were estimated on the basis of contributions from a large number of experts. The study refers to likelihoods ranging between one and 20 percent. In addition to the 23 *core global risks*, the study also refers to many safety risks that might present themselves but about which there is insufficient knowledge available to provide more than purely speculative estimations of chances and effects. For instance, there might surface as yet unknown negative health impacts of the high-frequency electromagnetic radiation that forms the basis of, among other things, mobile telephony and wireless internet; and as a result of climate change, the incidence of malaria might rise dramatically. A large number of the risks mentioned will primarily hurt people in the poorest countries, if they materialize. But also

residents of Western countries have ample reason to believe that behind their comparatively safe everyday existence, many risks are looming.

Aside from global and potentially catastrophic threats, there are also potential dangers that certainly have a less dramatic character but still require attention. Time and again, new scientific insights in the areas of health, nutrition and the environment reveal new risks or raise doubts about existing safety policies. Likewise, a change in normative positions can give rise to new concerns. The scientific literature particularly proves to be a genuine box of Pandora. Each new issue of a medical or scientific environmental journal may introduce a new risk that calls for action. The expansion of policies of course induces increased costs for the government or other parties. Moreover, this expansion leads to problems of overregulation, and complexities of implementation and coordination. Eventually, the question has to be addressed at which safety problems the limited resources available are best deployed. Which tasks belong to the government and for which aspects can citizens or businesses be deemed responsible? And how much safety is enough?

Not only the severity of threats, rising costs and administrative problems compel politicians to take safety issues seriously. Their urgency is also underlined by public opinion. Of late, climate change has been receiving much coverage – a topic whose relevance is evident for a country such as the Netherlands where millions of people are living below sea-level. There have also been many discussions on the dangers potentially tied to new technologies, such as genetic modification. Moreover, in the recent past several tragic incidents occurred that, in part because of their extensive media coverage, called for a swift political response.
To be sure, the public's expectations regarding safety are high; hence, there is great disappointment, if not outcry, when prevention fails. The BSE crisis and international environmental scandals, but also national-level calamities that raised doubts about the quality and efficacy of government supervision, have all led to questions about the role of the government as well as to quite some political commotion.

"Public interest in safety issues is substantial and this is likely to persist," the Dutch Cabinet wrote in its request for advice to the Scientific Council for Government Policy (Wetenschappelijke Raad voor het Regeringsbeleid, WRR) that instigated the report at hand (Request for advice on safety, letter from the Prime Minister, 16 December 2004, available in Dutch on the WRR website). The Cabinet specifically asked the WRR to address issues such as "(the transport of) hazardous substances, traffic safety, flood prevention, and environmental and health risks". Security issues related to crime, violence and threats in both the private and public domain, defence problems, and economic risks associated with the functioning of the capital market or the labour market are beyond the domain

the Cabinet referred to in its request for advice. It will be evident, however, that safety incidents can have large social and economic effects and may also affect security. The distinction between safety and security pertains initially to the *sources* of particular hazards. In practice, however, it is not always possible to delineate this distinction sharply.

The Dutch Cabinet's request for advice did not come out of the blue. In 2005, all Dutch ministries investigated to what extent their policies contributed to preventing social disorder. In response, the National Safety and Security Strategy (Strategie Nationale Veiligheid) was developed (Ministry of BZK 2007). In this strategy ample attention is given to safety issues. In other countries there is also much attention for such issues (see, for instance, reports from the British Strategy Unit [2002], the German Bundesverwaltungsamt [2003] and the Canadian Privy Council Office [2004]). Moreover, concerns about safety are not limited to the government. Firms equally pay attention to the various risks of operational management. In large companies especially, 'risks' have gradually turned from a concern primarily of specific company departments into an integral element of business policy (World Economic Forum 2007; Power 2004). Besides governments and firms, environmental organizations and patient associations are extensively concerned with safety issues. The academic and professional literature also reveals an explosive growth in risk research. Safety studies have become an autonomous academic discipline that deals with issues of risk management of businesses and governments. Also, the internet is a rich source of information, both ripe and green, about risks. Google's search engine provides some four hundred million hits for 'risk' – nearly half the number of hits for 'sex'.

The safety problem is both comprehensive and complex. Even when attention is limited to health and environmental risks, still a wide area is involved that confronts the government with many technical, administrative and social issues. By way of introduction, Chapter 2 of this report will discuss some of the main problems that have emerged in the past decades.

The Dutch Cabinet specifically requested the WRR to study the possibilities for strengthening society's sense of 'individual responsibility' for safety issues. That safety is a core business for the government is not disputed. In fact, two articles in the Dutch Constitution stipulate that it does have particular tasks in this area. Article 21 refers to "The government's concern for the country's inhabitability and for the protection and improvement of the environment", while Article 22.1 specifies: "The government takes measures to promote public health." As concise as these constitutional articles are, as substantial are the tasks the government has taken upon itself over the years in relation to safety. The issue therefore arises whether, and if so, how the burden for the government in designing and implementing safety policies can be reduced. The desire to redistribute responsibilities

(and hence burdens), however, arises not only from budgetary and administrative problems. Safety concerns often require highly specialist knowledge. It is questionable whether the government can claim to have all the necessary knowledge at its disposal. It is increasingly hard for the government to prescribe centrally what, exactly, has to be done in this context (Scheltema 2002: 3). Also for this reason, the urgency to rethink the allocation of public and private responsibilities for safety emerges.

1.2 PROBLEM FORMULATION

Over the past decades the concern for safety has taken shape in what we will call the *classical risk approach*. Characteristic of this approach is that risk policies are based, preferably at least, on scientific estimations of likelihoods and effects. Risks are carefully identified, on the basis of which decisions can subsequently be made about whether or not to take specific preventive measures. In this process of dealing with risks, responsibilities are distributed. For example, the government takes on the responsibility to organize particular services, such as for flood prevention. However, the government may also formulate laws and rules to promote that private parties deal with risks in responsible ways. There is extensive regulation, for instance, in the domains of food safety and transport of hazardous substances. Furthermore, firms also formulate rules and protocols for their operational management and define standards for the quality and safety of products they obtain from suppliers. NGOs and organized citizens, for their part, try to influence the risk policies of governments and businesses into directions they deem desirable. All these actors frequently make use of scientific expertise in support of their policies or to disprove those of others and to formulate alternatives. Individual citizens, finally, are confronted with various forms of preventive policy. For example, they are called upon to avoid risky conduct in all sorts of dimensions of their daily life.

The classical risk approach and the related demarcations of responsibilities call for the assessment of risks, formulation of rules and related allocation of responsibilities, as well as for organization of supervision and enforcement. To get a basic idea of the possibilities of redistribution of responsibilities, we have made an analysis of this approach and the existing involvement of the government, business, civil society and citizens in safety issues. Accordingly, the first question addressed in this report is:

1. What are the main characteristics of safety policies designed on the basis of the classical risk approach? How are responsibilities allocated on the basis of these policies?

The second question that in the view of the WRR needs to be addressed is:

2. Can the long-term sustainability of safety be sufficiently secured within the available policy frameworks? How future-proof is the classical risk approach?

The first question will be answered through an analysis of the ways in which the government, firms, civil society and citizens deal with risks and responsibilities. This is the subject of Chapter 3 of this report. The question concerning the sustainability of the classical risk approach invites analysis not only of the intrinsic problems of this approach and the policies based on it, but also of new challenges regarding safety and the solutions pursued in actual practices. These analyses will be provided in Chapter 4.

Based on considerations provided in the chapters mentioned, the WRR has concluded that the current approach to risks and the ways in which responsibilities are distributed are insufficiently future-proof. It has also concluded that the long-term sustainability of safety levels cannot be realized within the existing policy frames through a redistribution of responsibilities. With regard to safety, the space for political manoeuvring is significantly limited by the international nature of many safety issues and the intrinsic role of expertise. Furthermore, many new challenges are marked by the fact that they are loaded with uncertainties.

To organize dealing with risks in a future-proof way, the WRR argues in this report that politicians should opt for a new paradigm. In the face of the vulnerability of people, society and the natural environment, this new paradigm puts on dealing with uncertainty – rather than with risk – centre stage. The WRR observes that in various government policy sectors and in the business world developments towards this new paradigm are underway already. According to the WRR, the government is facing the challenge to design risk policies in the domain of safety based on a new model. This is why in this report a third central question is addressed:

3 How should a new risk approach, which centres on dealing with uncertainties, arrange the distribution of responsibilities for safety concerns?

Answering this question will be the subject of Chapters 5 and 6. The WRR shall thereby address not only the normative principle that is guiding in the new paradigm (the 'precautionary principle' for which the WRR will propose a new formulation), but it will also discuss various legal instruments and institutional arrangements that may perform a supportive role.

1.3 LIMITATIONS AND STRUCTURE OF THIS REPORT

This report is limited to issues around policies aimed at improving public safety. This means that attention is not focused on issues of social, economic and geopolitical security or on terrorism. In and of itself public safety is already a quite extensive domain that may stretch from hazardous substances to food, from information and communication technology (ICT) and the internet to flood protection, and from traffic safety to ecological risks. As such it involves a family of policy fields that do not necessarily have specific traits in common. However, they all struggle with similar problems with regards to the formulation of risks and responsibility, and they all have come to face a number of generic problems and strategic issues. This not only justifies treating these divergent fields under a single denominator, but also explains why these generic problems are central in this report. As a result, this report will contain no statements about domain-specific policy problems such as flood protection, enhancing food safety standards or the purchase of vaccines.

Within the domain of safety, the WRR has decided to focus on *ex ante* issues, i.e. issues of prevention, reduction or precaution. How the government behaves or should behave in times of crisis and disaster therefore falls outside the scope of this report. For *ex post* evaluation of particular crises and disasters, the WRR refers to the activities of, among others, the independent Dutch Safety Board (Onderzoeksraad voor Veiligheid). This report, then, addresses questions that arise around policies that chiefly aim to *prevent* harm or damage, rather than the question of how one should deal with damage or injury once it has been inflicted. Still, crises and serious incidents will be mentioned regularly here. After all, in many cases, they have provided a major incentive for changes in prevention-oriented policies.

This report makes use of theories and concepts developed over the past decades in various internationally evolving disciplines that address contemporary forms of dealing with risks, notably *risk analysis*, *science and technology studies* and the social sciences that deal with *risk governance*. Empirically, the primary focus is on the Netherlands and, where relevant, Europe. To prepare for this report, we have conducted an extensive study of the literature and interviewed a wide range of experts. In addition, to explore the field, four preliminary case studies were performed by the WRR. These studies address hazardous substances (Van den Brink 2007), ICT and the internet (Hoefnagel 2007), food and medicines (Jonkers 2007), and flood prevention (Van Leeuwe 2007). A case study about infectious disease control, commissioned by the WRR, was performed by the National Institute for Public Health and the Environment (Rijksinstituut voor Volksgezondheid en Milieu, RIVM) (Mensink 2007). The five case studies are available (in Dutch) as web publications on the WRR website. Some of the safety

issues addressed in this WRR report are generally considered to be highly important new challenges – as evidenced, for instance, by the abovementioned report of the World Economic Forum. In this context one should refer in particular to the attention paid to new technologies (such as safety problems around ICT and nanotechnology) and the challenges entailed by climate change and the risk of new infectious diseases. Other cases offer insight into topics for which policies have long been around, such as common infectious disease control, drug safety, risks of hazardous substances, food safety and flood prevention. Based on our study of the literature, our interviews with experts and the case studies, several major common patterns and problems of the safety domain were uncovered, and this allowed us to sum up the various challenges involved in designing safety policies in the years ahead. The conclusions and recommendations the WRR has formulated in this report seek to provide an answer to these challenges.

2 SAFETY ISSUES: A SURVEY OF THE DOMAIN

Safety issues emerge in many domains, and they have many faces. Increasingly, however, they are subsumed under a common denominator. In the Dutch National Safety and Security Strategy, for instance, safety is conceived as "…the undisturbed functioning of human beings in the Netherlands and its surroundings". This pertains to public health threats such as epidemics, breaches in dikes and accidents in chemical plants (House of Representatives, Tweede Kamer (TK) 2006-2007, 30821: 1). The Dutch Cabinet's request for advice, as cited in Chapter 1, follows this path. In this request, the concept of 'safety' is connected with a broad spectrum of policy areas: transport of hazardous substances, traffic safety, flood prevention, environmental risks and health risks. Another, increasingly mentioned threat is the so-called 'digital paralysis' that may emerge through the large-scale failure of ICT and internet technology.

The comprehensive approach to safety received a major boost from the terrorism threats of the past decade. They have fuelled the awareness that various kinds of risks are interconnected and that disruptions in one area may have major repercussions elsewhere. Because of the growing interrelatedness of social activities, in the assessment of threats cascade effects need to be taken into consideration. The tendency to refer to a comprehensive, multifaceted safety issue goes back further than 9/11, however, although it has unquestionably grown stronger due to the problem of terrorism. Post-industrial societies have been recognized as 'risk societies' in which new risks requiring attention crop up all the time and in which the approach of existing risks appears to have reached its limits (Beck 1986; 2007). The list of topics discussed in terms of 'risks' continues to grow longer each year, and increasingly, 'risk problems' dominate the political agenda.

However, the tendency within government and politics to address a wide array of risks under a common denominator raises a number of questions. Of course, it is possible to formulate safety policy issues in comprehensive terms. In many cases there are even specific reasons to take a broad perspective: increasingly, risks have become intertwined in intricate ways. But does that justify the idea of a single overarching policy domain? The various policy fields subsumed under the concept of safety each have their own history, and they comprise substantial tasks and practical activities of quite a diverse nature. For example, flood prevention and infectious disease control differ to such a degree that one may seriously question whether covering these divergent policy fields under the common denominator of 'safety issues' is meaningful at all. Is there a common problem that justifies lumping them together? Are there, strictly speaking, domain-exceeding problems that make it desirable to develop a comprehensive 'safety policy' and to reflect on the allocation of responsibilities in general terms?

The WRR has concluded that there are good grounds for doing so indeed. Safety policy is more than a loose container concept. Even though the differences between various domains are obvious, as to their substance as well as in practice, they share similar strategic problems. To explore these strategic concerns, we will consider a number of policy fields and their problems in some detail.

2.1 HAZARDOUS SUBSTANCES

In the Netherlands, the history of government policy pertaining to hazardous substances dates back some two centuries. In 1807 a ship with gunpowder exploded in the town of Leiden. To the young unified Dutch state, this calamity occasioned the first national regulation in the domain of safety. It marks the start of a long tradition. In the second half of the nineteenth century, the chemical industry started to produce new substances in large volumes. Quite soon this sector represented large economic interests. The government reacted by developing a general policy for hazardous substances, i.e. substances that are flammable, explosive, radioactive or poisonous (Ale 2003). The risk of most hazardous substances does not so much lie in the likelihood that an incident or a calamity will in fact take place – in most cases the likelihood is quite low – but in the far-reaching effects any incident in this sector, once it occurs, is likely to have. Damage may quickly reach high levels, both in terms of human casualties and in financial terms. Such incidents, moreover, can have large ecological effects that are usually addressed inadequately by environmental policy measures that focus on the prevention of long-term effects.

In the 1980s in the Netherlands much effort was invested in setting up a comprehensive risk policy for hazardous substances. The underlying reason was the growing awareness that to keep the economy going, the use of hazardous substances is inevitable. Absolute safety can only be provided by banning these materials completely. The problem thus shifted to the question of what should be done to manage the risks that are involved. Chemical plants must be safe for the people who work there; the chance that nearby residents are exposed to explosions must be minimized; and poisonous clouds or other calamities from the transport of hazardous materials should not result in large risks for areas near the transportation routes. In the past few decades the management of risks increasingly took shape in an approach based on calculating chance and potential damage and trading off benefits and risks of using hazardous materials (Ministry of Housing, Spatial Planning and the Environment [VROM] 1989). By objectifying risks, companies and government got a better handle on the issues involved. TNO, among others, has done much applied research on the risks of the production, storage, processing, use and transport of hazardous substances. This research, combined with practical experience and a strong policy tradition, has resulted in high levels of safety management of hazardous substances. As will become clear

in Chapter 3, these high safety levels can only be achieved by extensive legislation and regulation and systems of supervision and enforcement.

However, even a long-standing and largely crystallized policy field may prove to be vulnerable. Calamities in chemical plants in England (Flixborough 1974) and Italy (Seveso 1976), for example, prompted the European Economic Community to issue more stringent legislation and regulation for the industry. The huge disaster with the Union Carbide plant in Bhopal in India (1984) reinforced this process. The responsibilities of companies were described in much greater detail in order to limit large numbers of victims, environmental damage and economic damage in the future. In the Netherlands, the hazardous substances policy's vulnerability came to light in 2000, with the fireworks disaster in Enschede. The enormous damage that was inflicted by this major incident triggered questions about the transparency of legislation and regulation, the policies involved and the responsibilities of companies and government. Furthermore, this disaster emphatically pointed to serious problems with supervision and enforcement by government agencies. The fireworks disaster gave rise to extensive public and parliamentary discussion about failing government. Policies were sharpened, not just regarding fireworks but for the hazardous materials sector as a whole, in particular as to the roles and responsibilities of the government (Bressers 2004). In 2004, at the recommendation of the Oosting Commission, the Dutch Cabinet also set up the Advisory Council on Hazardous Substances (Adviesraad Gevaarlijke Stoffen), whose task is to provide solicited and unsolicited independent advice on hazardous substances policies.

What started with the explosion of a gunpowder ship in 1807 has evolved two centuries later into a both sizable and fine-meshed policy field in which both governments at various levels and companies, having learned things the hard way, pay close attention to risk management. As of late, the 2006 national regulation was replaced by the European Union's (EU) enactment of the *Registration, Evaluation and Authorization of Chemicals* (REACH) regulation that applies to all companies that produce chemical substances or preparations in substantive volumes on a professional basis, import them into the European Union, distribute them or professionally use them. Because of extensive risk management activities, we can afford the luxury of reaping the economic benefits of living with hazardous substances.

2.2 FLOOD PREVENTION

Over many centuries much knowledge and experience have been gained in flood prevention, especially in the Netherlands. However, the 1953 flood in the province of Zeeland triggered a fundamental change in the philosophy of flood prevention. Flood prevention policy was grafted onto a risk approach, which

started from an objectification of risks in terms of likelihood and amount of damage. The new approach drew particular attention to the chance of the occurrence of an incident. The reasoning behind the approach was that by building or strengthening dams and dikes, and thus reducing the chance of flooding, the risk, i.e. expected damage, would decrease (provided projections on the damage potentially caused by floods remain the same). Two questions were at stake: which likelihood of damage would be acceptable, and which costs were involved in implementing the measures needed (MNP 2004; Nieuwkamer and Van Tuinen 2004). In dealing with flood risks, again, absolute safety is not an option because it is impossible to pay for drastic measures. In all cases, then, a cost-benefit calculation has to be made, whereby a certain degree of risk is accepted, the so-called 'residual risk'. In 1960 the Delta Commission developed a number of standards for dams and dikes. It formulated norms for chances of breaches in dikes that became guiding for dike enhancement, the realization of the Deltaworks and other measures to limit chances of a recurrence of the 1953 flood. The risk approach constituted an important innovation that also became guiding in other policy areas, such as hazardous substances.

Today, however, the established approach is being disputed again. This time it is not some flood disaster that is triggering policy reconsideration, but a much more diffuse and intangible problem: climate change. International organizations like the Intergovernmental Panel on Climate Change (IPCC) have issued grim projections on sea-level rise and increasing water discharge of large rivers due to global warming. For a low-lying country such as the Netherlands, the effects of climate change could be disastrous in the long term. In the much discussed documentary *An inconvenient truth*, Al Gore showed animated images in which the Netherlands largely vanishes from the earth because of the rising sea-level. That in the future the Netherlands will experience the effects of climate change seems beyond dispute. Discussions among experts, in politics and in the media, focus on the likelihood of particular chances and effects and on the time frame of developments. Irrevocable proof of the extent of climate change, its effects and the timing with which problems will present themselves is not available (WRR 2006a). In the face of climate change, the government, therefore, is facing a tricky task: measures have to be developed in the absence of solid data for making cost-benefit considerations. The established methodology for setting standards and making policy decisions is running up against its limitations (for extensive discussion, see WRR 2006a: 73-80).

Even in situations where solid scientific data are available and standards can be set, however, the limitations of the existing water safety policy become evident. In the 1990s, the existing safety measures regarding the country's major rivers proved inadequate in the face of extreme water discharge twice. The ensuing river flooding led to discussions about measures for dealing with the residual risk. Dating from before the 1953 flood, an old measure to cope with rising water levels

is to discharge water into emergency overflow areas, where flooding would not cause much damage. This measure would only be needed under extreme conditions, such as during the river flooding of the mid-1990s. In the course of 2001 the Cabinet decided to set up a Commission on Emergency Overflow Areas (Luteijn Commission) to explore the feasibility of this measure. The plans of the Commission caused controversy in both science and society. In a counter-expertise report by scientists from Delft Technical University, it was argued, for instance, that the Commission assumed unrealistically high river discharges and that it confused structural and non-structural measures. 'The Luteijn Commission practises science fiction,' as one Delft scientist put it (De Boer 2003).

The issue has been hotly debated in society at large. Citizens set up *ad hoc* political action committees, sometimes in coalitions with local government. One of the political action committees is the Hoogwaterplatform, which sought to prevent the Ooijpolder near the city of Nijmegen being designated as an emergency overflow area. This group organized its own technical commission, which included hydraulic engineering experts, to refute the plans of the Luteijn Commission and also formulated alternative plans (see website Hoogwaterplatform). Another political action committee against emergency overflow areas is the Vereniging Belangengroep Overdiepse Polder. It came with an alternative plan (the so-called *terpenplan*), which made it possible for farm businesses in this polder near Waalwijk to continue their operations while the area would still be available for emergency overflow (Verhoeven 2006: 127-130). Eventually, the scientific and social controversies caused the Cabinet to refrain from developing emergency overflow areas. In 2006, a major river flood control policy (the so-called *Planologische Kernbeslissing Ruimte voor Rivieren*) was adopted. It was geared to solving the problems of high water in the rivers through measures such as lowering river forelands, putting dikes back into place, lowering groins and deepening summer beds (Projectorganisatie Ruimte voor de Rivier 2006). These measures were – and still are – followed critically by political action committees such as the Hoogwaterplatform, but they have triggered less controversy than the emergency overflow areas.

In the decades ahead the Dutch government will be facing challenges in the area of flood prevention that put pressure on its hitherto successful control of flood risks. The knowledge base for designing policies, however, has become much less transparent on account of the climate problem. It has become clear that measures conceived by the government may lead to scientific and social controversies about the need or usefulness of certain plans. It is not possible for the government to wait until the water literally 'is reaching our lips' as a Dutch expression says. The government needs to act today, knowing that the available knowledge is indeterminate and that it has to learn how to deal with scientific uncertainties and social resistance.

2.3 INFECTIOUS DISEASES

Worldwide, infectious diseases are still the main cause of death today. The chances of dying from an infectious disease, however, are distributed unequally. In particular, in developing countries the mortality rate is much higher in this respect than in Western societies (World Health Organization [WHO] 2002).

Many familiar infectious diseases have successfully been pushed back in the Western world. The main success factors are improved hygiene, clean drinking water, sewer systems, better food quality, the population's increased level of education, available vaccinations and the development of antibiotics (Mensink 2007: 13). Smallpox, according to the WHO, has been eliminated worldwide, and it is projected that in several years the same will be true of polio. Historically, the protection against known infectious diseases shows an upward trend. Pushed along by developments in science, the possibilities of control for governments – certainly in Western countries – have never been as great.

Aside from this good news, there is also reason for concern. The threat of infectious diseases has erratic sides to it. Several well-known infectious diseases that were deemed controllable prove harder to treat after some time because adaptation processes of the microorganisms have led to a diminished protection of vaccines (Van Loo and Mooi 2002). The increase of antibiotics resistance is equally alarming (Van der Meer and De Kruijff 2005). Furthermore, there are more and more signs that point to the threat of an epidemic with highly pathogenic bird flu strains, whereby the possibility emerges of an infection of humans by a combination of bird flu and human influenza. This combination may result in a new virus variant that may cause a flu epidemic on a worldwide scale (a so-called *pandemic*) (Mensink 2007: 22). In general, it is increasingly clear that the number of infections that can be transmitted from animals to humans is growing. About 75 per cent of the new infections among humans appear to come from the animal world (Mensink 2007: 16). Bird flu in the form of SARS is a well-known example, but it is likely that HIV was once transmitted from animal to man as well. New infectious diseases pose great challenges to science and governments worldwide. The fight against such infectious diseases is one against an opponent that in many respects is unknown. After the initial positive messages about imminent breakthroughs in the fight against AIDS, more recent press notices indicate that AIDS researchers are again much more moderate in their expectations about the control of this disease (Köhler 2007).

The challenges in the area of infectious disease control, however, are not only tied to the development of new viruses; they also depend on the scale and speed of new outbreaks. The worldwide mobility of people, animals, foodstuffs, crops and other goods increases the likelihood of the rapid spread of pathogenic microorgan-

isms on a large scale (Mensink 2007: 31-32). The economic, social and cultural benefits of internationalization have as a downside a raised risk of large-scale and rapid outbreaks of infectious diseases. On account of changes in scale and speed, it is possible only to a limited degree to make predictions about which microorganisms may cause large-scale problems in the years ahead. Another factor is that the size and composition of the Dutch population are changing. A larger population renders the nation more vulnerable, for in a more densely populated country chances of an outbreak are potentially larger. A change in the composition of the population also influences the spread of and susceptibility for infectious diseases. The Netherlands, in addition, has a larger population of vulnerable seniors, while the number of chronically ill is also rising (Mensink 2007: 30).

The protection against infectious diseases has long been a task of the government because the required level of hygiene could only be achieved through public resources (for sewers and clean drinking water). Moreover, the government is in charge of the instruments that enable massive vaccination in times of crisis. Although history shows that time and again new ways are found to shape this major task, both social changes and developments pertaining to new and existing viruses constitute a great challenge, whereby the struggle with the unknown bitterly exposes the constraints of risk management. The control effort runs up against limits in a literal sense as well. More than ever, the spread of infectious diseases does not stop at national borders. International coordination of infectious disease control – particularly in relations with developing countries – poses a challenge of nearly the same proportions as control of the climate problem.

2.4 ICT AND THE INTERNET

In the past decades information and communication technology (ICT) has invaded our daily life. Worldwide, people and services have become highly dependent on ICT infrastructure for their functioning. The best known example is the internet, essentially a large network within which the traffic of data is regulated in a decentralized yet uniform way. Originally, the internet was meant to ensure communication across long distances during and after a nuclear war. Connections remain possible after a calamity because there are various ways in which individual parts of the network can communicate with each other, without involving a process that is guided from a single command centre. However, new threats that may interrupt the proper operation of the internet have appeared. Meanwhile, many applications that make use of the communication options offered by internet technology (e-mail, the worldwide web) have become commonplace. The safety issues involved are substantial. Through new developments of interactive web applications for end users (Web 2.0), the dependence on the internet is growing, causing the urgency of the issues to increase further.

Safety issues in the area of ICT have by now become the order of the day. Preventive measures cannot stop worldwide hundreds of thousands of computers becoming infected by viruses and 'Trojans' that can be exploited by evil-minded individuals. The responsibility for protection measures is largely with the end user. The complex nature of the internet makes it hard to determine the liability of the various parties (such as, for instance, internet providers). Given the interrelatedness of particular technical services and the complexity of various linked networks, comparatively small problems may have large-scale consequences. The so-called cascade effects of specific disruptions are potentially enormous (Luijf 2004). Attacks on so-called root servers via hacked computers may disturb internet communication on a large scale. The effects are likely to be sizable because of the interdependency of many ICT services sectors. Regulations for safeguarding the continuity in case of a large-scale failure of communication generally concentrate on ensuring the functioning of telephony networks (Hoefnagel 2007: 32). Large-scale disruptions of internet traffic may cause not only substantial economic damage for social sectors, but may also put many people's lives at risk. In other words, 'digital paralysis' constitutes a danger that should be taken very seriously.

There is, however, limited insight into the size of such problems. Furthermore, the ongoing innovation and growing complexity of ICT services contributes to the ICT experts' problem of keeping up with all the developments. Regularly, they fumble in the dark about the chance of a major disruption of the virtual order. For example, the millennium bug, the fear that the transition from 1999 to 2000 would lead to disruption of all sorts of computer systems, eventually proved to be fairly innocent, but this was highly unclear beforehand (cf. Quigley 2005). It is uncertain to what extent the large-scale measures taken were necessary at all. In the meantime the government has set up a national warning service for threats of ICT systems (GOVCERT.NL), which should contribute to early identification of problems, including safety problems.

Most monitoring bodies that play a role in the management and control of the internet are beyond the Dutch government's direct sphere of influence. Many protocols are managed by international (sometimes largely US) organizations, such as the Internet Corporation for Assigned Names and Numbers (ICANN). The public accountability of such organizations is often marginal, or at least it is not organized through the usual political channels. This raises questions about the allocation of responsibilities in the regulation of the internet (Koops and Lips 2003). In this context there is growing attention for the formulation of (transnational) internet policies. The establishment of an Internet Governance Forum (IGF) (see website IGF) and the developments in the wake of the World Summit on the Information Society (WSIS) (see website WSIS) should be seen in this light.

However, national governments are still highly dependent on companies' willingness to collaborate on the control of risks. For a long time there seemed to be no clear overriding national or European policy on internet traffic. This situation is changing today, for instance through the development of a European framework in the field of (electronic) information exchange (European Commission 2005). But the international nature of developments in the field of the internet and electronic safety still makes it difficult for national governments to interfere directly. Companies have much know-how that, because of their competitive position, they will not want to share with others. Looking for smart forms of collaboration between governments, technocratic management organizations and companies seems to be the main challenge for countering risks of cascade effects and other threats to our vital infrastructures.

2.5 FOOD SAFETY

A steak from a cow from the Argentinean pampas with green beans from Ethiopia and Dutch potatoes in steam packaging: this is just one of many pre-cooked meals for sale in the local supermarket. Despite countless transportation moments and forms of processing, we assume that such products do not make us ill. And we have ample reason to assume so because in general the safety of our food is guaranteed well. This is in fact quite an accomplishment because food production takes place in lengthy and very complex chains. The ingredients of a ready-to-eat meal, after all, do not come directly off the land. A wide array of factors is involved: safe meat production requires attention to the health of animals; the processing of food has to happen in hygienic environments; during transport no infections or too large temperature fluctuations should occur; some products need to be processed and transported separately; the labelling of allergenic or other substances needs to be in order; and so on and so forth.

Living in a modern society, we tend to take a stable and diverse food supply for granted. But safe functioning of global production chains is far from a self-evident matter. The BSE crisis has revealed all the things that can go wrong along the line. This mid-1990s pan-European food crisis centred on the dangers of consuming meat from cows infected with BSE. The crisis moved from the United Kingdom to the continent. Crisis management was hindered by a lack of insight into the complex relations of various parts of the production and food chains.

Eventually, the cause turned out to be a kind of cannibalism built into the food chain of cattle: brain tissue and spinal marrow of diseased cows had been added to feed, which caused the livestock to be infected on an increasingly larger scale (Phillips 2000 cit. in Oosterveer 2005: 76). The mixing in of carcasses of infected 'mad cows' in feed proved eventually not only to put the health of the livestock at risk, but was also linked to the occurrence of the variant Creutzfeldt-Jakob

Syndrome in human beings. Because in the production chain offal was used again as feed, a loop emerged. As a result, all parties in the chain were both guilty of and victim to the spread of infected materials.

The spread of infected materials, moreover, did not limit itself to cows and meat for consumption. Residual materials from slaughterhouses are used in many – to most policymakers, unexpected – places in the industry. These materials are processed in countless products, such as gelatine, pet food, cosmetics and medicines. There was great uncertainty about the chance of infection as a result of the usage of such derivative products. The BSE crisis – and, on a smaller scale, the Belgian-Dutch dioxin crisis of several years later – revealed the complexity of production chains and the potential risks involved if there is no appropriate supervision.

The approach to the BSE crisis by the official authorities developed into a crisis of public trust, in particular in the United Kingdom. At first, experts proved incapable of giving a reliable assessment about the dangers of meat from 'mad cows' for human consumption – while the possibility of a link was widely recognized. The crisis thus uncovered the shortcomings of the usual role of experts and scientific advice: it turned out they were unable to tell what was going on. A direct consequence of the crisis was the intensification of the information supply between the various links in the chain and the interrelated large-scale reform of the European monitoring policy, which became known under the slogan *from farm to fork* (Hajer and Loeber 2006; Oosterveer 2005: 73-88). Likewise, the arrangement of scientific advising in this area was not left unaffected. The establishment of a European Food Safety Authority (EFSA) in 2002, which in addition to the various national agencies is responsible for monitoring food product safety, should be seen in this light (Borrás 2006).

Given the international character of food production and food sales, it will hardly come as a surprise that national policies in this area are increasingly elaborations of European regulations. At the same time, the government regularly leaves further details of enabling legislation up to the Food and Consumer Product Safety Authority (Voedsel- en Warenautoriteit, VWA) and associations of interested parties such as 'commodity boards'. Consumers, of course, have a role to play in ensuring food safety as well (Fischer et al. 2005). Due to the efforts of many, food safety is well guaranteed.

Nevertheless, new problems are bound to present themselves. There is increasing evidence, for instance, of an 'obesity epidemic'. It is an open question how problems linked to an unbalanced diet can be dammed. On top of measures to improve direct food safety, therefore, issues about the relation of food and public health have to be addressed (WHO 2003). This involves a long-term safety con-

cern, whereby it is still unclear how general changes in consumption patterns have effects on individuals. Partly motivated by government stimulation, the business sector has started to develop *light* products and food with specific 'healthy' characteristics, so-called nutraceuticals and functional foods. Lively discussions have arisen about the use, need and nature of policies that national and international governments have to develop to cope with this kind of public health problems, as well as about the legitimacy of such policies that interfere deeply into the private sphere of citizens, and the limits of interference of the food industry (Nestle 2002).

Even against the background of complex production chains, it turns out that food safety can be secured. Still, new problems may surface. They require ongoing alertness and much attention to the supply of information across the entire food production and consumption chain. Detailed allocation of responsibilities to various parties – governments, companies and citizens – thereby constitutes a both urgent and complex task.

2.6 NANOTECHNOLOGY

Although many safety policy areas by now have a long history, this is not true for all. New technological developments may confront society with altogether new kinds of safety issues. The rise of nanotechnology is a case in point. If this technology is highly promising, we still know little about its potential health and environmental risks.

Nanotechnology is the generic term for new technologies that distinguish themselves through the minuscule scale on which they are handled: in the order of (maximally several hundreds of) nanometers (10^{-9} m). Manipulation of materials on this scale enables new applications, because at the nanolevel materials may develop strikingly new characteristics. For the same reason, however, existing toxicological insights do not automatically apply. The different technological approaches lead to a multitude of possible applications. Synthetically produced nanoparticles may enable among other things more efficient drug delivery and the production of extremely strong light materials. Within this field different technical approaches are used. For example, the Dutch Health Council (Gezondheidsraad 2006: 10, 34) distinguishes between a *bottom-up* approach, aimed at grouping individual atoms in larger structures, and a *top-down* approach, focused on producing ever-finer structures in materials. In the latter case, one can think of, among other things, lithographical technologies for the production of computer chips.

Nanotechnology is a so-called enabling technology that offers opportunities in many areas, not in the least in the area of human enhancement – such as in combination with biotechnology and informatics (Teeuw, De Poot and Faber 2008).

This is why the research of nanotechnology, together with genomics and ICT, has been selected as one of the focal points of the Dutch science policy. Participants in the Nanoned research programme (see website Nanoned) are research centres of universities and among others the research laboratory of Philips. The Dutch attention on nanotechnology is not unique. Throughout the world significant investments are being made in research of this field. Also in a European context, as part of the Sixth and Seventh Framework Programmes, nanotechnology has been labelled a top priority (Hunt 2006).

The application of nanotechnology is still in its infancy, although some 140 products in which nanotechnology or nanoparticles are used are available on the Dutch market already (VWA 2008: 3). A precise number cannot be given, not only because the business sector has no information duty for this technology, but also because a broadly accepted definition of nanotechnology is still not available. The global indication that it involves particles in the order of nanometers is not enough to provide a basis for (legally binding) regulation. Following the British Department of Trade and Industry, the VWA uses 100 nanometers as the defining upper limit (VWA 2008: 11). However, Friends of the Earth (2008: 3) argues for adopting a limit of 300 nanometers. In practice, the particle size whereby materials start to display other chemical and physical characteristics varies. A simple standard is therefore hard to provide.

Still, setting a limit is important: it plays a major role in risk assessment and management. For example, use of a chemical substance may have been admitted on the basis of an assessment of its known characteristics without taking the possibilities of manipulation on a nanoscale into account. With the emerging possibilities of the use of the same material in nanotechnology, admission standards may have to be reconsidered. In the area of food safety, for instance, new standards are laid down in the *Novel Foods* directive (Van Est and Walhout 2007: 2). Also environmental effects need attention. Nanoparticles present similar problems as ultra fine dust, such as of black smuts from road traffic (Vyvyan Howard and Ikah 2006). But so far the characteristics of synthetic nanoparticles have been mapped out far less well (Van Est et al. 2004: 34). Not all forms and applications of nanotechnology are equally risky: the potential dangers of well decomposable nanoparticles (such as the use of gelatine in drug delivery) are smaller than those of poorly decomposable nanoparticles. In this area, however, future developments and safety issues are hard to predict (Gezondheidsraad 2006: 100-109).

If nanotechnology potentially poses safety problems to society, it is not possible today to provide an estimate of those problems. Elementary knowledge that would enable risk assessment is absent. For materials produced at the nanolevel, the common standards for toxicity as defined in, for instance, the European

chemical substances policy (REACH) fall short (Gezondheidsraad 2006: 107; Van Est and Walhout 2007; VWA 2008: 4). Specific regulation strategies with which possible problems can be assessed and removed are therefore welcome (Koops et al. 2005). Partly because of the absence of an unequivocal definition of nanotechnology, there is a stalemate in the debate on this topic between the government, NGOs and the business sector (Van Est and Walhout 2007: 2). In the wake of the 2006 advice on nanotechnology from the Royal Dutch Academy of Sciences (KNAW 2004), the Dutch government chose to develop standards based on existing regulation regimes, such as REACH, the Labour Conditions Act (*Arbowet*), Food and Drugs Act (*Warenwet*), and Pesticides Act. In its vision, however, the Dutch Cabinet also acknowledged that the absence of useful methods of measuring makes "…application, compliance and enforcement of the existing regulation difficult" (TK 2006–2007, 29338, nr. 54: 15). The current and future safety issues around nanotechnology are still largely uncharted territory.

2.7 COMMON DENOMINATORS IN SAFETY CONCERNS

The various cases illustrate the wide diversity of issues and policies that safety concerns imply. The problems climate change presents for flood prevention are hardly comparable to, for instance, emerging lifestyle-related concerns about obesity. The control of new infectious diseases has little to do with the safety of ICT infrastructures. Given the problems intrinsic to a specific field, it is hardly surprising that many actors opt for a division of labour and limit themselves to addressing safety concerns on a domain-specific basis only. Moreover, policy fields each have a history of their own and a relatively autonomous dynamic. No wonder, then, that many measures have a specific character, tailored to the policy field involved. Once translated into concrete domain-specific policy problems, generic problems soon disappear from view.

Unquestionably, however, the different cases also underscore the particular relevance of domain-wide strategic issues. Time and again they show that even in well-established policy areas, unpleasant surprises may emerge that expose the vulnerability of the existing strategies for dealing with risks.

At the same time, the cases illustrate the extent to which the risks of contemporary societies are closely linked to achievements that are taken for granted. The risks of food safety are connected with the fact that our food contains ingredients from all over the world. Infectious disease control has to be implemented in a world characterized by large-scale international mobility of goods and individuals. And, as the climate problem suggests, even the risks of flooding, which used to be seen as a purely external safety threat, seem to be directly linked with the consequences of human action. Safety concern, then, has become an intrinsic task for modern society as a whole.

Crises and new developments – such as the BSE crisis, climate change and new infectious diseases – put pressure on the established relations between science, politics and society. Flood prevention, infectious disease control and food safety, but also ICT and internet safety are confronted with problems for which experts and professionals do not have ready-made answers. This is increasingly the case for new technologies such as nanotechnology. Major, normatively charged political decisions have to be made, also when experts can provide only limited insight into likelihoods and adverse effects. Moreover, experts regularly have different views on the interpretation of available data, adding to the significance of political decisions. Furthermore, policy is increasingly formulated against the backdrop of ongoing social controversies. Civil-society organizations and *ad hoc* citizen groups regularly dispute the knowledge base of decision-making and thus the legitimacy of measures pursued by the government. The cases we have discussed in this chapter illustrate, moreover, the strong interconnection of problems and the mutual dependency of numerous actors. Companies cooperate in lengthy, complex production chains; risk management takes place in complex networks of governments, companies, civil-society organizations and citizens. These chains and networks meanwhile have an international reach in most areas. Allocation of responsibilities thus requires complex arrangements. Safety problems show little regard for regional or national administrative boundaries. As a result, the vulnerability of preventive policies increases: successful risk management requires that ever more actors coordinate their responsibilities across ever larger distances. The problems of regulation, supervision and enforcement transcend both national boundaries and boundaries between specific policy fields.

For these reasons, a future-proof safety policy cannot be based on reflections on specific policy fields only. Overarching strategic issues regarding the availability of knowledge, social controversies, complex network relations and internationalization ask for a comprehensive approach. As will be shown later in this report, it is sensible to bear in mind the individual character of specific policy fields. For this purpose we will introduce distinctions between various sorts of risk problems. A typology of various types of risk problems will be introduced in Chapter 4.

As briefly indicated above, the generic character of problems within the safety domain deserves further elaboration and analysis. To this end, the next chapter will address the role of governments, companies and citizens in dealing with risks and responsibilities as it emerged in the context of various policy fields. We will subsequently label this effort to deal with risks and responsibilities as the *classical risk approach*. This approach is under pressure, however, as several of its assumptions are becoming increasingly outdated. Moreover, a number of social developments has complicated the relationships between science, politics and society that

are implied in the classical risk approach. This will be addressed in Chapter 4. In response to it, a new risk approach has emerged. Its political implications are discussed in Chapters 5 and 6.

3 THE CLASSICAL RISK APPROACH AND THE ALLOCATION OF RESPONSIBILITIES

3.1 THE CLASSICAL RISK APPROACH

Concerns about safety have always been present. Today, however, they are articulated in a new way. If formerly one referred to 'fate' or 'God's will' and misfortune was accepted as an inevitable fact, now we speak of 'risks'. This change in language points to a change in our attitude to hazards. People who speak of 'risks' assume that the actual manifestation of a hazard is not inevitable. And they will start looking for options to reduce the likelihood of the hazard, or for means to limit its damage. They conceive of hazards from a *social engineering* perspective.

The concept of 'risk' dates back to the sixteenth century, when it was first used in the context of insurance against shipwreck and piracy. The word is possibly derived from the Greek *rhiza*, which means 'root' or 'reef' (under water). 'Risk' thus refers metaphorically to all that constitutes a particular danger (Van Asselt 2000: 147; MNP 2003: 19). Apart from damage, the concept is also linked to 'chance'. The concept entered science with the development of the theory of probability. Its application domain was initially limited to the world of games of chance, lotteries and betting. Later, the use of the concept was extended toward the social and medical sciences, and to the financial world and economics.

In the past decades attention paid to risks has grown explosively. Power (2004) even speaks ironically about "the risk management of everything". Unfortunately, the ease with which we speak of 'risks' does not mean it is an unambiguous concept. In the scientific literature countless definitions circulate (cf. IRGC 2005: 141 for an overview). They usually have two components. The first one almost always refers to some element of damage or adverse effects. The formulation of the other component strongly varies: reference is made to the chance, likelihood, probability, possibility or expectation of some harm or damage. The most common definition combines the chance of a specific event's occurrence and its effects, such as in the much-used formula 'risk = chance x effect' (Gigerenzer et al. 1989: 3, 19-26). This definition forms the basis of the *classical risk approach*, which developed in the course of the twentieth century. For many decades, this approach has guided practices for dealing with risks in society.

In the classical risk approach we can basically identify two phases: identification and evaluation of risks (*risk assessment*), and taking measures to limit or control risks that are deemed non-acceptable (*risk management*). In this chapter we discuss the main elements of the classical risk approach, and we will analyze the possibilities for governments, companies and citizens to shape their responsibilities for

dealing with risks. We use again the case studies on flood prevention, hazardous substances, food and medicines safety, ICT and internet and infectious diseases, which have been prepared specifically for this report, to illustrate the issues.

3.2 RISK ASSESSMENT AND RISK MANAGEMENT

3.2.1 RISK ASSESSMENT

Experts, government agencies and companies make scientifically informed and preferably quantitative *estimates* of likelihoods and the size of dangers. Next, an *assessment* takes place on the extent to which particular risks are acceptable. Risks assessed as non-acceptable call for *risk management*.

Quantitative estimation of risks is the heart of what generally is called risk assessment. It involves processes that have at least three components: 1) identification and, if possible, estimation of a particular hazard; 2) an assessment of exposure and/or vulnerability; 3) an estimation of risk, combining the likelihood and the severity of the targeted consequences based on the identified hazardous characteristics and the exposure/vulnerability assessment (IRGC 2005: 27). Basic data are derived from scientific research from many disciplines, nearly always on an international basis. Expressed in numbers it becomes clear what is at stake and which likelihoods are at issue. This quantitative approach is the cornerstone of the classical risk approach. It is the gateway to risk policy.

Next, on the basis of these data, an assessment is made of the degree to which the estimated risks are judged to be acceptable or require measures for risk reduction. Hard numbers provide a basis for a pragmatic and often unproblematic evaluation of risks in the assessment process. Risk estimation and risk assessment both entail, ideal typically, a division of roles between experts and risk managers. Experts perform the estimation, risk managers make the assessment, and based on it, if needed, they decide to take appropriate measures for risk reduction (MNP 2003: 22). Subsequently, the implementation of policy takes shape in institutional arrangements in which experts, officials and politicians are involved. Increasingly, these arrangements are international. Today nearly all important safety policy domains are European-based; in some fields (such as infectious disease control) there are even worldwide policy agreements.

In recent years the institutional arrangement of risk assessment has received major boosts. The case studies performed for this report illustrate that proactive identification of risks increasingly receives attention in many areas. In the area of *infectious disease control*, for instance, international surveillance systems have been set up to monitor the development of possible new threats. In the Netherlands, the RIVM and the Health Care Inspectorate (Inspectie voor de

Gezondheidszorg, IGZ) play a major role. Also at the level of the European Union, networks exist to monitor infectious diseases, such as the recently established European Centre for Disease Prevention and Control (ECDC). In addition, the Netherlands is linked to monitoring systems for infectious diseases of the World Health Organization (WHO). The need for both international collaboration and the development of more insights into the dynamic of infectious diseases, including the concomitant epidemic intelligence, is widely recognized (Mensink 2007).

Also in the domain of *food safety,* a lot has been invested in proactive detection. In the Netherlands the dioxin crisis of the late 1990s strongly contributed to the establishment of the Food and Consumer Product Safety Authority (VWA) in 2002 and, in its context, a risk assessment agency for the proactive detection of risks of food. Its counterpart at the European level is the European Food Safety Authority (EFSA). The EFSA is focused on collecting scientific research, assessing contradictory insights therein based on standardization and risk communication aimed at citizens. Also, on account of the BSE crisis, a *Rapid Alarm System* was established to enable fast detection and recall of unsafe food throughout Europe.

There are comparable networks, aimed at proactive detection, of European and national organizations in the area of *safety of medicines*, whereby the communication and registration of side effects of use is reminiscent of surveillance and detection regarding infectious diseases and food. Here it is the European Medicines Evaluations Agency (EMEA) that collects scientific insights and assesses the interpretations of the (side) effects of medicines that companies, academic science and health authorities supply.

In the fairly underdeveloped field of *ICT and internet safety*, adequate systems of risk detection and knowledge gathering are needed to protect data and to counter the threat of 'digital paralysis'. A first step at the European level in this respect is the establishment of the European Network and Information Security Agency (ENISA). At the national level we now have the Computer Emergency Response Team (GOVCERT) for threats to ICT systems.

As stated already, the institutional arrangement of risk assessment offers a major basis for decision-making on policies for prevention, reduction or precaution. Once risks are estimated and assessed, processes of risk management can be implemented.

3.2.2 RISK MANAGEMENT

When assessment points to the necessity or desirability of measures, a need for risk management emerges. The first step in risk management involves the *decision process* about policy measures to be pursued. Depending on the domain, of

course, these measures may take on quite divergent forms – from regulation of the handling of hazardous substances and organizational measures (such as limiting the supply of medicines by linking them to prescriptions) to policies on large-scale infrastructures such as dikes.

Basically, this decision-making process has three possible assessment results (IRGC 2005: 40). First, there are small or negligible risks that we accept as a society. At most these require policy measures to distribute information and, possibly, to promote insurability so that those who suffer damages through no fault of their own can be financially compensated. Second, there are risks that are acceptable provided measures for reduction are complied with. This is the case, for instance, in the production of hazardous substances, where risks are accepted because we all benefit from the production of, for example, gasoline or LPG. We tolerate the risks, but only within stringent boundaries controlled by companies and governments. Third, there are also risks that we do not accept, such as major floods or life-threatening infectious diseases, but also some health and environmental hazards associated with new technologies. These cases may involve intricate and at times controversial processes to settle the boundaries within which risks are handled, as well as to determine appropriate policy measures.

For governments the decision-making process has an extra component. They have to design appropriate policy measures for a wide variety of risks, and thus have to set priorities and weigh risks. To do so, systems have been developed for ranking risks on a scale. In principle, these systems make it possible to arrive at decisions that ensure the efficient allocation of resources. An example is the classification of health risks based on calculations of annual mortality and loss of disability-adjusted life years (DALYs) (cf. Table 3.1).

By combining data from this table with calculations of the expected efficacy of measures, an assessment can be made of a risk policy's cost effectiveness. This is often expressed in terms of added quality-adjusted life years (QALY). For several areas, like health care, such calculations are available. They show a huge variety (MNP 2003: 34). For instance, illness prevention (such as vaccination programmes and support for smoking addiction) often proves to be cost effective (less than zero euro per QALY), as is also the case for the prevention of domestic injuries. It will hardly come as a surprise that high-tech medical interventions score substantially lower. It is perhaps more surprising that airbags and periodic automobile inspections end up in the same range (10,000-100,000 euro per QALY) as such medical *tours de force*.

Universal risk standards have major limitations, however. Comparisons between risks are hard to make on the basis of a limited number of quantitative data on mortality, DALYs or QALYs. Besides cost effectiveness, after all, other considera-

Table 3.1 Health risks classified on the basis of mortality and DALYS

Risk factor	Mortality/year	DALYS
Cigarette smoking	20,000	440,000
Obesity	8,000	170,000
Physical inactivity	8,000	135,000
Unhealthy food (wrong fats)	7,000	137,000
Alcohol*	2,200*	195,000
Domestic accidents	2,200	52,500
Traffic accidents	1,200	85,000**
Air pollution dust***	1,300	1,800
Radon in houses	800	7,900
Passive smoking	530	6,300
Legionellae drinking water systems	80	560****
Benzene		3140
Large accidents	1	40****
Lightning	1.5	40

* excluding traffic accidents
** only permanent injuries
*** based on studies of the relations between daily variation in mortality and air pollution
**** only lost life years due to mortality

Source: MNP 2003: 17

tions play a role as well, such as the extent of the damage expected (not only in terms of casualties but also economic and social disruption), whether or not that damage is reversible or permanent, whether or not the risk was taken voluntarily, the policy's practical feasibility and legitimacy, and questions about justice and constitutionality. A report showing that for men the risks (in terms of expected loss of life years) of being unmarried are higher than those of cigarette smoking (Fischhoff et al. 1981: 82; Gardner and Oswald 2004) obviously does not lead to a call for government action to reduce the number of bachelors.

After the decision-making on policy measures is completed, the other aspects of risk management come into view: policy implementation, supervision, monitoring and enforcement (IRGC 2005: 43). Laws and rules are implemented, protective provisions made, communication strategies applied and subsidies granted. Governments, companies and citizens are thus each assigned responsibilities or take them on. The tailpiece of risk management is the monitoring of policies, inspection of compliance and enforcement of rules. Criteria for the evaluation of policy success are developed; inspection and enforcement as to compliance with rules and monitoring of the quality criteria are organized. These tasks will often be carried out by governments but can also be performed by private organiza-

tions. These aspects of risk management will be discussed in more detail in subsequent sections.

3.3 RESPONSIBILITY AND RISKS

Virtually every human action is tied to possible damage consequences. When these dangers are conceptualized as 'risks', they are placed in a social engineering perspective. Decision-making on the acceptability of risks then occurs against the background of an assumed freedom of choice to refrain from risky action, to continue it or to adapt it. This implies that where risks are known and still damage is inflicted, one may ask who is responsible for the harm or damage and, possibly, liable in a legal sense. In advance of these concerns, the question of who is responsible for taking preventive measures may present itself as well.

Of course, human beings not only have to face adverse consequences of their own, or someone else's, action, they are also threatened by natural hazards. This may involve issues of responsibility as well. Today, flooding, which in Bangladesh leads to what is conceived as a natural disaster, proves to be quite manageable in the Dutch province of Zeeland. If in the case of a flood in Bangladesh we only think of the forces of nature and feel that local residents just had 'bad luck', we have something to explain indeed. We must explain why evil forces were not controllable in this place, and in our quest time and again we will run into human actions and failure, economic interests, power, unwillingness, indifference, lack of money and poverty. So with regard to 'natural' disasters too, it is quite possible to ask questions about responsibilities (Shklar 1990: Ch. 1; cf. also Bijker 2007). The same applies to examples closer to home. Because a risk value depends on the extent of damage that will be inflicted when catastrophe occurs, a risk also increases if the potential damage of a disaster goes up. For example, the risk of springtides in the Netherlands has not only increased since the flood of 1953 because climate change has raised the likelihood of springtides, but also because since the 1950s there has been an enormous expansion of both housing and industrial activity right behind the dikes. If today a dike were to break in Zeeland, the damage would be substantially greater than anticipated at the time of the design of the Deltaworks. This is why risks – likelihood multiplied by extent of damage – have gone up since 1953 (WRR 2006a: 73-93). Animal diseases provide another example. Intensive livestock farming is not only a major factor in the emergence and spread of animal diseases; in this area, too, the damage caused by an outbreak is raised in part by the increase in the number of animals present. Also where nature entails risks, then, responsibility issues are soon at stake.

The basic legal principle that applies within the domain of safety is that the loss is left where it falls: one person cannot transfer to another the burden of what

happens to him. This principle of 'individual responsibility' was explicitly formulated already in the nineteenth century (Ewald 2002: 274). Unless the government explicitly decides otherwise, private parties themselves carry responsibility for refraining from risky behaviour as well as for risk prevention.

Where damage is inflicted on others, the person who caused the infliction can be held liable, while the person who suffered damage can try to recover the losses – whether or not through court – from the party that inflicted them. Questions about liability arise *after* the performance of an action that has caused particular effects. A rational actor, in deciding for specific action, will of course anticipate such questions. In light of the risk of being held liable for harmful effects of actions later on, he will consider preventive measures to limit this risk, or take out insurance so as to be able to pay for possible self-inflicted damage or damage inflicted on others. Assigning liability, then, has a preventive effect *ex ante*. Effective allocation of liability is an essential element of any society's risk management.

Governments, businesses, citizens and organizations of civil society all make use of diverse opportunities to take or allocate responsibilities for risk management. In this chapter they will be presented from the perspectives of these various actors. This provides insight into the available room for distributing responsibilities. In a general sense, to begin with, we distinguish a number of dimensions of responsibility that present themselves when dealing with risks.

Responsible action obviously requires financial and other resources for taking preventive measures and, if needed, restoring or compensating damage. In many cases, however, it also requires specific knowledge about what others have done or failed to do. To safely prepare their food, consumers must be able to trust that the food they buy meets the standards and that manufacturers have provided correct information. Companies too are in many ways dependent on what others do or do not do. They may have organized their risk management effectively in their own production facilities, but if their suppliers are not as careful, things may still go wrong. Because risky activities often take place in (border-transgressing) chains and networks, intricate relations of interdependency emerge among the responsibilities of those involved. Citizens and businesses, therefore, cannot limit themselves to attention for their own conduct. To carry responsibility, they have to have sufficient information about each other's conduct and products.

Where responsibilities are at stake, the knowledge or information of those involved plays a crucial role. In many cases citizens and businesses lack the resources to gain information on their own of all the risks that come into play in certain behaviours or products. Not each load of raw materials or semi-finished

products can be thoroughly inspected at the company gate. Any producer must be able to trust that his supplier does not deliver products that later on will cause problems. Bearing in mind the motto 'confidence is nice, control is better', one is likely to fall back on standards, contracts, regulations and private or public monitoring. The same applies to relations between citizens and businesses. Sufficient measures have to be taken to compensate for the *information asymmetry* between actors. The ways in which information is produced, communicated and distributed largely determines the extent to which it is possible to bear responsibility for one's own safety. As a consequence, despite the basic principle that everyone bears responsibility for his own damage, the government often comes into play. It can raise the capacity to bear responsibility, for instance by taking measures that reduce information asymmetries. But also if these obstacles are removed, it is not obvious that businesses, civil-society organizations or citizens in fact take their responsibility. By taking legal measures and through monitoring and inspection, the government may urge or force private parties to do so. Private law, administrative law and criminal law provide the frameworks to compel private parties to act responsibly.

Given the mutual dependence, information asymmetries and government involvement, in many cases it is hardly possible to discuss responsibility for safety for each actor separately. Responsible action in dealing with risks requires the effort of many parties, and hence responsibilities must be considered in their interrelatedness. What is called for, however, is transparency about the delineation of tasks and jurisdictions. It should be clear who takes on which aspects of the interrelated responsibilities. This clarity is improved by distinguishing different types of responsibility.

To begin with, we can distinguish between *final* and *operational responsibility*. Operational responsibility comprises the concrete concern for prevention of a particular risk. Final responsibility of a party means that it ensures that other parties can or must take their operational responsibility. These two forms of responsibility are thus linked. Businesses, for instance, can have operational responsibility for the safety of their products, while by regulating the measures to be taken by businesses and companies the government bears final responsibility for the level of risk prevention.

A second useful distinction is the one between responsibilities that are *taken* by some party and responsibilities that are *assigned* to a party. By deploying specific instruments, the government *takes* final responsibility. For example, it promulgates regulations or decides to make protective provisions. As an *effect* of this deployment of instruments, operational responsibilities are assigned to other actors or they get an option to *take* responsibility.

Businesses, of course, have fewer options for assigning responsibility to others than the government. Reduction of operational risks takes place here through self-regulation, contractual relations and private inspection. For individual citizens and organizations in civil society, this applies even more strongly. They bear responsibility for their own actions, of course, and they can be expected to take measures that limit the likelihood of damage through their actions. In some areas, for example flood risks or infectious disease control, the reduction or prevention of many risks is largely beyond the reach of individual citizens. In such cases individual prevention offers no relief and collective measures are called for, which then must be taken collectively, in most cases by the government.

Dealing with responsibility in risks is thus shaped in a wide variety of actor configurations by the government, businesses, individual citizens and civil society organizations. The various ways in which final and operational responsibility can be assigned or taken will be mapped out below. A description of the various ways in which actors arrange responsibility will reveal the complexities involved in the shared social task of managing risks.

3.4 GOVERNMENT INSTRUMENTS AND ADMINISTRATIVE PROBLEMS

Establishing connections between risks and responsibility has long been a major political issue for national governments. Meanwhile, many risks transgress national borders. Globalization comes with a strong population increase, with the emergence of mega cities and decline of ecological systems, with international food production chains and a huge increase in the international traffic of persons, animals and goods. This has major implications for the allocation of risks.

As we have seen in Chapter 2, the internationalization of trade, agriculture and industrial food processing has brought about the emergence of lengthy production chains. These chains generate not only more risks but also contribute to turning risk management into a rather complex task. Also, the risks of infectious diseases take on new contexts through globalization. Each year, for instance, there is a worldwide threat of a pandemic involving highly pathogenic bird flu strains, with increasing chances of developing a new variant of human influenza. The influence of globalization manifests itself emphatically as well in risks resulting from the use of ICT and internet technology. Likewise, climate change puts a policy area such as flood prevention, which used to be a national affair, in an international context because the problems cannot be resolved only through heightening dikes in one's own country. For instance, international consultation on technical measures for river flood control is needed. The transport of hazardous substances, finally, has long been an international affair for which extensive international regulation has been developed.

The internationalization of risks influences the instruments the national government has at its disposal for taking on or allocating responsibilities for risk management. This is most obvious in *legislation and regulation* whereby the European Union, through its directives, limits the influence of national legislators. It also applies to the *protective provisions* made by the government itself to manage risks. Policies on risk communication and most forms of *monitoring* and *inspection* are still largely national. The deployment of these instruments, then, presents the national government with quite a number of administrative problems. It takes place within a highly complex structure of government organizations and therefore provokes countless discussions. We return to this at the end of section 3.4. First we discuss the various instruments and discussions involved.

3.4.1 LEGISLATION AND REGULATION

A major instrument for assigning operational responsibilities by both international and national governments is legislation and regulation. By issuing laws and rules, governments restrict or prohibit the risky activities of businesses and risky behaviour of individual citizens. Governments thereby take on the final responsibility for stimulating businesses and citizens – and, where needed, forcing them – to ensure adequate execution of operational responsibility for safety. Various types of law contribute to this effect. All risky activities of businesses primarily fall under private law. Tort law distinguishes between liability in case of guilt (intentional, culpable conduct or negligence) and strict liability (whereby regardless of the issue of culpable conduct or negligence, a party is liable for damages). For example in product liability, manufacturers and retailers are held strictly liable for products that have caused injuries. Risky activities of individuals are also covered by civil law regimes, sometimes in combination with criminal law regimes. The government commits itself to standards and rules as well. Through public law and administrative law regimes, the government sets frames for the protective provisions it provides for the prevention or containment of risks. Thus, the government's operational responsibility in areas such as flood prevention and infectious disease control is framed through administrative law legislation.

The use of legislation and regulation for distributing responsibility to businesses and citizens varies significantly among the cases studied. For example, in the area of ICT and internet safety, legislation is limited. This has to do with the overwhelming complexity of the networks of hardware and software producers, providers, international private organizations and quite divergent constellations of users among businesses, government, social organizations and citizens. In addition, the de-territorial nature of the internet restricts the options of national governments to limit risks through laws and rules (Ecotec 2005; European Commission 2005). For the time being, solutions are pursued by setting up governance structures whereby governments, businesses and civil society agree to

exchange data, technological standards and requirements for professionalism (WSIS 2005). Furthermore, in the EU the liability of internet providers has been harmonized.

In the domain of the production and transport of hazardous substances, national and international governments have more options for allocating responsibilities. It involves, however, very complex systems of legislation and regulation. Production is largely restricted by national government through a combination of 'duties of care', 'target regulations' and specific technical regulations. Specific duties of care exist for 'internal safety' (i.e. on the site of production and storage facilities), for which companies themselves are responsible. Target regulation is used in relation to 'external safety', in the form of standards for both the mortality risk of an individual in a certain location (site-related risk) and the annual risk that a particular group of persons falls victim to a calamity (group-related risk). In addition, businesses have to implement a large number of, often very detailed, technical regulations to get the official permits needed for operation. After disasters in Flixborough and Seveso, the influence of international guidelines, regarding both internal and external safety, has increased significantly. For example, the post-Seveso guidelines formulate standards for internal safety, for informing local government, and for communication with nearby residents in case of a disaster. Transportation of hazardous substances involves very detailed technical regulations developed by international governments as well as by specialized international non-governmental and private organizations.

The internationalization of legislation and regulation is also prominent in food safety. The food sector is characterized by lengthy, often international, production chains. These chains are increasingly regulated at the European level. This process has been accelerated by a number of incidents (such as BSE, foot-and-mouth disease and swine fever) and is also strongly influenced by European internal market considerations. For instance, the European Union has formulated standards regarding the possibility of tracking and tracing raw materials in the long chains from producer to consumer, the maximally allowable concentration and quantities of health-threatening substances and product labelling (Tielemans 2004; Heumer 2005). Because of the technological nature of the issues involved, experts play a major role. We see a similar picture in the regulation of the production of medicines. Here, too, lengthy international production chains are at issue while standards are set mostly at the European level. For businesses that operate in international markets, harmonization of regulations is of course important also for economic reasons.

In cases in which the government itself takes on operational responsibility by providing protective provisions – such as in flood prevention and the control of infectious diseases – legislation and regulation often distribute responsibility

among various government authorities and agencies. There are target regulations based on flood risks, in combination with technical standards that dikes and other facilities have to meet (MNP 2004). In the case of infectious disease control, target regulations are absent. No explicit statements are made on the level of risk that the government does or does not accept. Policy in this area is mainly realized in an international (WHO) context. Through enabling legislation, laboratories, physicians and microbiologists are encouraged to introduce self-regulation and to develop professional guidelines and protocols (Mensink 2007).

The case studies conducted in preparation for this report show a number of important developments in the use of legislation and regulation and the national government's options to shape responsibilities. Some fields show a dynamic of their own that severely limits the possibilities for action by the national government. Under pressure of scandals, crises and internal market considerations, European directives are formulated that indicate the framework within which national governments are allowed to develop legislation and regulation. This limits the freedom of national governments to allocate responsibilities for risks. Moreover, this process is reinforced by putting emphasis on technological standardization as, for instance, in the areas of hazardous substances, food and medicines. These standardizations are developed by experts who commonly are not employed by national governments. Increasingly the decision-making process on technological standardization takes place within international non-governmental and private organizations. As a result, more and more risk standardization has become not only international but also private. The national government's options for detailed delineation of responsibilities are increasingly limited indeed (Van Waarden 2005).

Another striking development is the frequent use of 'open norms'. Open norms are marked by the fact that they set frames for action or goals that have to be reached, but refrain from making a specific action mandatory. For example, European directives can be seen as open norms because national governments are prescribed frames within which they have room to develop their own policies. Duties of care are another example of open norms, such as regarding internal safety of the production of hazardous substances, where the government imposes particular obligations to ensure safe labour conditions but allows companies to take measures that best suit their production facility. Likewise, target regulations can be viewed as open norms, in the sense that they indicate which global requirements apply to external safety in the production of hazardous substances or which global requirements dikes have to meet.

Although the goal of open norms is to provide actors with more policy freedom or room for manoeuvring, thus assigning more individual responsibility to them, practice proves to be erratic. Because of the interconnectedness of various policy

fields or because of the involvement of governments at various levels, in actual policy contexts, open norms may well translate into a hermetic regime of rules, requirements and measures that still limit the freedom of businesses substantially. For instance, in a fairly transparent policy area such as the production and transport of hazardous substances, the uses of target regulations or duties of care may still lead to little freedom of action because of the much more rigid environmental legislation that this sector has to address as well (Dorbeck-Jung et al. 2005: 28). Another example is the largely internationally defined technological regulations for the transportation of hazardous substances (external safety) that in theory limit the room offered by duties of care to arrange internal safety according to one's own views. Producers, after all, have to reckon with both and must bring their risk management into line with the most stringent standards.

Another problem of open norms is that they may have quite divergent implications for different actors. With hazardous substances, for instance, target regulations are preferred by larger businesses, which have the expertise to implement safety policies effectively. They experience drawbacks of detailed rules because in a large international organization they may be hard to keep up. The absence of detailed regulations, however, can be disadvantageous for smaller and midsize businesses. Detailed regulations in fact unburden smaller businesses which lack the resources to develop a safety policy of their own, and may have to comply with the same standards their competitors have to meet.

Open norms also have implications for supervision and enforcement. Compliance with open norms is harder to monitor than detailed regulations of conduct. Monitoring whether businesses have adequately implemented the standards' general goals puts higher demands on the expertise inspectorates should have at their disposal.

3.4.2 PROTECTIVE PROVISIONS

In some areas, the government installs protective provisions that reduce the chance of damage or alleviate its effects. This will be the case where risks are involved that can only be limited substantially through collective measures. Familiar examples are flood prevention and infectious disease control.

Flood prevention constitutes one of the oldest forms of protection against natural risks in the Netherlands. The government is in charge of an extensive infrastructure of dams and dikes, polders, channels, sluices and pumping stations. The flood of 1953 (prompting the Deltaworks) and the river flooding of 1993 and 1995 (triggering the Deltaplan Large Rivers adopted to step up implementation of river dike improvements) have played a large role in bringing these facilities up to standard. Traditionally, flood prevention policies and their

implementation are realized in an extensive network of ministries, provinces, water board districts and municipalities.

An issue of concern is the weakened grasp of the relationship between risk and behaviour that seems to have surfaced more than fifty years after the 1953 flood. Substantial building projects and new housing developments in river forelands suggest that local or regional decision-makers do not seem to be overly worried about the risks of water anymore. The horizontal administrative culture appears to have bred decision-making in favour of other goals than flood control. As a consequence, more locations have emerged that in the case of flood might suffer unacceptable damage. To counter this negligence, in the recent past it was decided to subject spatial development plans to a 'water test' (Wiering 2004).

Another important development is that flood prevention increasingly evades the network of national, regional and local governments. Due to projections on climate change and sea-level rise, the role of other countries and the European Union in this policy field is growing. Higher dikes or larger pumps in one country no longer offer the exclusive solution for adequate flood control. In the basins of large rivers and in coastal protection plans, cooperation and coordination between countries are needed (Ebrecht et al. 2005; European Commission 2004). Through these developments, flood prevention has meanwhile become a much debated issue. Also within the Dutch National Safety and Security Strategy it is marked as one of the main points of attention for policy (Ministry of BZK 2007).

A second major area in which the government has long provided protective provisions is infectious disease control, which is aimed at preventing or suppressing large-scale epidemics (or pandemics) among humans and animals. Infectious disease control involves an intricate network of government organizations as well as many non-government organizations. The responsibility for implementation lies with the municipalities, but the national government, through the State Vaccination Program, provides for collective prevention. Furthermore, the national government builds up stocks of antiviral medicines to be able to take repressive measures swiftly in case of a pandemic, in collaboration with aid and emergency services such as medical care and police and fire departments. The increasing interrelatedness of infectious disease policies with other policy areas, such as food safety and the processing of waste products, has regularly caused tensions between ministries and agencies with respect to the distribution of tasks and responsibilities. Also, it is questionable whether a purely national approach is still productive. The international mobility of persons, animals and goods has reached such levels that infectious diseases can rapidly spread across the world. Only intensive and drastic international cooperation may give solace (Mensink 2007).

The cases of flood prevention and infectious disease control show that establishing protective provisions is a complex affair. Also, where the government takes operational responsibility, its deployment has to take place in networks of statist and non-statist actors. Mutual coordination problems and complex intrinsic considerations with bordering policy areas further complicate the taking of protective measures. Moreover, the influence of other states and the European Union on these traditional national activities is growing.

3.4.3 RISK COMMUNICATION

To manage risks, the government, businesses and citizens are highly dependent on each other. A major aspect of these dependency relationships is information asymmetry. To allow other actors to behave responsibly, the government pays great attention to removing these asymmetries.

The requirements the government sets with regard to the risk communication of businesses vis-à-vis consumers are a case in point. For instance, businesses are required to indicate risks on food labels and to provide information about side effects of medicines. Furthermore, health care professionals provide information on the risks of particular foodstuffs, medicines, infectious diseases such as HIV, other sexually transmittable disorders and so on. Patients' associations do the same from the angle of the interests and experiences of their members. Consumer organizations are involved in quality marks for food. Risk communication by businesses, professionals and social organizations may contribute to a raised awareness of risks and thus to better prevention. However, when the information quality is not guaranteed, it may also contribute to confusion and misinformation or to (unjustified) worries of citizens. Given the dependency on the activities of other actors, the government has limited control in the latter.

The government itself may also engage in risk communication. Generally, its objective is to reduce undesirable risky conduct by citizens in the public interest. For example, the national government provides information on the risks of food, the composition of a healthy diet and the proper way of handling and preparing food. Warnings about smoking, alcohol and drugs are familiar to everyone. The government is also active in the area of safe internet use. Risk communication may however also be aimed at raising risk acceptance. The public awareness campaign on water ('*Nederland leeft met water*'), for instance, intends to create support for new flood prevention policies and to raise awareness for the fact that today there are still (or again) risks of flooding. Finally, government risk communication is an important aspect of crisis or disaster management. In large-scale outbreaks of infectious diseases, floods or major disasters with hazardous substances, the government provides information to citizens via various media, such as radio, television and the internet. The local fire department, police and other

aid services may issue information to citizens and in special cases offer specific guidelines on how to act in such cases. Careful and clear-cut communication is crucial to prevent unnecessary worries or needless costs. In times of crisis, citizens must be able to rely on the government as well as on professionals.

3.4.4 SUPERVISION

Government risk management is secured through monitoring and inspection. Monitoring can take place, for instance, through benchmarks, output indicators, and peer review procedures. The European Union monitors how member states implement European policies (Sabel and Zeitlin 2007). On a national scale, government institutions such as the Food and Consumer Product Safety Authority (VWA) and the Water Management Inspectorate (Rijkswaterstaat) perform various monitoring tasks.

In relation to the private sector, the government performs (on site) inspections to ensure that businesses comply with the rules. In contrast to monitoring, government inspection is still predominantly organized at a national level. The European Union may set the framework, but inspection activities are largely conducted by or in the name of national governments. In some cases, specific agencies are in charge (such as VWA, which is in charge of compliance with the Food and Drugs Act), in other cases specific inspectorates (such as regarding environmental issues or labour conditions in hazardous substances). Also lower governments perform supervision tasks, such as with respect to hazardous substances licensing.

The proper relation between government supervision and the private sector is subject to debate, however. Mertens (2006) argues in favour of viewing inspectorates as intermediaries between the government and the business sector. This requires inspectors to have more discretionary room for making arrangements with a sector, in order to align with a sector's practices better. This approach also comes with risks, however, as Mertens concedes. One risk is *regulatory capture* whereby the government agency turns into an extension of the sector to be inspected. Another danger is that customized arrangements may lead to inequality before the law. Inspectors may partly overcome this problem by making explicit how they use their discretion.

A second discussion on government inspection concentrates on improvement of the efficacy and efficiency of inspection. In this respect, the Dutch House of Representatives has adopted a resolution to centralize the supervision of business activities (TK 2005-2006, 29362, nr. 77). This resolution gave rise to '*Eenduidig Toezicht*' (Unequivocal Oversight), a plan to establish a single inspectorate for each business sector, to streamline cooperation between monitoring

efforts and inspection and, where needed, to combine various types of inspection (TK 2005-2006, 29362, nr. 107).

In addition, there is a trend to externalize monitoring and inspection tasks to private parties and to limit government involvement to control of the performance of private inspectors and licensing institutions. This implies that the government keeps a larger distance from what is actually happening in companies. It monitors therefore inspection organized by businesses and licensing organizations: the government, in other words, 'inspects inspection' (Michiels 2006). Transportation of hazardous substances, where for many years classification organizations such as Lloyd's Register have played a major role, provides a well-known example. Without a certificate of an official classification organization, ships that transport hazardous substances are not allowed to dock in the port of Rotterdam. The government's involvement is limited to monitoring these classification organizations. In food safety one often finds combinations of private and public actors. The so-called 'commodity boards', for example, draw up rules that are checked by employers' organizations, private inspectors and licensing institutions and that subsequently are enforced by the commodity board, the public prosecutor or the customers themselves (Havinga 2003: 192-194). An acknowledged drawback of the displacement of inspection to private parties is that the government's own expertise will gradually diminish while the dependence on private institutions increases.

A last relevant development – whether publicly or privately organized – is that increasingly inspection is based on a reversal of the burden of proof. Businesses have to show the inspectorate that their risk management is in order. The standard in this field, according to Mertens (2006: 24), is the safety case approach, whereby the organization under inspection has to document extensively how it executes its safety policies (cf. Bishop and Bloomfield 1998: 1). The company has to render transparent how risks are avoided or reduced. Outside inspection takes place without detailed regulations of risk management. This form of control also requires expertise, but no top expertise (Mertens 2006: 24). The lack of expertise within the inspectorate can be compensated, Mertens argues, by hiring it elsewhere. Of course this assumes that one has a clear picture of where and which expertise is absent.

The developments within inspection and the various discussions involved provoke questions about what the most effective and just arrangements are. In particular where alternative forms of regulation are introduced – such as 'open norms' – this will need to have implications for the form in which inspection is organized. The main problem, however, is that empirical insight into the effects of alternative forms of regulation is scarce. Despite the many discussions about this issue and the growing importance of these modes of inspection, there is remarkably

little empirical research into their efficacy and efficiency (Mertens 2006: 21; Leeuw and Willemsen 2006).

3.4.5 ADMINISTRATIVE PROBLEMS OF THE CLASSICAL RISK APPROACH

The deployment of the instruments discussed so far presents the government with a number of administrative problems. Risk management is accompanied by a large number of laws and rules, administrative organizations, a heavy emphasis on communication and an elaborate system for monitoring and inspection. In all policy areas studied, substantial organizational complexity has emerged, and in many cases one can speak without any reservation of lack of transparency. In the policy concerning 'digital paralysis', for example, at the state level three ministries are involved centrally and four ministries indirectly, assisted by the ICT warning and protection service GOVCERT (Ministry of BZK 2006: 9 ff). Even within a single ministry there can be multiple policy fields, which each use their own policy philosophy. The Ministry of Traffic and Water Management (V&W), for instance, comprises domains such as water management, traffic safety, transportation of hazardous substances, tunnel safety and aviation. All these policy areas have their own history, policy goals and standards, as well as arrangements for monitoring and responsibility (Ministry of V&W 2004, 2006).

All in all, the safety domain leaves a confusing impression, and not only with outsiders. Insiders voice the same complaint. In some cases, they claim, even experts do not know what exactly is arranged and what is not. This is not just the case in the Netherlands. In a study about the United Kingdom, Hood et al. (2001: 174) compares the institutional disorder of safety policy with what parents have to face when they enter the untidy bedroom of their teenagers.

The complexity and lack of transparency become apparent in particular during crises and disasters. The BSE crisis, Chernobyl, the outbreaks of several animal diseases with potentially severe public health effects, and several national disasters with many casualties – including the Enschede fireworks plant and the huge fires in Volendam and Schiphol – are still fresh in our memory. These disasters fuel the notion that many government organizations may be involved in a single policy, but that there are major problems of coordination. To face this problem, the National Safety and Security Strategy was set up. In this context, the Ministry of BZK (TK 2006-2007, 30821, nr. 1) speaks of the need for an *all-hazard approach*, or an integral approach that should prevent *ad hoc* incident management and mono-focus. Similarly, the Dutch Safety Board was set up because a more systematic approach was felt to be necessary.

The complexity and lack of transparency not only present governments with management problems. They also deserve attention for political reasons. After all,

because of a lack of transparency, the legitimacy of politics can become an issue. The Ministry of V&W (2004; 2006) has concluded that between and even within policy fields there are multiple approaches and that safety is measured and assessed incoherently. For example, the policy area of V&W has 'wet' water management projects where one defines unsafety in terms of economic damage and social disruption, and 'dry' projects (roads, bridges etc.) where one starts from absolute numbers of deaths and wounded. In aviation policies other standards are used than in the area of hazardous substances. The Ministry has become increasingly aware of the fact that this lack of transparency might lead to inequality before the law, and that citizens might hold policymakers and officials accountable for this. This is why the report 'Safety Transparently Weighed' (*Veiligheid in Transparante Afweging*) argues that the use of different policy concepts "may [have] evolved historically, but now that citizens increasingly question the government about upholding safety, there is a need to interpret these differences and, where possible, to ensure cross-strutting" (Ministry of V&W 2004: 62).

The complexity and lack of transparency of regulations also raise the issue of whether the national 'Safety Euros' are effectively spent in fact. One of the conclusions of an interdepartmental study on National Safety is that a general framework for weighing safety is absent. The Ministry of BZK (TK 2006-2007, 30821, nr. 1: 5) points out that the current approach to national safety provides insufficient possibilities "for arriving at a substantiated political weighing of risks and a prioritizing and attribution of scarce (financial) means". The conclusion that money can only be spent once also incited former Under-Secretary of Environmental Affairs Van Geel in 2003 to restart the discussion on risk assessment and management (MNP 2003).

The concerns about integrality, legitimacy and effectiveness of policies, which are prompted by organizational complexity and the lack of transparency within the classical risk approach, have fuelled quite some discussions in recent years. These discussions are dominated by the call for coordination and a clear distribution of responsibilities, as well as pleas for uniformity and rationality. "More than ever collaboration [is] needed between all organizations responsible for aspects of [policies]: various ministries, different layers of government, the private sector, or, in other words, policy and implementation, monitoring, inspection and enforcement," the Ministry of BZK writes (TK 2006-2007, 30821, no. 1: 1). The National Safety and Security Strategy (Ministry of BZK 2007) aims to restructure government activities around national safety systematically at a strategic level. One of the core issues is aligning all parties involved through principles of coordination and guidance, and transparency about tasks and responsibility (clear-cut distribution of roles, steady roles, *unité de doctrine*, coordinated approaches and uniform information network). The Advisory Council for Transport, Public

Works and Water Management (Raad voor Verkeer en Waterstaat) and the Dutch Council for Housing, Spatial Planning and the Environment (VROM Raad) (2003) also mention unambiguous allocation of responsibilities as a key point for future policies.

In response to the problems of legitimacy and effectiveness, more uniformity and rationality in targets are pursued. In the area of health risks, systems to enable comparison of standards and the deployment of resources for prevention are available already (cf. subpar. 3.2.2). In other areas the development of similar systems is being pursued. For example, the Ministry of V&W has issued 'Safety Policy Examined' (*Veiligheidsbeleid doorgelicht*) (Ministry of V&W 2006), a study in which a historical sketch is given of similarities and differences between standardizations in various ministerial policy fields. Although the report stresses that harmonizing risk standards does not belong to its explicit objectives, the exploration of similarities and differences in the various policy domains is not a random exercise. Other initiatives fit the picture. The Netherlands Environmental Assessment Agency (MNP) has been asked by the Ministry of VROM to "…supply the scientific building blocks which might allow rationalization of the risk policy, or dealing with risks 'pragmatically'. This involves mutual consistency in permitting various kinds of risks and the consistency with previously accepted risk levels" (MNP 2003: 3). Likewise, the Ministry of V&W (2004) recommends 'pragmatic' dealing with risks by putting together a checklist of kinds of safety effects, in which suggestions are provided for the accountability, measuring methods and ways of monetizing. One of the core issues of the National Safety and Security Strategy, finally, is a national risk assessment whereby threats are measured along a single yardstick to enable prioritizing of risks (which risks need to be reduced and for which priorities should scarce financial means be allocated) (Ministry of BZK 2007).

However, striving for clear distributions of responsibility, uniformity and rationality also has its drawbacks. Complex regulation may lead to lack of clarity, but it entails many, partly overlapping, advantages as well (Hood et al. 2001: 174 ff). First of all, an institutional system composed of multiple units and proper *checks and balances* will be more conducive for experimentation and learning than uniform arrangements. If everywhere the same approach is adopted, the same errors will be made everywhere, and little is to be learned. Multitasking of government agencies often proves to lead to cost reduction as well. Some degree of redundancy in institutional services, moreover, helps to limit the risk of failure or short-sightedness of specific parts of the system. Where diversity exists, policymakers can transcend institutional boundaries to serve the public interest from a broader perspective. In addition, organizational diversity opens up space for professional expertise to play its proper role and for taking into consideration specific local conditions more effectively.

Striving for uniformity of standards and efforts at policy rationalization should be considered critically. After all, it comes with the risk that solutions are pursued for problems that are mainly artefacts of the question. Of course, unreflective differentiation of standards that does not serve a single goal and that may lead to inequality before the law needs to be addressed. But in itself, government use of divergent standards in different domains does not have to be a serious problem. That in aviation other standards apply than in the transport of hazardous substances is as little remarkable as the fact that in hospitals other standards apply than in the food or chemical industry. Before measures to attain uniformity are adopted, it should therefore be asked whether it makes sense to subsume divergent areas under uniform standards and criteria. In many cases, contextual assessment of standards is more appropriate. Risk assessment and management involve making judgments about matters that have many dimensions; they are never merely a matter of making a clear-cut calculation.

3.5 MEASURES TAKEN BY COMPANIES

The administrative problems of the classical risk approach, as well as the solutions that are proposed, strongly focus on government and responsibilities among governments. Much risk management, however, is company-based. The ways in which firms perform this task varies significantly. There are not only major differences between sectors, but also between large and small companies. In particular for companies listed on the stock exchange, reputation damage after an incident with e.g. hazardous substances may have financial effects that far exceed the material damage. (Interestingly, for ICT companies this is much less self-evident.)

In spite of such differences, three major developments in the way responsibility for managing risks is organized in the business world may be observed: a rise of the emphasis on corporate security; the emergence of self-regulation; and an increase of private forms of inspection and enforcement. The two last developments show strong analogies with developments towards open norms and inspection, as discussed above in relation to government. The rise of corporate security is a recent trend. Many sectors of the business world now follow the lead from high-risk organizations such as oil companies, chemical companies or nuclear plants that have addressed these concerns already for much longer.

3.5.1 RISK MANAGEMENT AND CORPORATE SECURITY

A majority of the measures aimed at limiting and controlling risks that business operations inevitably entail is taken by companies themselves. They do so not out of altruism, but to serve their business interests. A large-scale incident not only constitutes a threat to one's business operations, employees and third parties, but

often leads to substantial damage claims as well. Insufficient risk management may lead to problems elsewhere in the lengthy chains of producers and customers, and they may seek compensation. Furthermore, in such cases companies increasingly face reputation damage, which eventually may even threaten their continuity. Risk management or corporate security, then, is widely seen as an increasingly important element of business operations (Briggs and Edwards 2006; Felsted 2006; World Economic Forum 2007).

In *The Risk Management of Everything* (2004) Power describes how companies deal with their own need, as well as that of stockholders and clients, to limit risks as much as possible. Since the mid-1990s, large companies have introduced risk management on a large-scale, notably in response to incidents and scandals, mounting premiums of insurers and the growing importance of reputation. Risk management comprises not only attention to the control of technical risks in business operations, but also reflection on values and standards concerning liability and responsibility. Most remarkable, Power argues, is that the new penchant for risk management is not primarily motivated by government requirements; rather, it emerges from the increased presence of consultants and professional services companies in the private sector. They present new ways of thinking about handling risks and uncertainties. The concept of risk is turned into an *organizational* principle: a 'good' company has become a company with serious risk management. This has been a gradual development. Power indicates, for instance, that since the early 1980s many organizations, from high-risk industries to universities, had introduced quality standards on a large scale already. However, external crises, such as the affairs with the Brent Spar and Barings Bank, and external control have contributed to a strong anchoring of company-wide risk management and internal control of risky activities (cf. also Van Waarden 2006). In addition, there is increasing attention for what Power calls secondary or reputational risk management.

In the new millennium this development has continued. A study by Briggs and Edwards (2006) shows that the 9/11 terrorist attacks have strongly raised attention for risks. Surveys indicate that managers and Chief Executive Officers (CEOs) have increasingly been concerned about crime, the risks of their ICT systems, fraud and natural disasters, and a terrorist attack on their company. Moreover, they believe that more attention for an integral approach of risks and safety within their company may substantially contribute to core elements of their business operations. This applies in particular – in order of importance – to the continuity of the company activities, upholding consumer confidence, protection of brand and reputation, upholding trust among stockholders, and reassuring employees. More and more, large companies have therefore set up a corporate security department aimed at integrally guarding these core elements of business operations. Practices of multinationals that are successful in implementing corporate security

show that one of the main success factors is that corporate security does not merely focus on how to avoid risks but rather helps companies to take risks (Briggs and Edwards 2006: 14).

The diffusion of risk management in the 1990s and the more recent rise of corporate security have contributed to companies becoming more professional in restricting risks as an accepted part of their business operations. This development is still ongoing, however. For example, in a fairly new development, companies from entirely different sectors have started to exchange knowledge about safety policies. One example is the transfer of knowledge and management techniques from high risk organizations to, for instance, hospitals. Furthermore, there is not only a focus on preventing damage, but also more and more on the prevention of the disruption of operations. The latter move is triggered by a growing awareness of the mutual dependency of other companies and suppliers in the chain. So-called business continuity arrangements are developed to allow continuation of core business activities elsewhere after a disaster or incident (cf. Briggs and Edwards 2006, Website UK resilience).

3.5.2 SELF-REGULATION

The business sector itself takes many measures to limit the risks linked to its products and those of others. Besides government-imposed legislation and regulation, the private sector has an increasing number of arrangements based on self-regulation. There is a strong increase of quality marks, quality guarantees, codes of conduct and so on (Van Waarden 2006). The reasons for this can be found, among other things, in the growing use of open norms by government and, every so often, in deregulation operations. Although such operations seek to diminish the pressures of rules on businesses, it is not automatically evident that the number of rules that businesses have to meet actually goes down. Open norms lead in many cases to initiatives from the business sector itself to set up sector-specific rules. Changes in government regulation are not the only ground for self-regulation within the business sector. In some cases the failure of governments in times of crisis (such as the BSE crisis) has also been the direct occasion for new and more intensive forms of self-regulation.

Examples of self-regulation are evident, for instance, in the production of hazardous substances, the production of medicines and the food industry. In the production of hazardous substances, there is self-regulation by means of behavioural codes, peer reviews, self-assessments, the exchange of knowledge and experience, but also regulations around product stewardship whereby producers retain responsibility for products also after they have ended up in the hands of others. In the production of medicines, we see self-regulation, around advertising and marketing geared to physicians and the public. In the food industry, there is

self-regulation through certification and codes to safeguard product quality. Companies try to do away with differences in knowledge and information that are identified on the basis of own rules, 'privileges' – trade preferences for those who adhere to them – and control. For example, the British Retail Consortium (BRC) and the Euro Retail Produce Working Good Agricultural Practice (EuroGAP) have developed strict standards that sometimes are much higher than legally required. Most Dutch supermarkets already demand BRC certification from their suppliers (Havinga 2003).

Between explicit government regulation and self-regulation many intermediate forms exist. One example is public-private partnership (PPS). We see this, for instance, in the domain of ICT. Much of the technological knowledge and the resources to limit the risks of ICT and internet technology are concentrated within companies. Only close cooperation and exchange of experiences between government organizations (also at the international level) and companies can provide opportunities for limiting risks. To this end, the Dutch government and private providers have jointly set up the National Continuity Plan Telecommunications (Nationaal Continuïteitsplan Telecommunicatie, NACOTEL). The aim of this public-private partnership is to bring public interests into line with the commercial interests of providers. The government thereby primarily acts as stage-director and mediator. The private parties have committed themselves to making continuity plans and to prepare for crisis management and periodic reporting.

3.5.3 INSPECTION AND ENFORCEMENT

In the private sector, legislation, regulation and self-regulation have led to extensive internal control mechanisms. This requires knowledge of regulations, the competence to compel compliance, insight into how legitimacy of regulations is experienced, and in expected financial and social costs of compliance or violation of regulations. Assessments are also based on company size, company culture, earlier experiences with the company, its relations to the public, and reputation. Obviously, the nature of production processes plays a role as well.

In subsection 3.4.4 we discussed the trend to shift inspection and enforcement to private organizations. The shift comes with the promise of more specialized certification, inspection and quality control. A problem is, however, that private inspection organizations themselves need to be sufficiently qualified. Some authors expect, for instance, a rise in liability disputes because of claimed failing inspection (Michiels 2006). When a company has been granted its certificates, it has good reason to assume it has complied with the rules. In case of incidents, businesses will try to hold the private inspection firms liable for the damage.

It is important to realize that not all companies are equally equipped to comply with public, private or public-private rules. In general, this is easier for larger companies than for smaller ones. Often small companies will opt to farm out their safety policy. This makes them all the more dependent on the quality of private inspection.

3.6 INITIATIVES OF CITIZENS AND CIVIL SOCIETY

In many areas citizens are expected to take on responsibility for prevention on their own. In some cases, such responsibilities are explicitly assigned to them by law. Much of this individual responsibility takes shape in their everyday activities. Citizens also take on responsibility by joining citizen organizations. Through a variety of non-governmental organizations, they exert influence on the risk management of governments and companies.

3.6.1 ACTIVITIES OF CITIZENS AND CIVIL SOCIETY

As individuals and as consumers, citizens share in the concern for safety. In many cases it is up to them to increase their own safety and to not inflict damage onto others. They may profit from an abundance of information that is available to them, for example on the internet. There are countless websites on subjects like safety at home, fire safety, product safety, transport safety, safe use of the internet. Who plans to go on a holiday to exotic destinations can get information on the vaccinations needed. And also regarding risks that citizens in terms of prevention cannot control, such as the transport of hazardous substances and water management, much information can be found through the internet (cf. subsection 3.4.3). Of course, the abundance of available information itself may lead to a new problem: information overload.

For actually taking up their responsibility, however, in many cases citizens are dependent on others. Regarding many risks, citizens can do fairly little on their own. For instance, with respect to the transport of hazardous substances, the best they can do is consult so-called risk atlases published on the internet, and decide not to live near a storage tank or a LPG station. If moving to another house entails a longer commute to work, however, it is questionable whether their net risk decreases. Also regarding flood prevention, citizens have fairly limited options. They can win information on risks and decide not to live in river forelands, but they have no direct means to limit the risk of large-scale flooding. Of course there are also risks whereby citizens may be able to take preventive measures. In the area of food safety, for instance, they can limit risks by paying careful attention to the foodstuffs they buy and their hygienic preparation. Citizens may also look for information on healthy diets – even if they fail to do this on a large scale (RIVM 2004). Regarding infectious diseases, citizens can reduce the chance of

infections substantially by vaccinations or by adjusting their lifestyle. Likewise, citizens may protect themselves against safety problems on the internet by installing appropriate software, such as firewalls and virus scanners. But here too limits apply: for the protection of their payments through the internet, citizens are highly dependent on the measures taken by banks. In many cases, then, the possibilities citizens have to reduce risks are dependent on the possibilities offered to them by the private sector or the government.

Another way in which citizens can actively take responsibility for safety issues is by organizing or joining non-profit organizations in civil society. Consumer organizations, patients' associations, environmental organizations and so on take advantage of the significance attached by businesses to keeping up a good reputation. Pressured by public opinion, businesses are encouraged to make safer products. Conversely, some businesses present themselves to the market as suppliers of products that reduce risks. This is the case, for example, in the marketing of healthy products and food with all sorts of additives aimed at improving health. Furthermore, under pressure of collective action, companies invest in good public relations to prevent damage to their reputation. The Brent Spar case – whereby Greenpeace, after an extensive media campaign, exacted from Shell another solution than the sinking of the Brent Spar – is often seen as a turning point. After this affair, Shell began to issue annual sustainability reports and introduced an explicit policy of corporate social responsibility. The substantial damage to Shell's reputation that resulted from the Brent Spar case was gradually restored along these lines. This case also had drastic effects on how the company arranged its risk management. In the next chapter we come back to this issue.

Not only the policy of companies but also the risk management by government is increasingly influenced by NGOs. At the European level, for instance, some NGOs have advisory functions regarding the development of legislation and regulation or in discussions on policy implementation. This applies, for instance, to patients' associations that are on expert committees of the European Medicines Agency (EMEA). Slightly more direct is the influence of consumer organizations within the European Food Safety Authority. Four members of the EFSA management board have backgrounds in – but no direct ties anymore with – consumer organizations (Krapohl 2004). Apart from this direct or indirect influence, NGOs may also exert influence through the European lobby circuit around the comitology or by means of national lobby circuits in the area of environmental policy, public health and such.

Of course, through collective action, citizens can also exert pressure on their national government. Protests against nuclear energy in the 1970s and actions against the introduction of genetically modified organisms are familiar examples (Hagendijk and Egmond 2004; Hagendijk and Terpstra 2004). More recent examples are Swedish protests against the placement of UMTS antennas from special

interest groups of citizens who claimed to be radiation sensitive (Soneryd 2007) and protests by political action committees – such as Hoogwaterplatform – who opposed the plans for emergency overflow areas and other measures the Dutch government initially planned to take in response to new challenges associated with river flooding (cf. Ch. 2, section 2.2).

3.6.2 GOVERNMENT AND INDIVIDUAL RESPONSIBILITY

Citizens' individual responsibility is not only expressed in the activities they unfold on their own initiative. In many areas the government emphasizes and promotes 'individual responsibility' of citizens for the prevention of risks. This takes place in various forms and gradations.

In many cases the government leaves it up to its citizens to choose whether and, if so, how they take measures to limit risks. Increasingly, the government values that citizens actually have the possibility of choice in ever more areas. This applies, for instance, to the choice of taking out insurance regarding particular risks, or to taking preventive measures against damage. As a consequence, the costs of both potential damage and the measures to limit damage are at the expense of the individual, even if often the government will continue to provide a helping hand by providing background information. Individuals are invited to make their own judgments and to accept individual responsibility for prevention. The possibility of choice is underlined, without – implicitly or explicitly – articulating preferences. The question that presents itself for politics is to what extent citizens are really capable of making sensible choices on their own. Is the information available appropriate to allow everyone to make serious choices indeed? Is access to the various options sufficiently guaranteed, also for those of modest means? And does information supply about specific topics also really guarantee choice, given the fact that knowledge is often not enough to bring about a change in individual behaviour (Kooreman and Prast 2007)?

The government, however, also relies on strategies that go further than stimulating choice, namely by calling upon individual responsibility and simultaneously urging or even (implicitly) obliging citizens to decide in a certain way or to refrain from making wrong choices (De Bakker and Overbeek 2005; Ossewaarde 2006). In such cases the government does not aim to increase choice, but to bring about specific behavioural changes in dealing with risks. Familiar examples are measures to counter smoking, drugs and alcohol abuse, dangerous driving, dangerous uses of fireworks, spreading of venereal diseases and other lifestyle-related risks. The stimulation by the government of less risky personal behaviour is motivated in part by the concern for rising collective expenditures for health care. Whether this anticipated financial effect will really materialize is questionable, however (Polder 2008).

This way of appealing to individual responsibility evokes specific questions for politics. A major concern is how risks are exactly presented, who in that presentation is exactly held responsible for particular matters, and which consequences it has. An example may illustrate this. In recent policy papers and reports on obesity, two partly conflicting movements are visible. On the one hand, we observe the issue's medicalization (obesity is considered as an increasingly occurring problem that needs medical attention because it is tied to risks of chronic diseases, such as diabetes). On the other hand, there is a strong emphasis on 'individual responsibility' by stressing that individuals themselves can take measures to limit such risks, notably through exercise and a healthier diet (cf. Iyengar 1990; Noordegraaf et al. 2003). The risk is thus presented in different ways. On the one hand, there is the risk of the emergence of a collective problem because more and more people fall chronically ill, which legitimizes taking collective measures; on the other hand, people themselves decide to eat more fatty foods and to take less exercise, so it is also a problem of individual lifestyle, and this is why people's individual responsibility should be called upon. The way in which the risk is talked about subsequently determines to a large extent which strategies the government chooses, the distributions of responsibility thereby implied and the specific policy legitimization. In practice, a double strategy is chosen: the call for individual responsibility is complemented with a policy that promotes citizens to make the right choices (cf. Klink 2007). Although the call upon 'individual responsibility' might suggest that the government is disburdened of responsibilities, it *de facto* takes on extra tasks. In this case redistribution of responsibilities is no zero-sum game: the responsibilities increase, both for government and citizens. Similar effects also occur in other cases, as we will see.

3.7 LIMITED ROOM FOR REALLOCATING RESPONSIBILITIES

Public risk management is realized in complex interactions among many parties. Through the extensive deployment of government instruments, measures taken by companies, and activities of citizens and civil society, the Netherlands is a comparatively safe country to live and work in. The management of risks seems fairly well organized in the Netherlands. The various actors generally take their responsibilities. And if they do not, there are sufficient options available for correction in the form of liability claims, monitoring, inspection, enforcement, political lobby and collective action.

The allocation of responsibility, however, involves a complex process in which the relationships among actors show a high degree of mutual dependency. Citizens are dependent on the information that businesses and governments provide to avoid risks. Businesses, in turn, are dependent on other businesses and on the legal frames within which governments offer room for more or less risky activities. Governments are dependent on the emerging mutual distributions of

tasks, from the European Union to the local level, and on the degree to which businesses and citizens comply with the rules. The complexity of these dependencies has only increased. Internationalization of risks implies in particular for governments and businesses that they have to coordinate their risk management within elaborately stretched, border-transgressing chains and networks. Often, because of the various dependencies, reallocation of responsibilities is not a zero-sum game.

Although in dealing with risks the basic principle is that loss is left where it falls, i.e. individual responsibility, the role of national and, increasingly, also international governments is of great significance. The package of tasks that governments take on is sizable. This is true in particular of areas in which governments themselves take on operational responsibility for providing protective provisions. But also when governments only take on final responsibility for the management of risks, much effort is required to assign operational responsibility to businesses and citizens and to ensure they take it as well. Substantial costs and administrative burdens are involved in arranging this system. No wonder, then, that questions arise about the limits of government involvement and the extent to which more individual responsibility can be asked from citizens and businesses alike.

The government tries to mitigate its involvement in several areas by allocating responsibility in alternative ways. For example, the introduction of open norms is meant not only to ease the pressure of regulation on companies, but also to disburden the government and to limit financial pressures entailed by the formulation of detailed rules. Another example is the privatization of inspectorates. Appealing to citizens' individual responsibility fits in this same pattern. By influencing lifestyle-related forms of risky behaviour, the government seeks to diminish the pressure on the future collective burden for health care – with uncertain results, to be sure. But promoting policies to stimulate 'individual responsibility' for health risks may well lead to major progress in overall health.

All in all, the efforts of the government to ease its burden are accompanied by a variety of concerns. Regarding open norms, for instance, it is questionable whether the government really disburdens itself and the business sector. When the government calls upon citizens' individual responsibility, similar questions may be asked. Finally, in all these interventions there is the issue of whether they comply with European Union policies. In its wish to cut back on final responsibility for risk management, national governments cannot ignore European regulations and policy frames. If a national government would step back and drop rules set for businesses in dealing with risks, internationally agreed standards for safety are violated, while quite soon the demands of the internal market are disregarded as well.

These questions make it clear that in its efforts to transfer responsibilities to society, politics is faced with limited room for action. In many cases it must be concluded that reallocation of responsibilities is prohibited (by Europe), is impossible (because of limited capacities of other actors to bear responsibility) or does not lead to less government involvement (because of inspection and enforcement and the policies they require). In the decision-making process involving risks, politics is faced with what former Dutch Prime Minister Den Uyl (1978) once called "the narrow margins of democracy". If this much-discussed expression ever applies, it is here.

4 THE CLASSICAL RISK APPROACH UNDER PRESSURE

By anticipating hazards and taking preventive measures, modern societies succeed in managing risks in many areas. Certainly, incidents have occurred in the past, every so often with quite serious consequences. But generally speaking, the classical risk approach, including the policies grafted onto it, constitutes a success story. And yet this risk approach has come under pressure. Aside from the problems linked to administrative complexity and lack of transparency discussed in Chapter 3, current policies face two types of problems.

First, the classical risk approach is facing several persistent intrinsic problems. The mixture of science, politics and policy that characterizes this approach has resulted in a rather unstable amalgam that requires careful handling, as became clear as early as the 1970s (cf. Fischhoff et al. 1981). For this reason, a sizable part of the extensive scientific literature on risk assessment and risk management is aimed at improving risk regimes through fine-tuning and containing the intrinsic problems of the approach. A number of concerns, however, continue to attract attention. We will discuss them below by addressing four basic assumptions of the approach that are open to criticism. Apart from scientific interest, they also demand political alertness.

Second, the established risk approach increasingly has to operate under new conditions. New risks associated with globalization and new technologies are often loaded with substantial cognitive and normative uncertainties. Likewise, in the past few decades the conditions under which the risk approach is put into practice have changed. This applies to both the role of science in society and the relationships between citizens, government and the media. Both aspects have consequences for the role of the classical risk approach in policymaking.

Within communities of experts, there is ample awareness of these two sets of issues. They have responded to them in various ways, both in practice and through reflection. In these reactions it is possible to trace the beginnings of a *new risk approach* that plays a different role in policies from the classical approach. In various areas the risk approach has turned from a policy *instrument* into a factor that is *constitutive* of policies. Within this new approach differentiations are being made between various categories of risk problems, each having their own policy implications and strategic paths. This leads to a fundamentally different perspective on how to address safety issues. It is even possible, as we will argue in more detail below, to speak of the emergence of a new *paradigm*. The backgrounds of this new risk approach, as well as its further development, are centre-stage in this chapter.

4.1 INTRINSIC PROBLEMS OF THE CLASSICAL RISK APPROACH

In many areas risk assessment and risk management are standing practices. As such they substantially contribute to high-quality risk prevention and risk reduction. Still, several assumptions of this approach call for reflection, on account of the new conditions under which policies are developed, as well as for a number of theoretical reasons. We will discuss four assumptions, notably 1) that assessment and management should always be performed separately; 2) that knowledge is value-free; 3) that experts have the proper knowledge and 4) that knowledge of risks implies manageability. As we will demonstrate, each of these assumptions requires attention, not only from science but also from politics.

4.1.1 SEPARATING RISK ASSESSMENT AND RISK MANAGEMENT

The classical risk approach is founded on a clear-cut distinction between risk assessment and risk management. In many policy areas these phases are distinguished formally and institutionally. The logic behind this will be evident: to prevent bias, the calculation and assessment of risks should not be in the same hands as the decision-making about policy measures dealing with prevention or reduction. If they are too strongly interwoven this could easily lead to political underestimation of risks and inadequate policies or, conversely, to extreme forms of risk aversion and exaggerated policy measures. Political pressure could undermine the independence of scientific knowledge. Analyses show that this problem was partly at the root of the BSE crisis (Dreyer et al. 2007: 7). Transparent institutional separation of risk assessment and risk management helps to prevent murky decision-making.

No matter how defensible this separation may be, it is not self-evident. For one thing, it does not parallel the widely accepted demarcation of science and politics. In both risk assessment and risk management, scientific expertise plays a role, while in both phases decisions are made that are politically loaded.

In risk assessment the political load is primarily in the assessment of acceptance and tolerance regarding risks once they are calculated. This is why assessment is basically sensitive to political contestation and controversy. Opinions may vary as to the normative considerations involved. After all, how safe is safe enough? Considerations about the voluntary nature of undertaking risky activities, or the advantages of such activities, may well interfere. Although essentially such judgments are the prerogative of politics, as they cannot be decided on a scientific basis, in practice the boundaries are not always clear-cut. In various areas, for instance, issues of acceptance and tolerance of risks are linked to the technical question of whether there are threshold values below which substances or radiation have no measurable effects. Often in such assessments another issue is which

timeframes should be reviewed in assessing effects. Political judgment and target regulations need to be translated into technological-scientific terms, and this requires expertise. Who will eventually determine where to draw the line when it comes to accepting or tolerating specific risks? In many cases there is no unambiguous response to this question. Normative and cognitive elements are inextricably bound up with each other.

In risk management the political load is hiding in questions concerning the most suitable policy measures. For instance, the decision to work with either open norms or with stringent regulation is politically loaded. Concerns about the feasibility and monitoring of standards and inspection thereby present themselves as well.

In a number of situations, it would in fact be advantageous to coordinate assessment and management. This applies, for instance, in cases in which a risk is deemed acceptable only when strict and controllable regulation is in place, or when the effects of possible damage are judged to be sufficiently subject to control or compensation. The question of whether assessment and management should be separated must therefore be carefully weighed. Separate treatment carries the risk that the role of political considerations in assessment are obfuscated, while their combination entails the risk of political bias that may affect the calculation and assessment of risks as well as the eventual decision-making on policies. For this reason the institutional relationship of risk assessment and risk management – for instance around food safety, where this separation is formalized in European regulations – is still subject to debate (cf. Dreyer et al. 2007).

The distinction between risk assessment and risk management is challenged, moreover, by the internationalization of risk issues. In various areas standardization has *de facto* become a matter of international organizations, while formally risk management is still a matter of national jurisdiction. This development, too, undermines the notion that in risk assessment and risk management, autonomous judgments are at issue. For example, standards ccepted in an international context can have repercussions for ways of arranging policy implementation and monitoring on the national level. Moreover, governments, businesses and NGOs manoeuvre side by side in various arenas involved in these types of decisions. Power relationships soon play a role as well: the strong players determine the policy of weaker ones (Power 2007: 193). Who holds the trump card – governments, businesses or NGOs – is not given in advance.

4.1.2 THE ROLE OF HIDDEN NORMATIVE ASSUMPTIONS

Risk assessment is no value-free affair. It is not strictly based on facts. After all, calculation and assessment of risks assume passing the judgment that potential

damage is of such a nature or size that it calls for concern. This presumes knowledge, of course, of chances of possible damage, as well as of the size of such chances, but eventually it involves making a *normative* judgment (cf. also MNP 2003).

Frequently, the normative considerations that play a role in calculating risks and their further assessment are not subject to debate. In some cases these considerations are too trivial to discuss: that it is undesirable that people die prematurely of coronary and vascular diseases goes without saying; and when it is established that eating too much fatty food substantially raises the risk of coronary and vascular diseases, it is obvious that this is a subject worthy of concern. The debate may be limited to whether the risk is so great that one should speak of an issue of public interest, and, if so, how concern for this risk needs to be reflected in specific policies. Similarly, no one will dispute that large-scale flooding constitutes a serious safety problem.

In other cases the implicit normative judgments that underlie the calculation or assessment of risks are not subject to debate because they are deeply embedded in established cultural customs, managerial practices or legal traditions. For instance, the American sociologist Gusfield has shown in what has become a classic study (1981) how even the way in which the risk of alcohol in traffic is framed is a product of established ways of thinking in science, alcohol policy and law. The responsibility for alcohol-related traffic accidents is allocated to the drunk driver, and the risk is identified as a hazard of alcohol use as specified in terms of alcohol permillage in the blood of the driver. Gusfield argues that this allocation of responsibility is not self-evident. In retrospect, it is possible to conceive of a development whereby it would have been deemed the responsibility of the auto industry to design vehicles that would cause little damage, even when driven by drunk people or – less utopian – whereby granting a business license to bars and discotheques along highways would have been rejected as irresponsible. In the first case, the auto industry rather than the car driver would 'own' the problem and be held responsible for finding a solution. In the second case, the risks of alcohol in traffic would be considered initially a problem of spatial planning and business licensing policy. There is a close link, then, between framing risks in a particular way and the allocation of responsibilities. In many cases the way in which a risk is talked about anticipates already the nature of the later risk reduction policy.

Also in other areas, the implicit normative load of the way in which risks are estimated and assessed comes to light quite soon upon closer consideration. For example, for a long time the emphasis has been on collective risk calculation and spreading of risks. When in the course of the nineteenth century statistical data became available, it became clear that in many areas the incidence of illnesses and industrial accidents displayed a regular pattern and thus that such hazards occur

without respect of persons. By applying statistics it was possible to identify the underlying factors causing the hazards. The risk factors were implicitly deemed to be more decisive than the individual actor causing the hazard. Dangers and risks were rendered anonymous, so to speak. Based on this argument, the conclusion has been drawn that the scope of the principle of individual responsibility has to be limited. In some cases (such as in infectious disease control) risk management can only be realized through collective action; for other cases it has been concluded that to cover risks, insurances and other similar collective regulations are desirable (O'Malley 1996). These scientific findings prompted the introduction of a new normative principle in addition to individual responsibility: 'solidarity' (Ewald 2002).

In this context, a new perspective on health risks has gradually evolved. In this new approach the emphasis is again much more on the individual, in particular on their behaviour (Lupton 1999; Ewald 2002). Here, too, the shift has been occasioned by a scientific finding, namely the discovery that many health risks are related to lifestyles. As a result, more priority is given to the relationship between individual lifestyle and potential health damage, and hence to individual responsibility.

This shift may be illustrated by the development of the way in which coronary and vascular diseases have been conceptualized. In the 1960s the risks of coronary and vascular diseases were primarily seen as a *social* problem; it was assumed that they were 'Western diseases', i.e. tied to the Western lifestyle and the stress caused by modern industrial production modes. Since the 1980s, however, it has become increasingly common to link such disorders to *individual* lifestyles and thus to individual choices and responsibilities regarding consumption of food, alcohol and smoking, as well as exercise (Aronowitz 1998; Horstman and Houtepen 2005; cf. Schlich 2004). Although this shift is motivated in part by advanced epidemiological insights, it also has a normative load. After all, with the change in the way coronary and vascular diseases are framed, risks are identified and preventive policies are formulated, the responsibilities for this risk shift as well. The risk of coronary and vascular diseases turned from a social problem into a problem of individuals and their choice of lifestyle. To reduce that risk, individuals would merely have to adjust their lifestyle – and opt for more exercise, a healthier diet and also quit smoking. The conceptual shift mentioned once more illustrates the complex interwovenness of cognitive and normative aspects. Seen from the new perspective, the advice to do more exercise is based on facts; but seen from the old perspective it concerns a normative choice, because the individual, rather than society, is considered to be responsible for the prevention of coronary and vascular diseases. How the relationship between cognitive and normative aspects specifically turns out, therefore, depends on the paradigm on which the reasoning is based.

In many cases it is exceedingly difficult to gain insight into the concrete normative assumptions that play a role in practice. After all, normative issues are often interlaced with technical issues that render the former invisible to nearly everyone. To uncover the implicit normative issues involved in determining maximum allowable levels of concentrations of hazardous substances (so-called MAC values), we will have to study the technical details of toxicology. This prospect will of course diminish the eagerness of policymakers to raise such normative issues. They go by what the experts who performed the assessment tell them while accepting the implicit normative decisions on which they are based. The intricate interrelationship between calculation of risks by experts and decision-making on appropriate policy measures limits the margins of policy design. In many cases policies are already implicitly anticipated in risk identification.

International differences in policy design or dealing with risks are linked to differences in the way national experts deal with evidence. Styles of accountability, notions of objectivity and expertise, and the public role of experts strongly vary between the United States, the United Kingdom and the European continent. Individual countries differ in 'civic epistemologies' (Jasanoff 2005). It happens quite regularly that authorities in different countries arrive at opposite policy measures based on the *same* internationally accepted scientific data. In the early 1970s, for example, Aldrin and Dieldrin, two pesticides, were listed in the US as carcinogenic, and for this reason they were prohibited by the Environmental Protection Agency (EPA), while for a long time it was possible to use these pesticides freely in the United Kingdom (Gillespie et al. 1982). Similar differences can be observed in drug registration (Bodewitz, Buurma and De Vries 1987; Abraham and Davis 2007) and in the way in which in the US and in Europe the admission of GMOs is addressed (Whiteside 2006: Ch. 3). Upon closer analysis, apart from the role of economic interests and lobby activities, such assessment disparities prove to be connected with cultural differences in the national communities of experts involved and in particular with the way in which experts assess evidence (Jasanoff 2005). Where internationalization of risk assessment occurs, national traditions and practices may come under pressure. The public role and established rules of conduct of experts, and long cherished national standards of accountability may sometimes have to be adapted in response to the demands of new international obligations.

Where risks are at issue, we are looking at *expected* damage. In the formulation of this expectation, both cognitive aspects and normative aspects play a role, whereby the latter often present themselves in forms of disciplinary traditions, cultural assumptions and apparent technological decisions that are hard to trace. As a result, part of the risk policy is actually realized outside the official political bodies, and important aspects in fact escape political control. For what has become known as the 'displacement' or 'diffusion of politics' (Bovens et al. 1995; Duyvendak 1997), the domain of risk policy shows striking instances.

4.1.3 THE LIMITS OF EXPERTISE

Risk assessment is the domain of experts. Assessment of the results of laboratory research, epidemiological studies and clinical findings requires thorough knowledge of scientific details. But experts, too, make mistakes. Even if there is consensus, the scientific world may be on a wrong track. As the past has taught us, risks may be estimated both too high and too low. Underestimation and late recognition of risks have led in several dramatic cases to major social damage. A report issued in 2001 by the European Environmental Agency (EEA) describes dramatic examples of so-called false negatives – ranging from at first insufficiently recognized hazards of radiation and risks of PCBs, DES and asbestos to BSE (EEA 2001). For obvious reasons, risks estimated too high (false positives) are less well documented. If an anticipated disaster does not occur, this may well be explained with reference to the preventive measures taken, but it is also possible that the risks were overestimated. Perhaps the boldly articulated risks of the 'Year 2000 bug' are a case in point (cf. Quigley 2005).

In other words, scientific researchers are human beings too. They can be arrogant and may overrate their own expertise or suffer from 'tunnel vision'. Although the vast majority of risks were identified by scientific research, in several major cases outsiders – individual citizens, journalists and NGOs – first called attention to particular risks, sometimes against the consensus among scientists. The first reports on possible risks of asbestos date back to around 1900. They came from (non-scientifically trained) health inspectors but were ignored – at the expense, eventually, of many lost lives and huge economic damage (EEA 2001: Ch. 5). Also more recent cases such as DDT (Carson 1962), radiation hazards near Sellafield (Wynne 1996), stench in Rijnmond in the 1960s (Dijstelbloem 2007), and debates on nuclear energy and genetically modified organisms and crops (GMOs) speak volumes.

Although in general the risks established by science serve as a basis on which policies are elaborated, risk managers cannot steer blind on expert judgments. Alertness to signals of possible misguided scientific consensus from outside scientific circles is called for. Moreover, much scientific information is present in circles that may have an interest in downplaying risks. For example, underreporting of side effects of medicines in studies funded by the pharmaceutical industry has become by now widely recognized and well documented (Jonkers 2007).

That every now and then scientific insights have to be revised does not always point to demonstrable shortcomings of researchers or conscious misleading. It is a normal aspect of scientific practice. Science offers no certainties. It functions by virtue of the principle that scientists correct each other, so that a collective learning process emerges whereby initially accepted insights are corrected in the light

of new research data. Sufficient room should be allowed, however, for this process of learning via mutual adjustment. In processes of risk assessment, there is evidently a public interest in the proper functioning of the system of self-correction that is characteristic of good science. But openness to signals from outside scientific circles is needed as well. Besides *early warners*, *early listeners* ought to be available (RMNO 2004: 27-28).

4.1.4 KNOWN RISKS ARE NOT NECESSARILY MANAGEABLE RISKS

Above we noted that the thinking in terms of risks implies the identification of concrete possibilities for taking risk prevention or risk reduction measures. In other words, to speak about 'risks' implies adopting a social engineering perspective (cf. section 3.1). This is not to deny that many factors may stand in the way of successful risk prevention. For example, an effective prevention policy may require measures that encounter criticism for political reasons, e.g. because measures would cause privacy concerns, unacceptably disrupt economic activity or lead to discrimination. Likewise, cost aspects and technical feasibility may stand in the way of prevention.

A more fundamental reason may also come into play. Even when a risk is known on the basis of scientific research and laboratory studies show preventive measures to be effective, it may still be hard to establish whether, where and how this risk may surface in actual social practices and how effective prevention will be. Knowledge generated in controlled laboratory settings or through statistical data is not always translated easily into actual social practices that come with their own local order and unruliness. In this respect, the British government has learned a hard lesson in the recent past. Its measures to countering the spread of BSE proved not feasible in meat-processing facilities. What applied on paper and in the laboratory turned out to be practically impossible to implement in abattoir practice. Because at first this was not recognized, the initially deployed British policy failed to stop the spread of BSE (Oosterveer 2005: Ch. 4).

Time and again administrators are faced with the fact that in many respects society itself is 'unknown' (Van Gunsteren 1992; Van Gunsteren and Van Ruyven 1995). Many risks occur under complex social circumstances about which little information is available and on which politics has only limited influence. In order to gain a grip on actual practices, levels of control would have to be introduced that are feasible in laboratories (Latour 1988). Not only may there be good political reasons to oppose this, but also in practice the actual possibilities for control turn out to be limited (Scott 1998). That a risk is known to science may thus be accompanied with administrative and political uncertainty. Administrators who fail to acknowledge this and who design a policy only on the basis of scientific knowledge run the risk that their measures do not work, are

counterproductive or meet with social resistance (which administrators tend to dismiss as irrational).

4.2 CHANGING EXTERNAL CONDITIONS: NEW CHALLENGES

The intrinsic problems of the risk approach discussed require caution and call for political alertness. Although the classical risk approach offers managers in both government and business a powerful tool for promoting a responsible concern for safety, they cannot rely on it blindly. An array of factors need attention, such as the separation of risk assessment and risk management, the role of normative assumptions, the fact that expertise also has limits, and the gap between laboratory knowledge and social practice.

Several external conditions put sustained pressure on the classical risk approach as well. Because of globalization and the development of new technologies, new issues are looming. In the past decades, moreover, expertise has taken on a new face while also the changed relations between government and the public – partly as a result of media influence – have drastic consequences for the classical risk approach (RMNO 2004).

4.2.1 NEW RISKS

The development of new technologies and their applications present major problems for the classical risk approach. New technologies emerge with many uncertainties; because real world experience with the new technology is absent by definition, assessments have to be made that are partly speculative and hence may trigger controversy. For example, the convergence – anticipated by many – of information technology, biotechnology, nanotechnology and cognitive science not only invites speculation about currently unknown technological possibilities, but also comes with warnings about substantial potential risks (Wood et al. 2003; Van Est et al. 2004; Royal Society and Royal Academy of Engineering 2004; KNAW 2004; Maynard et al. 2007; Scheufele et al. 2007).

Seen from a risk perspective, technology development is ambivalent: it may entail both good and bad news. Some risks have been drastically reduced by the application of new technologies. For example, environmental hazards grow smaller through the introduction of cleaner technologies. Similarly, microchip technologies for tracing and tracking raw materials and products in the lengthy production chains of the food, pharmaceutical and chemical industries now allow quick responses to emerging safety problems. The bad news is that new technologies may lead to more diversity and complexity in the use of materials, to scaling-up of production and transport, and hence to adverse effects of yet unknown scale. Moreover, the emergence of new techniques does raise ethical questions and may

necessitate the rethinking of established policy principles. This is not only the case for widely discussed technologies such as genetic modification. In the past few decades, risk assessment and management for food and medicines involved separate legal and institutional arrangements, each with their own standards and procedures for accountability. However, due to the development of functional foods and nutraceuticals, the boundaries between food and medicine have started to blur (Hasler 2002). The policy consequences of this development are far from obvious.

Where radical new technologies emerge, entirely new policy challenges present themselves. After all, there is no real-world experience yet with the risks of a new technology. Risk assessment under tightly controlled laboratory conditions is often a poor indicator for what a technology will bring about when it is widely distributed in society. The ways in which a new technology becomes embedded in society prove to be highly unpredictable. Even experts have limited insight into how future use may shape technologies. Examples abound of predictions put forward with great certainty that later proved to be altogether misguided (De Wilde 2000). When a technology is still in its infancy, everybody – policymakers, scientists and citizens alike – grope in the dark as to future threats and their political and ethical implications. By the time there is more clarity about a new technology's effects, often major investments have been made already, and the point of no return may have been passed.

Apart from the uncertainties associated with new technologies, society also faces new challenges because social developments may change the nature of risks. As we have seen before, due to globalization, infectious disease control has to face new problems. New viruses have presented themselves in the recent past and will likely continue to do so in the future. Policymakers regularly have to take measures while there is still much uncertainty about the extent and nature of the threat.

Health authorities were faced with such a situation, for instance, when in the early 1980s the world was confronted with AIDS (Dijstelbloem 2007: Ch. 4). Their task was to develop ideas about the nature of the disease and the potential size of the epidemic. But at that time there was little experience on which to rely. Initially, therefore, various hypotheses were explored. Was it a disorder caused by specific lifestyles (e.g. the use of particular drugs, such as 'poppers')? Or was some new and yet unknown virus involved? Each of these hypotheses would ask for specific policies to meet the disease's hazards. Each hypothesis, moreover, implied specific expectations on the spread of the disease. If lifestyle was involved, only specific population groups would be at risk; if a virulent virus was the cause, the disease could also spread outside the groups in which the disease first occurred. By developing different models the various conjectures could be

specified, after which they could be tested based on – the unfortunately rapidly increasing – experience with the spread of this disorder. As a result, the hypothesis that AIDS involved a disorder caused by an (as of yet unknown) virus transmitted by sexual contact or blood contact managed to win support quite quickly, after which measures could be proposed accordingly. Only several years later was it possible to corroborate this hypothesis through the discovery of HIV. The health authorities, however, were forced to intervene way before this knowledge was available. The issue they faced in the early 1980s was how to deal with a threat about which there was still much uncertainty. They had to make decisions before the medical world was able to provide decisive answers on the risks of AIDS.

A variety of developments, then, may fuel if not force reconsideration of existing and successful practices of risk assessment and risk management. As we saw in Chapter 2, this is even true for flood prevention. Today, climate change urges the Netherlands to reconsider the risks, assumptions and approaches of its water management arrangements (WRR 2006a).

To government, such developments and the uncertainties they involve present major challenges. How should particular hazards, which are still uncertain, be understood in terms of risks? How to deal with the cognitive and normative uncertainties entailed by these developments? And is the national government capable of providing answers to the international character of many new risks?

4.2.2 CHANGING POSITION OF EXPERTS

Scientific experts perform a key role in detecting risks and in advising on risk management. This applies not only to new technologies, but also and pre-eminently to existing risks. Scientific insight into risks is significantly expanding today. Each issue of a scientific journal in for instance medical science, food sciences or environmental sciences may produce new insights into risks that need attention. Regularly, there are reports on the discovery of new health effects of substances used in industry or households that reveal themselves only in the long run or only with specific groups (such as seniors, children, or people with special sensitivities). Based on daily experience alone, such long-term and statistical effects are not visible. While stench and noise may be experienced by everyone, the health and environmental effects of many chemical emissions come to light only after sustained and often long-term scientific research.

Risks are prominent not only in disciplines such as medical science, environmental studies and toxicology. In the past decade, safety science has become an established discipline, which studies safety issues in an integral fashion (Hale 2006). Increasingly, attention is paid to aspects of risk management by governments and businesses. This has resulted in new insights, in particular about social aspects of

risk control in fields such as management, design and regulation as well as in the realm of beliefs, culture and mentalities.

Governments have to formulate policies amidst this constantly expanding flow of scientific advice. At the same time, the growth of scientific knowledge makes us ever more aware of the uncertainties that almost inevitably accompany scientific advice. This awareness of uncertainty leads to a call for more and better research. Van Asselt and Vos (2006) refer to an 'uncertainty paradox'. While scientific research is a known source of uncertainties, simultaneously it is hoped that more scientific study will lead to more certainty.

The growing dependence on science and the increasing awareness of uncertainty runs parallel with a changing role of experts. In the past few decades, the research landscape has been transformed. The relationships between science, (government) policy and the public have shifted. A much used – but also criticized – term for this shift is 'Mode-2' science (Gibbons et al. 1994; Nowotny et al. 2001; WRR 2002; for critique cf. Hessels and Van Lente 2008).

'Mode-2 science' differs from more traditional science in several respects. A major difference is that from the outset knowledge production takes place in the context of issues formulated outside of science itself. The research questions are dictated not by the internal heuristics of disciplinary research programmes but by the context in which solutions of social, economic or technological problems are pursued. This new orientation often goes hand in hand with new forms of organization. 'Mode-2' research is usually organized on a project basis, is often of a trans-disciplinary nature and takes place within numerous institutional frames in both the public and private sphere. Apart from the individual researcher's curiosity and the disciplinary frames that guide it, the course of Mode-2 research is determined by what is socially desirable, market and patent positions, provisions laid down in legislation and regulation, and findings in focus groups of prospective users. To understand the development of Mode-2 research projects requires a broader approach than understanding traditional scientific work. Attention needs to be focused also on the role of various non-scientific actors involved in the project, such as marketing experts, legal experts and managers, or, in other cases, politicians, civil servants and NGOs.

This development did not affect research in all areas to the same extent. Research that fits the traditional image of academic, disciplinary science is still prominent. But for the debate on the role of expertise around safety issues, this qualification is less significant. Research on such issues is largely performed based on goals formulated outside of science and in close interaction with policy goals. *Regulatory science* involves research at the interface of science and policy (Jasanoff 1990).

The position of experts is more complicated than the traditional image of their role also for another reason (Pielke 2007). Increasingly, experts are asked to contribute under circumstances in which knowledge is still uncertain while the stakes in decisions are high. Funtowicz and Ravetz (1992, 1993) aptly articulate the resulting situation: while in the old days scientific researchers restricted themselves to giving judgments on issues marked by 'hard facts and soft values', today increasingly their judgment is asked about issues marked by 'soft facts and hard values'. Such situations, the authors argue, should lead to other roles for researchers. If the uncertainties and political interests increase, new roles emerge that according to Funtowicz and Ravetz also entail new *mores* for researchers. For instance, in what these authors call 'post normal science' – science on subjects that are disputed both scientifically and normatively – the role of researchers is no longer that of experts who supply facts for which they are only accountable to scientific colleagues. Post normal science requires new forms of quality control. Post normal research should take on a reflexive or dialogical character. Discussions can no longer remain restricted to the traditional circle of researchers from one's own discipline. There is a need for 'extended peer review' (Funtowicz and Ravetz 1993; Funtowicz et al. 2000).

Scientific research is increasingly funded by private sources. The reason is simple: much research has become so expensive that public resources fall short. However, the effects of this development seem ominous. Because of the entwinement of interests, the autonomy of science may be at risk (Resnik 2007). For years now the distinction between *doing science* and *doing business* has been fading (Sulston and Ferry 2002). In areas such as pharmaceutical research and nutrition sciences, the risk of 'commercialization' of science is by now widely recognized. Attempts to curb the erosion of the autonomy and to restore the reliability of science and thus its legitimacy are widely discussed (Angell 2000; Angell 2004; Resnik 2007; Bijl et al. 2006). Scientists who want to publish in leading medical journals, for instance, are now asked to disclose possible conflicts of interest. This increasingly applies also to *referees*, the evaluators of submitted articles, as well.

Moreover, in response to the BSE and dioxin crises, whereby the independence of scientists was at issue, new institutes were set up in the area of food safety, such as the European Food Safety Authority (EFSA). These institutes are also meant to bring about independent assessment. This development, however, also has drawbacks as it may contribute to the creation of entirely new wheels of government (European Commission 2001). Efforts to gain more support for the European food safety policy through the EFSA have been contested; in particular, environmental organizations have disputed the legitimacy of this body (Borrás 2006). Moreover, the independence of regulatory authorities may well conflict with government policies to stimulate private funding of academic research (Jasanoff 2002: 363-364).

Given the increasing dependence on experts, the growing awareness of uncertainty and the rise of new forms of science and funding, both the knowledge base and the normative foundations of policymaking have become subject to debate. These developments require governments to become more aware of the divergent roles of experts in risk assessment and risk management. The scientific and normative uncertainties involved in the control of risks can no longer be tackled by calling on the traditional ideal in which independent experts speak *truth to power*. Where consensus on values is absent and uncertainties exist, experts may be expected to play a new role. Pielke (2007) refers to this role as that of the 'Honest Broker of Policy Alternatives'. Integrating scientific knowledge – and insight into its limitations – with the interests and concerns of stakeholders, the role of the 'honest broker' consists in putting forward a range of possible policy alternatives.

4.2.3 HIGH EXPECTATIONS, MEDIA AND THE PERCEPTION OF CITIZENS

Safety levels have never been as high as in today's modern societies. Still, public awareness of unsafety has gone up substantially. There is decreasing acceptance of risks, if not increasing 'risk aversion'. In this context, citizens look to the government: they expect the government to act and to provide protection against threats (Van Waarden 2005).

However, citizens do not only have high expectations about the fact *that* the government will act; they also have expectations about *how* political choices will be made. The legitimacy of the decision-making process is no longer taken for granted (Hajer 2003; Verhoeven 2004). Increasingly, citizens are critical of choices underlying policymaking and policy results. They voice concern by protesting, as well as by formulating alternative plans. One example discussed above is the fight against emergency overflow areas as a measure to counter high water of large rivers (cf. section 2.2). Also regarding new technologies, citizens increasingly protest against decisions made by the government or industry. Not every citizen is easily won over by the message that government experts have deemed a technology to be safe. That many experts argue that UMTS does not cause health problems does not convince everybody. Citizens have political and legal means to turn their doubts into action. They may stop the spread of UMTS technology or at least delay it. In Sweden, for instance, complaints were lodged against one-third of the planned UMTS aerials (Soneryd 2007).

Frequently, the administrative reflex is to downplay the uncertainties that have been advanced. Government then takes on the obligation to meet the high safety expectations that are generated. If an incident or disaster nevertheless occurs, government may expect questions about its responsibility and its dual role of legislator and inspector. In the fireworks disaster in Enschede, for instance, not

only the factory owner was blamed but also the government, which was held co-responsible for creating the conditions under which the disaster could occur (Van den Brink 2007). At the political level it was concluded that the government had fallen short in its task of monitoring and inspection. In response, regulations in the entire policy domain of external safety were beefed up and expanded. This further raises expectations of course. But also after improved measures have been taken, it remains relevant to ask whether government can fulfil its promise to guarantee the expected level of safety.

In putting safety issues on the public and political agenda, the media play a major part. Their role is a mediating one: citizens learn about particular safety problems in most cases through the media. However, the media pay little or no attention to considerations underlying actual safety policies. Their reporting focuses on incidents – in the area of food safety, for instance, some 40 per cent of the reporting is on crises and incidents (Jonkers 2007). This may lead to what the experts involved in risk assessment and management perceive as irrational overreactions. This discrepancy between public opinions and views of experts, too, has its effects on public confidence in safety policies.

Differences in point of view between public opinion and experts are an essential aspect of current safety issues. It is all but evident, however, which political conclusions should be drawn from it. Decision-making, after all, cannot just ignore relevant expertise. Nor is politics capable of resisting permanent public pressure. The tension that may emerge between scientific support and democratic legitimacy of safety policies is an important political fact. It is a major *political* assignment to configure it in new ways. To this end, a new risk approach developed over the past two decades may serve as an important first step.

4.3 THE EMERGENCE OF A NEW RISK APPROACH

The classical risk approach emerged in the 1960s and 1970s. Initially, it involved a new *instrument* for policy in areas such as health and the environment. Over the years this position has changed in some sectors of business and also government. Thinking in terms of risks has become *constitutive* of policy in general (Power 2007). Out of the instrument designed to support efforts dealing with *given* risks, an approach has developed that focuses on early detection of *potential* risks. This shift changed both the scope and the nature of how risks are conceived and safety policies are organized. One may even speak of the emergence of a new paradigm that focuses on dealing with uncertainties rather than with risks (Ewald 2002).

Various factors have contributed to this development. First, trust in the classical risk approach has been undermined by a variety of serious incidents. These have confronted administrators with the fact that they had to operate in a social and nat-

ural setting they – and also their best advisers – can only know partially. Several of these unpleasant surprises have been discussed in earlier chapters. The outbreak of HIV and SARS disrupted the optimism that infectious diseases in the industrialized world were reasonably under control. And outbreaks of animal diseases not only caused enormous economic damage, but the practice of slaughtering hundreds of thousands of animals to prevent further spreading of the disease produced images that evoke associations with the Middle Ages rather than modernity.

Equally, the business sector unexpectedly had to face incidents with substantial primary and, on occasion, secondary (reputation) damage. The BSE crisis not only confronted government but also the food sector with fundamental questions about safety policies. Shell was forced to acknowledge reputational risks as a prominent management problem when in 1995 the oil company faced problems around the Brent Spar and, in the same year, was confronted with negative publicity about its activities in Nigeria. Although Shell believed it was most rational – both economically and environmentally – to sink the Brent Spar platform as a way to abandon this oil storage and tanker loading buoy, the company was forced to change its view after protests initiated by Greenpeace and the ensuing strike of consumers in several countries. The company discovered it operated in a setting it knew insufficiently. Likewise, the scandals of the 1990s in the financial world (such as Barings Bank and ENRON) have underscored the need of early detection and control of risks. This need has been reinforced by the more recent problems around the subprime crisis. These incidents confronted managers with the fact that aside from the *known* risks, they also have to reckon with *potential* risks and that they have to redesign their policies to incorporate this fact.

Based on this awareness, organizations in several sectors of both business and government have gradually been adjusted. Management structures and internal information systems are increasingly focused not only on proactively detecting uncertainties that may (and every so often indeed will) present themselves, but also on translating these uncertainties as far as possible into objectified risks. Along this line, the Brent Spar case induced Shell to institute new management procedures aimed at the early identification, understanding and internalization of stakeholders' expectations (Fombrun and Rindova 2000). A similar development has occurred in the financial world. Partly through new legislation (such as the Sarbanes-Oxley Act that also applies to internationally operating non-American companies) and new standards that in many countries apply to accountability, it became necessary to organize management processes much better than before, in a way that makes visible which potential risks (both financial and reputational ones) are entailed by company activities. In international companies a new function has emerged. Next to the CEO and the CFO there is now a *Chief Risk Officer*. Moreover, as we saw in Chapter 3, *corporate security* systems were introduced. In various areas in which government is active – notably around infectious disease

control, safety of medicines and food safety – similar developments can be observed. Here, too, we encounter measures aimed at the early detection of still unknown risks. For instance, physicians are actively invited to report side effects of medicines. The scientific value of such anecdotal information is limited of course, as no reliable evidence is involved. But anecdotal information may well serve as a basis for initiating more focused, methodologically controlled studies of unexpected side effects. Its results may give rise to a reassessment of risks, adjustment of prescription guidelines and, possibly, reconsideration of registration decisions. In the worldwide domain of infectious disease control, early warnings are actively pursued as well. International networks of research institutes systematically follow developments regarding specific diseases and pathogens. In the area of food safety, in particular after the BSE crisis, early warning and monitoring were also given more systematic attention. Among governments, too, there is increasing awareness of the necessity of limiting unpleasant surprises as much as possible through proactive policies. This has led to concrete management adjustments.

Second, and parallel to this development, the need to adapt the classical risk approach has been widely discussed also in the scientific literature. Reconstructions of serious incidents have shown that in many cases early signs of problems failed to be communicated prompt to authorities, which could have made decisions that might have averted the calamity. Large organizations in both the private and public sector have blind spots for uncertain and ambiguous signals; hence they tend to miss the opportunities to intervene in time to avert a catastrophe (Morel 2002). In-depth study of 9/11 and the disasters with the Challenger and Columbia space shuttles has revealed this much. Likewise, a report issued by the EEA in 2001 demonstrates that in countless cases early doubts about the safety of products were not taken seriously enough and did not reach the desks where decisions to avert serious damage might have been taken. In many cases, insufficient awareness of uncertainty and inadequate anticipation of *potential* risks has led to disasters.

In the risk governance literature a typology has been proposed to distinguish the different types of risk problems that may present themselves. It is now widely understood that *simple*, *complex*, *uncertain* and *ambiguous risk problems* require different approaches (Klinke and Renn 2002; IRGC 2005; cf. MNP 2003). *Simple* and *complex risk problems* refer to risks that are known on the basis of data from experience or scientific research. Complex risk problems differ from simple ones by the complications that present themselves in establishing the relations between causes and effects (often long-term), by the occurrence of unknown intervening variables, non-linear effects and so on. In both cases the classical risk approach is adequate, even if in complex risk problems it may be necessary to do more research or bring in more expertise and do more specific study.

Uncertain and ambiguous risk problems, however, require another approach. *Uncertain risk problems* come with major uncertainties (about the chances and/or the extent of the damage that may be at issue). Examples are risk problems related to natural disasters (little insight into chances, but knowledge of the amount of damage), new infectious diseases (little insight into chances and sometimes also in damage amount) and new technologies such as genetic modification and nanotechnology (little insight into both chances and damage amount). The notion of *ambiguous risk problems* is used where there is controversy about the nature and magnitude of the risk. In some cases controversies emerge both within and outside the scientific world, while other cases (such as UMTS) largely involve experts and non-experts who are pitted against each other. The risk governance literature argues that the classical risk approach is insufficiently equipped to deal adequately with uncertain and ambiguous risk problems. Uncertain risk problems call for a precautionary approach. Ambiguous risk problems require a wider social debate than provided for in the classical risk approach.

Finally, aside from organizational measures taken by larger companies and sectors of government and attention in the scientific literature for uncertain and ambiguous risk problems, a third development is relevant here. Since the 1970s, initially around environmental problems but gradually in other areas such as food safety as well, a debate has evolved about the so-called precautionary principle. In the authoritative formulation of the Rio Declaration on Environment and Development from 1992, this principle implies that "…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 precautionary principle has made inroads in countless international treaties and has also been formally adopted by the European Commission. The significance of uncertainties for risk assessment and risk management is by now widely recognized. The precautionary principle has also been extensively and critically discussed. In Chapter 5 we will review these discussions.

The three developments mentioned have gradually given rise to an approach that is significantly broader than the classical risk approach and that also deviates from it in terms of basic assumptions. The new approach centres on the question of how an organization can learn to deal with uncertainties that result from its own activities or outside factors. Obviously, this calls for an active stance: potential – but as of yet uncertain – damage that is linked to activities or that flows from the vulnerability of the environment in which operations take place must be detected early. And if uncertainties persist, the question arises of whether new policy principles, such as the precautionary principle, should be applied.

The classical risk approach assumed that *risks* are given, whereby risk assessment focuses on characterizing these risks in as much detail as possible, while risk

management is directed at anticipating them. Next, by taking preventive measures, an attempt is made to limit or avert risks deemed unacceptable. By contrast, the new risk approach puts *uncertainties* centre stage. It focuses on anticipating *potential* risks. Where the uncertainties are limited and risks can be calculated on the basis of past or laboratory experience, they will subsequently be dealt with along the lines of the classical approach. In the new approach it is also recognized, however, that this will not always be possible. It may well be reasonable to speculate that substantial damage may occur, while there is not enough experience or knowledge available to translate the uncertainties into objectively established risks. This means there continues to be uncertainty. In such cases there is no basis for a preventive policy, and it has to be considered whether precautionary measures aimed at preventing or limiting a risk that *might* present itself are necessary.

4.4 FOUNDATIONS OF THE NEW RISK APPROACH

The new risk approach can be interpreted in two ways. The *first* interpretation considers the new risk approach as a *supplement* to the established classical approach, namely for those special cases in which risk problems come with uncertainties or ambiguities that cannot be eliminated as of yet. The *second* interpretation has a wider reach: it argues that a *new paradigm* has emerged for dealing with safety issues. This interpretation stresses that in the new approach, safety issues are both conceptualized and assessed in a new way.

The second interpretation does not deny that in many cases the classical approach can – and should – be followed. A new paradigm will rarely make existing approaches obsolete. Consider, for instance, a familiar example from physics, the acceptance of the relativist paradigm. This new paradigm did not completely replace classical Newtonian physics: it continued to be valuable for making calculations in situations involving velocities way below the speed of light. The old approach thus started to function as a special case, having an application domain that is limited to specific conditions. In the second interpretation of the new risk approach, a similar dynamic is at work between the new approach and the classical one. From the point of view of the new approach, the classical risk approach is still adequate for dealing with simple and complex risk problems that imply no or only minor uncertainties and ambiguities. Today, however, it is explicitly recognized that also other (namely uncertain and ambiguous) risk problems may surface, and that organizations need to be set up to allow the early detection of potential risk problems, even when they are still linked to substantial uncertainties.

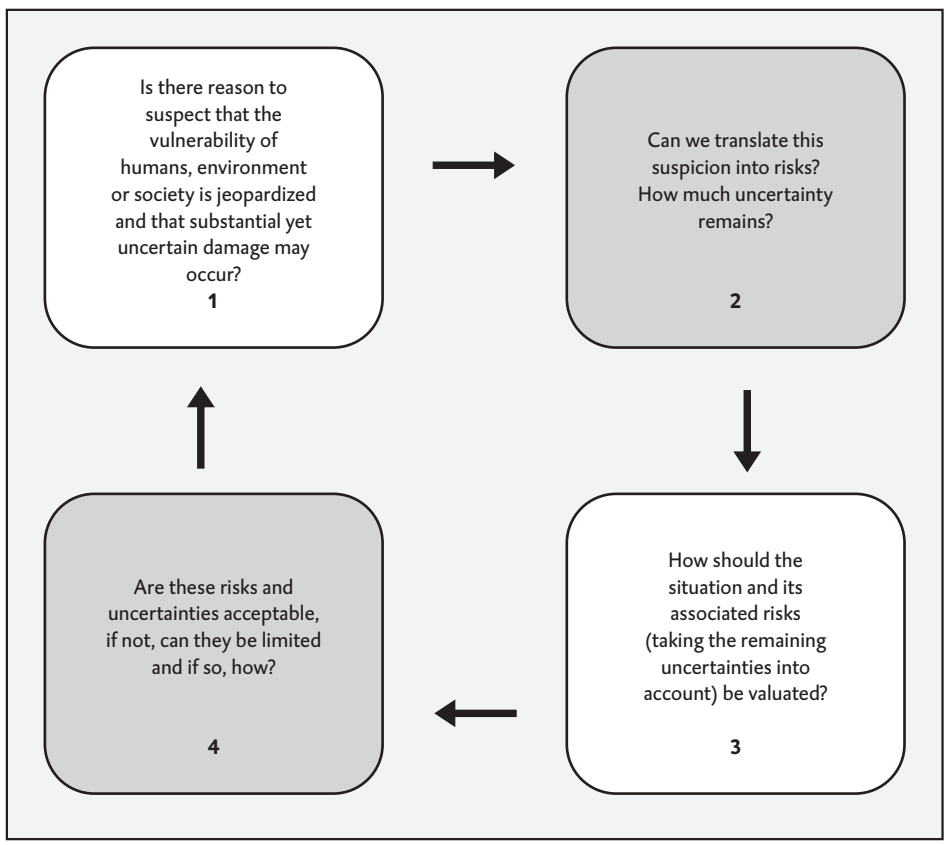
There are good grounds indeed for the claim that the new risk approach introduces a new paradigm, rather than merely being a supplement to the classical approach. One major argument is that the new approach of safety problems not only comprises extra managerial measures, but also has a fundamental

conceptual side. The new risk approach takes into account that risks are a much more complex object than the classical approach assumes. The new approach starts from the notion that not risks are given, but uncertainties. Subsequently, the new approach focuses on how to deal with uncertainties.

The new risk approach, however, primarily conveys that policymaking and implementation have more phases than hitherto identified. If in the classical risk approach (ideal typical) two phases were distinguished, risk assessment and risk management, in the new approach (again ideal typical) four phases have to be considered. Figure 4.1 summarizes the four phases of the cycle.

In the new risk approach, risk assessment (2) is preceded by a phase (1) which explicitly centres on the question of which possible but as of yet uncertain damage has to be taken into consideration. This question is thus not answered (implicitly) by waiting for risks that actually present themselves. Moreover, an extra phase (3) is added in between risk assessment (2) and risk management (4). This phase is

Figure 4.1 The cycle of the new risk approach



marked by a focus on the valuation of the various risks. In the new approach risks are viewed as an intrinsic aspect of the activities and the operational setting. This is why questions about risks pertain to both 'bad chances' of dangerous activities – that which usually is called a risk – and 'good chances', the expected benefits offered by the risky activities. This weighing of good and bad chances also took place in the classical risk approach of course, whereby the risk of – say – transport of hazardous substances was assessed against the background of the social and economic benefits of such substances. What distinguishes the new approach, however, is not only that this weighing is rendered explicit, but also that it is implied that it may take place under conditions of uncertainty. Furthermore, the new approach assumes that the issues are potentially controversial and thus have a political load. As a result of reactions to adopted policies, newly available knowledge or a reconsideration of the risks weighed, it is perhaps necessary to go through earlier stages of the policy-making process again.

4.4.1 RISKS ARE CONSTRUCTIONS

The new risk approach not only comprises an expansion of the aspects to be addressed, but also reflects a more fundamental change. This approach starts from a concept of risk that is markedly more complex than that of the classical risk approach. The latter is based on the idea that risks are *given*: society or a company is simply confronted with risks, and they present themselves as uninvited guests, as it were. Subsequently, risk assessment aims to calculate the value of these risks as precisely as possible. Because this value is determined by the product of likelihood and effect (amount damage), both components have to be calculated as carefully as possible. Data derived from experience – either laboratory studies or actual practice – provide the basis for this calculation. Next, risk management is focused on the prevention of risks that are deemed unacceptable. Several profound problems, however, are hiding behind the simple formula 'risk = chance x effect'.

That we are faced with risks and that they thus present themselves may seem to be self-evident. This is how we usually come into contact with risk problems. We know from bitter experience that the combination of springtide and heavy storm can lead to flooding. When these circumstances occur, extra surveillance will be activated. Similarly, we are familiar with the risks of smoking or traffic. Such risks unmistakably exist; they are *objectively given*. But *where* are they? By posing this rather silly sounding question a *first* complication of the risk concept may come to the fore.

After all, we do not so much encounter risks in the outside world as we come across trees and mountains. A risk does not refer to the catastrophe itself – the flood, the traffic accident or the disease that emerges because of smoking – but to the *possibility* of or the *chance* of an event with harmful consequences. The

concept refers to a catastrophe that is *expected* with a particular probability. The abovementioned formula also expresses this: chance x effect is mathematically speaking the expected value of that effect. The answer to the question of *where* risks are to be found, then, seems to have to be: 'in our expectations'.

Does this imply that risks are *subjective*, a mental construct, instead of objectively given? Some authors have indeed advanced this conclusion (Luhmann 1995). It is a rather frivolous one, though. After all, it would easily entice us into believing that we might reduce risks by adjusting our expectations. Smokers who do not believe their physician and do not expect to die from lung cancer, however, run an equally high risk of contracting this disease, simply because they smoke.

By speaking of 'the dual nature of risk' several authors have addressed the problem that emerges from the fact that risks are, on the one hand, objectively given, and on the other hand are subjective, mental constructs (Klinke and Renn 2002: 1076). But this clarifies very little: the problem is merely given a label. It seems more sensible to choose another entry, one that evades speaking of 'objective' and 'subjective' aspects. These notions are rife with philosophical subtext and to employ them is likely to stir up a hornets' nest. The concept of risk blurs the usual conceptual distinction between the objective world we find as given and the subjective notions people have of that world – their knowledge and expectations. It is a hybrid construction that calls for further analysis.

We do not simply run into risks in nature. Risks are complex *constructions*. But this makes them no less 'real' than – say – houses, which are constructs after all as well. What the concept of 'construction' emphasizes is the fact that preceding something's existence, *work* has to be done (Latour 2005: 88-93). This also applies to risks. Before we can talk about the existence of particular risks, data must have been collected and statistically processed and relations need to be drawn that can be tested once more in new statistical studies or in the laboratory. All of this takes time, a lot of energy and quite some organizing effort. Only after this work has been achieved can a risk function as an objective given, as something that exists independently of the person who makes the observation. And not in all cases will this work be sufficient to conclude with certainty that the risk indeed exists. Uncertainties, in other words, may linger.

When after all the work that precedes the existence of a risk, we pose the question 'but where are those risks I have to be fearful of?', we act like the person who after being shown the station buildings, railroad yards, railroads and ticket machines asks, 'and where is the train ride for which you have to buy a ticket?' (cf. Latour 1999: Ch. 2). Without the work that links mortality data caused by lung cancer to smoking behaviour, the risk of smoking does not exist – just like without the presence of railroads, locomotives and a railroad company that provides the train

service, there is no 'train ride'. The everyday, individual experience is insufficient to make the connection between smoking and lung cancer. This connection can only be established on the basis of extensive (epidemiological and laboratory) research. But once this scientific work is performed, we may talk about a risk as a given, just like, provided we are living in a country with railroads, we can talk about the train trip we plan to take tomorrow.

So, a risk is a *product* of organized effort. In the way in which risks are construed, a host of factors come into play. The various disciplines involved in risk assessment each bring along their own assumptions, research techniques and practices. Normative assumptions play a role as well. This does not imply that the risks which are subsequently talked about would be unreal, less serious, mental constructs or even imaginary. But whoever really wants to be realistic in this matter, should keep in mind that when we speak about objectively given risks, we encounter not only the dangers with which the world confronts us, but also the frames and practices with which we approach that world and which are shaped by traditions, disciplinary perspectives and social interests.

The new risk approach takes on the practical consequences from this abstract insight. This approach recognizes explicitly that in order for risk management to be focused on objectively given risks, other work has to be done first. Based on this awareness, the organization of the effort is structured. Starting from the notion that risks are not unproblematic givens, facilities and procedures are set up that make it possible to translate suspicions of possible damage in terms of risks that may become the object of discussion and management. The first phase in figure 4.1 therefore receives explicit attention, and measures are taken to promote the shift from phase one to phase two.

4.4.2 UNCERTAINTY AND RISK

The concept of risk hides yet another complication. Where risks are at issue, there is no certainty that damage will occur; rather, such damage is bound to present itself with a certain degree of *probability*. That concept, too, is loaded with conceptual puzzles extensively discussed by mathematicians and philosophers. At first sight, these academic debates may seem far removed from the affairs of policymakers. But in fact they are not. The first to realize this sharply was the American philosopher and economist Frank Knight.

In his classic study *Risk, Uncertainty and Profit* (1921), Knight introduced a distinction between decision-making in situations which involve *risks* and situations which involve *uncertainty*. The context for which he made this distinction was that of an entrepreneur who has to make decisions on investments and who thereby faces the question of which chances he has of either success or failure. In

some cases such chances can be calculated on the basis of experience. Past performance provides insight into both the possible outcomes and the relative frequency with which particular results occur. The risk run by the entrepreneur may then be statistically estimated based on these data. This no longer applies, however, when the entrepreneur decides to invest in a wholly new activity. In this situation it is not possible to call on experience, and each claim about 'chances' of success and failure thus has a purely speculative character. In such situations, according to Knight, an entrepreneur has to decide under uncertainty.

Knight thus made a fundamental distinction between (calculable) risks and (non-calculable) uncertainties. In his view, we can only speak of probabilities, and thus of risks, where the sample space, i.e. the space of possible outcomes – the range of damage amount that may occur – is known, and relative frequencies can be determined, i.e. where experience is available. The concept of probability he assumed is known as the 'frequentist interpretation'. That it is possible also to interpret probabilities differently was convincingly shown several decades after Knight's publication (Savage 1954). The proponents of the 'subjectivist (or: Bayesian) interpretation' conceive of probabilities as an expression of the degree to which a speaker believes that an event will happen. A subjectively interpreted probability claim, then, does not refer to the relative frequency of events (like where the frequentist notion of probability is used), but to the degree to which one believes to be certain that some event will happen and thus also to the degree to which uncertainty exists. Confronted with the same situation, then, different actors, prior to experience, can forward different (*a priori*) probabilities. When later on experience becomes available, and relative frequencies of events can be calculated statistically, a rational actor will be able to adjust his (*a posteriori*) probabilities on the basis of the so-called rule of Bayes. In the long run, *a posteriori* probabilities will converge. Where a Bayesian concept of chance is used, the strict distinction made by Knight between risks and uncertainties is overruled; it is dynamized.

Knight's lasting contribution is to have situated the problems of risks and uncertainties in the context of decision-making. In the contemporary risk literature, however, the radical distinction he made between risks and uncertainty is relativized. Uncertainty is conceived as an *attribute* that may belong to risks more or less (Van Asselt 2000; Klinke and Renn 2002; MNP 2003; RMNO 2004; IRGC 2005; Dreyer et al. 2007). As a result of a lack of experience with the hazards that present themselves or of partial insight into the underlying processes, claims about risks can be loaded with more or less doubt. Also where experience is altogether absent, the current literature talks of 'risks', but such risks are thus marked by much uncertainty: this means that only subjective *a priori* estimates can be made about the chances and/or the amount of the damage. Such situations occur, for instance, when talking about health or environmental effects of radi-

cally new technologies. The distinction between simple, complex, uncertain and ambiguous risk problems that has become popular in the *risk governance* literature (cf. section 4.3) is an expression of this: the various types of risk problems are loaded with more or less uncertainty. To the decision-maker the different types of risk problems will call for different strategies for action.

This insight, too, is constitutive of the new risk approach. It takes into account that risks can be loaded with more or less doubt (uncertainty) and that this has implications for how such risks and measures to be taken need to be discussed. Uncertainty thus plays a *double* role: it is not just recognized that damage may not occur in all instances but only with a specific probability (relative frequency), so that one has to speak of risks; the new approach also starts from the notion that *about* this probability and the damage that may occur there can still be uncertainty, meaning that multiple outcomes are consistent with our expectations (Pielke 2007: 55). In the new risk approach, in other words, it is recognized that uncertainty does not present itself only at an *ontological* level: the world confronts us with uncertainties because natural and social processes come with variability and hence surprises, because these processes are not fully deterministic. In addition, there is the awareness that uncertainty may also present itself at an *epistemological* level: our knowledge about chances, outcomes, and cause and effect relations is limited and marked by uncertainty. In the classical risk approach, because of its assumption that risks are given, the divergent sources of uncertainty are insufficiently acknowledged and distinguished.

4.4.3 SAFETY AND DANGER ARE CONNECTED

A third complication of the concept of risk comes to light when valuation is in order. When risks are taken as given threats, one usually focuses on possible damage, on – as we have called it – 'bad chances'. Various authors, of whom the American political scientist Wildavsky is the most prominent, have rejected this one-sidedness. Safety and danger, Wildavsky argues, are always connected in the same actions and objects. Actions always harbour both 'bad' and 'good' chances. Wildavsky (1988: 4-5) calls this the 'axiom of connectedness'. In his view the trick is not to discover how risk can be fully avoided, because this is impossible; rather, one should discover how to deal with risks in a way that results in more of the good and less of the bad. Safety policy, in Wildavsky's view, is always a balancing act (cf. also Schneier 2003).

Where the risk problem is seen as a problem of weighing 'good' and 'bad chances against each other, the focus is no longer exclusively on the threats that may present themselves, i.e. on possible damage, but also on the activities that are undertaken and on the setting in which one operates. The vulnerabilities of both and the uncertainties that are involved are treated as an *intrinsic* given. Seen from

this perspective, food safety is not merely a matter concerning the risks of – say – a particular bacterial infection and the ways in which those risks can be reduced. The debate on food safety is conducted on the basis of an understanding that the risks and uncertainties that present themselves are connected with the activities that are involved in food production. In a society where people expect to see food on their dinner table that is produced hundreds or even thousands of kilometres away and that along the way has undergone all sorts of processing, other uncertainties and hence other risk problems emerge than in a society where citizens only consume vegetables from their own garden. A choice presents itself: how to weigh the 'good chances' (being able to eat attractive products produced elsewhere) and 'bad chances' (the uncertainties and extra safety problems that emerge as a result) against each other? Attention is now focused not only on the bad chances that occur, but also on the activities with which they are intrinsically connected.

The need to weigh risks, however, does not only occur regarding bad chances connected to risky human activities. The same applies regarding threats of a natural origin. After all, the risk of flooding is determined not only by the frequency of storms and springtides but also by the damage that occurs in case of a flood, in other words, by what lies behind the dikes. The more properties built there, the larger the possible damage, and hence the larger the risk. This suggests that in such cases, risks are also connected intrinsically to the way in which society is organized. The disastrous damage of the 1999 earthquake in Turkey cannot be seen in isolation from the fact that building regulations had been violated on a massive scale. In a country where the same natural conditions apply and earthquakes occur in the same frequency, but where a more cautious approach is taken, the *risk* of an earthquake disaster is lower (because the extent of damage will be smaller) than where corruption reigns.

That risks have to be weighed is not a new fact. Also, the classical risk approach accounts for it (Fischhoff et al. 1981). In the past, the risks of hazardous substances were also assessed in a context of debates on whether the use of a particular substance was necessary – for instance, for economic reasons – and whether perhaps less risky alternatives were available. The new risk approach, however, explicitly stresses that decision-making involves making judgments, while it also allows that judgments frequently have to be made under uncertainty about both the good and bad chances at issue. In those situations comparative assessment involves substantially more than making a calculation.

4.5 FOUR TYPES OF RISK PROBLEMS

The new risk approach conceives 'risk' as a markedly more complex concept than is assumed in the classical risk approach. As a consequence, policymakers have to

address a wider range of issues than in the classical approach. A classification of risk problems proposed in recent publications (Klinke and Renn 2002; IRGC 2005) may help to sort them out (cf. also section 4.3).

In the IRGC classification, risk problems are distinguished by their degree of uncertainty and ambiguity. Although the focus is on 'bad' chances, we should recognize that uncertainties also occur around 'good chances'. For instance, where a new technology presents itself, not only its risks (bad chances) are still uncertain, but also its promises (good chances). Since real-world experience is not yet available, one can only speculate.

When the good chances are also taken into account, four different types of risk problems can be distinguished. Using the terminology proposed in the literature we will distinguish *simple*, *complex*, *uncertain* and *ambiguous risk problems*. While for simple risk problems the classical risk approach is appropriate, the other risk problems mentioned put higher demands on decision-making and the framework needed for it. They call for other strategies and different types of discourses, whereby the involvement of a variety of actors is required. The judgments that have to be made are subject to special requirements, whereby the *uncertainties* at issue should be given attention. To construct risks as problems that may become the object of debate and judgment, quite some *work* needs to be put in. Organizations need to be tailored to this task. The requirements organizations have to meet to accomplish this task should be subject to policies and regulation.

4.5.1 SIMPLE RISK PROBLEMS

Simple risk problems present themselves around known and already established practices. We generally know why we undertake the risky activities and who benefits from them. For instance, we know where hazardous substances are used and which economic or social interests are served. The nature and extent of the risk are known from experience on the basis of scientific study. This knowledge has reached the status of textbook and handbook knowledge. The uncertainties involved are small. This is why one can rely on the existing routines of risk assessment and risk management. Both the risks at issue and the good chances function as givens. Questions may arise about how simple risks are best managed; questions about the risks themselves, however, seldom arise.

4.5.2 COMPLEX RISK PROBLEMS

Also for *complex risk problems* it is commonly known why (and for whom) activities that lead to risks are interesting or, in other words, offer 'good chances'. However, in this case there is still little insight into the relations between causes and effects (damage). Science is still discussing their details. For example, there

may be questions about synergetic or antagonistic interactions between different factors, non-linear effects between causes and effects, inter-individual variety, long-term delays between cause and effect, or still unknown intervening variables (Klinke and Renn 2002: 1085; IRGC 2005: 29-30). Although these issues are reported in the scientific literature, the knowledge has not yet reached the status of handbook knowledge. Examples of this type of risk problem show up, for instance, in the identification of risks of complex chemical installations, where synergetic effects of potentially toxic substances occur; in risks of failure of large, interconnected systems and infrastructures; and in the critical load of ecosystems. That there is still uncertainty about many details complicates the assessment of risks as well as the finding of adequate means for managing them.

Klinke and Renn (2002), and in their wake the IRGC (2005) and in the Netherlands the MNP (2003), argue that *complex risk problems* require another strategy for risk assessment and risk management than simple risk problems. Because of the lack of established (handbook) knowledge, more discussion is needed. In risk assessment, it does not suffice to consult the usual experts and to follow the established procedures. The most sensible strategy is first to concentrate on generating more knowledge. This is possible through organizing what Klinke and Renn (2002) call an 'epistemological discourse', aimed at generating more consensus among experts from a variety of disciplinary backgrounds. Familiar methods for this are Delphi techniques or scenario workshops. Such processes should generate state of the art knowledge that may serve as an entry for assessing risks or decision-making on policies. In management, the problem of complexity can be addressed, for instance, by setting up *high reliability* organizations, building in more diversity in the design of safety systems, etc. (IRGC 2005: 16). In these solutions, then, one largely builds on the existing, classical risk approach. For this reason 'complex risk problems' are sometimes treated as just complications of simple risk problems.

4.5.3 UNCERTAIN RISK PROBLEMS

In the recent literature *uncertain risk problems* have drawn much attention. These risk problems emerge when operating in a vulnerable world that is known only in part and/or when activities are undertaken with consequences that can be anticipated only partially, if at all.

Van Asselt and Petersen (2003) offer a concise description of uncertainty: 'uncertainty is limited knowledge'. The nature of this limitation may vary from *inexactness* (statistical problems, such as substantial margins of error in measurements) and *unreliability* (problems at the level of models or constructs) to *ignorance* (nothing is known about likelihoods, effects or their relations; or substantial lack of insight into the underlying processes, MNP 2003: 22). Klinke and Renn (2002)

and the IRGC (2005: 30) use a similar approach to designate variations in uncertainty but make use of other terms.

In most studies the differentiation of the concept 'uncertainty' is not elaborated or translated into different strategies for dealing with the variations involved. Uncertainty seems to be understood in particular as ignorance, as interpreted by the MNP, or as a combination of uncertainty and ignorance as interpreted by Van Asselt and Petersen: we acknowledge that we know little or nothing about chance, damage, or about cause and effect relations. We will conceive of uncertainty here in this double meaning and speak of *uncertain risk problems*.

Uncertain risk problems have by definition a speculative character. This applies not only regarding 'bad chances', but often also regarding 'good chances'. Uncertain risk problems present themselves for instance around new technologies. Not only the chances of health effects and the potential environmental damage of such technologies are unknown for the time being also about their long-term promises, one can only speculate. In predicting the social impact of technological developments, even experts grope in the dark (De Wilde 2000; cf. Tetlock 2005). The dimensions of promises and threats are generally not controversial as such, but there are divergent estimations of chances and/or the extent of both damage and benefits. This is discussed also outside of the scientific press, and in many cases various social organizations take up arms. Companies that come to face uncertain risk problems will have to reckon with diverging expectations among their stakeholders, from their stockholders to NGOs, while governments will have to entertain complex political considerations.

In most risk governance studies, uncertain risk problems lead to a strategy that starts from a precautionary approach. One cannot adopt concrete policy measures aimed at risk reduction because the necessary knowledge is absent. Klinke and Renn (2002: 1086) propagate in this situation a 'reflective discourse' that comprises mapping of the existing knowledge by experts (concentrating on the question: what do we know?) in order to subsequently conduct a much wider debate with stakeholders and NGOs. The discourse focuses on the acceptance or toleration of uncertain risks. Its outcomes, according to the authors mentioned, may subsequently provide an entry to decision-making about the most appropriate policy measures that may be based on either precaution, promoting resilience, prevention or reduction.

Uncertain risk problems have ramifications for the position of scientific experts. If little knowledge is available about chances or damage, the position of experts will change from adviser to facilitator of either politics or the more broadly organized reflective discourse (MNP 2003: 15). The established distribution of roles between experts who calculate the risk and possibly join the evaluation effort in the assess-

ment phase and risk managers erodes. The normative, and hence political, aspects of assessment and decision-making become more important. Not all contributions to the risk governance literature acknowledge this shift. For instance, Klinke and Renn (2002) and the IRGC (2005) assume without much discussion that uncertain risk problems remain exclusively the domain of experts.

The changing position of experts, however, calls for other ways of dealing with advice. Van Asselt and Petersen (2003: 136-137) argue that policymakers must ask experts explicitly for information on uncertainties, so it can also be explicitly taken into account. Furthermore, they argue that policy production under conditions of uncertainty would have to involve trans-disciplinary processes of knowledge production that involve scientists from various disciplines *and* social actors and citizens. Knowledge production will then be a critical, creative and interactive process. Several problems of trans-disciplinary discourses are identified immediately as well: bounded rationality, vested interests and the dominance of scientific epistemology. A third element advocated by Van Asselt and Petersen is reflexive professionalism, whereby experts are critical of their own approach and open to the perspectives of others. This might take the form of *extended peer review* (whereby assessment of research achievements is also provided from circles outside one's own specialty [cf. subsection 4.2.2]). Also among policymakers, it is necessary to promote an attitude of uncertainty awareness, Van Asselt and Petersen claim (2003: 146). Likewise, the RMNO (2004: 27) argues that scientists and experts should learn to deal with uncertainty in new ways. They might take on the role of *early listeners*, in the sense that they listen seriously to the signals of *early warners* (NGOs, media or citizens). It is noted that to prevent a conflict of interests, it is better not to involve representatives of parties with large interests too early in the process (RMNO 2004: 28).

4.5.4 AMBIGUOUS RISK PROBLEMS

In *ambiguous risk problems* the nature of benefits and harm, and thus the valuation of the issues involved, is controversial. In addition, in many cases uncertainties will also be present. Whether and to which respect one may speak about 'good' and 'bad chances are contested. Apart from different cognitive interpretations of the same threat (Klinke and Renn 2002: 1085), normative problems present themselves. The discussion circles around the divergent opinions and concepts of what is or is not normatively acceptable, rather than cognitive issues (IRGC 2005: 30-31).

Ambiguous risk problems pop up where scientific or social controversies on possible risks emerge. In scientific controversies, there is an overlap with uncertain risk problems. Scientists dispute the estimations of risks while they have quite divergent normative assessments about to what extent the risks are socially

acceptable or tolerable. In addition, such doubts may be voiced outside the scientific world by individual citizens or NGOs.

The debate around GMOs, for instance, focused not only on their potential health and environmental hazards, but also on their economic promises, the consequences for the position of farmers and their dependence on seed improvers, and on the contribution GMOs could have for biofuels (including their benefits and drawbacks), while landscape aspects were also addressed as well as expectations about the global food situation. In addition, philosophical issues were put forward (such as whether or not it is permitted – and should be considered as a 'good chance' – to transgress species boundaries and thus, as they say, 'to play God') as well as animal ethics. In ambiguous risk problems both the number of aspects and actors involved in weighing the issues rapidly increases.

Controversies may arise not only around uncertain risk problems, but also regarding the other forms of risks. This includes simple or complex risks, about which there is general agreement among scientists. In Sweden, as we have seen, there was substantial social protest against the placement of UMTS aerials, while experts were virtually unanimous on the absence of serious effects of radiation for public health. Citizens pointed to the possibility of long-term adverse effects, while some claimed in fact already to be suffering from health problems (Soneryd 2007).

Ambiguous risk problems require a 'participative discourse', most authors argue (Klinke and Renn 2002; MNP 2003; IRGC 2005). The emphasis is on conflict settlement or on developing via deliberations with a broad public of experts, stakeholders, NGOs, and other social organizations and individual citizens a widely accepted policy. The goal of this strategy is to reach social consensus through deliberation (Klinke and Renn 2000: 1086-1087; MNP 2003: 13). Less clear, however, is whether this strategy should mainly be limited to issues of risk assessment or may extend to the management phase and the decision-making about suitable policy measures. Dreyer et al. (2007: 31 ff) argue that ambiguity in the assessment phase can be addressed with the help of *concern assessment*: mapping and elucidating the various ambiguous views found among experts, those directly involved and the public at large. From this perspective, in all cases the degree to which risks can become ambiguous should be studied, and the results should play a part in the assessment of risks and the further steps in risk management. Depending on the outcomes, policies may be precaution, prevention or reduction based.

4.5.5 ADDITIONAL COMMENTS

The classification into simple, complex, uncertain and ambiguous risk problems provides a practical and clear taxonomy of risk problems, including useful sugges-

tions on the proper strategies for each of these types. Several additional comments are relevant here.

First, a policy area may be confronted simultaneously with different types of risk problems and thus the need to pursue different strategic trajectories at the same time. For example, policymakers in the field of flood prevention will generally be trained in addressing 'simple risk problems' that are manageable with established prevention-oriented forms of risk management. This tradition, however, is profoundly affected by climate change. Water management has turned into a much more uncertain practice, which in concrete cases of risk management – e.g. regarding emergency overflow areas – also has ambiguous elements. All of a sudden, then, this policy area should also cover uncertain and ambiguous risk problems, which requires adaptations in its strategic approach.

Second, a specific risk problem may migrate from one category to another. What initially presented itself as a problem of weighing good and bad chances of simple or complex risk problems, for example, may turn into a problem of uncertain or ambiguous risk problems because a new party entered the discussion. The hazards of nuclear energy provide an illustration. Initially, they were treated as simple and complex risk problems, but when problems of long-term nuclear waste storage and the proliferation of nuclear weapons began to play a role in the considerations, the risks involved migrated to the two other risk categories and soon became much more complex and politically loaded. A reverse migration of risks is possible as well. Asbestos presented originally an uncertain risk problem and later on evolved into a complex risk problem, but today asbestos has become a simple risk problem that allows for clear-cut policies. Any classification of risk problems thus comes with a time index.

Third, the classification of risk problems suggests that the problems involved are progressively more 'wicked' or 'untamed' (WRR 2006b). The classification presents a continuum that moves from a rather routine dealing with risks to practices which basically require *customized* handling of the various aspects of risk problems. In some ambiguous risk problems, for instance, new forms of political deliberation have explicitly been introduced, for example in the 1980s Dutch debate on nuclear energy and the 2002 Food and Genes debate on genetic modification. Aside from such explicit political efforts to arrange accommodation of opinions in the light of ambiguity, there are many examples in which discussion of risk problems developed spontaneously outside of the established bodies, such as in the abovementioned debate on stench in Rijnmond or in the debate on DDT.

Fourth, the classification implies progressively greater challenges to the role of experts. In simple and complex risk problems their position is uncontroversial.

But in uncertain risk problems their position is much less obvious, while in ambiguous risk problems it soon becomes contentious. This is related in part to the fact that where knowledge is less certain, normative aspects gain weight, and to the fact that scientific epistemology may conflict with alternative styles of reasoning embraced by NGOs or citizens. As a result, the legitimacy of policies may soon become a matter of concern.

Finally, the various risks and uncertainties to be weighed are progressively more complicated and more strongly politicized. This is further complicated where good and bad chances present themselves at different moments or for different social groups, or when the issues are formulated in terms – ranging from economic ones to philosophies – that are incommensurable. Moreover, decisions often have to be made while situations are still evolving.

In spite of these comments, the conceptual classification into different types of risk problems is a useful tool for reflecting strategies for risk assessment and risk management. This approach may contribute to a stronger sensitivity for better policies and unusual circumstances. We will therefore use this classification for further discussing the problems governments have faced with regard to safety policies.

4.6 CONCLUSION: THE LIMITS OF THE SOCIAL ENGINEERING PERSPECTIVE

The new risk approach has developed in various contexts and for a variety of reasons out of the more traditional approach. It is accompanied by the awareness that our society as a whole, or specific sectors thereof, is faced with divergent types of risk problems. The new approach embodies a concept of risk that is markedly more complex than previously thought. It involves a notion in which uncertainty plays a major part and the intrinsic character of risks is taken into account. The new approach also implies a change of perspective: attention shifts from the risks that are given, and hence from damage, to the vulnerability of settings and individual activities, including the *potential* risks associated with them.

The new risk approach emerged primarily as a reaction to incidents that increased the awareness that we are being confronted not so much with risks but initially with uncertainties. To develop policies, such uncertainties have to be translated into risks that may become the object of discussion and judgment. This translation requires adequate organization and information systems in which *potential* risks are actively searched for and in which information about them reaches those who can weigh them and who take measures, if needed, proactively.

Today, in a growing number of large companies, the new risk approach already serves as a starting point for dealing with safety. Their management processes are organized along the lines suggested by the new risk approach. Companies not only perform research, but also maintain contacts with stakeholders. There are internal accountability systems, and there is the possibility to report potential problems outside the context of established routines. Via *tracking and tracing,* products are followed, while suppliers are contractually required to supply adequate information, etc. A modern company knows it has to *learn* which potential risks need attention and has changed its risk management procedures according to this message. The price of failure is high, not only in terms of the material damage that may occur, but also in terms of possible reputational damage. In particular with companies quoted on the stock exchange, the secondary, reputational, damage can be a lot greater in financial terms than the immediate damage.

But not only companies are increasingly confronted with this wider problem addressed by the new risk approach. The same applies of course to governments. Administrators in the public sector have to deal with the fact that in significant ways society is 'unknown' to them (Van Gunsteren 1992; Van Gunsteren and Van Ruyven 1995). Also, government has to *learn* which potential risks need attention. It is thereby confronted with problems that are increasingly politicized and in which experts can no longer play the role afforded to them in traditional views of rational policymaking. Uncertain and ambiguous risk problems call for new policy processes. They require the participation of actors and types of discourses that remain unmentioned in the classical risk approach. If the old approach already confronts politics and governments with problems of considerable size, the new approach also presents a range of new problems and concerns.

Over the past two decades, more awareness has arisen among policymakers as well as in the scientific literature about the challenges of uncertain and ambiguous risk problems for both government and private organizations. It is hardly surprising that initially these new challenges were largely interpreted through the prism of the classical risk approach, and that measures aimed at tackling these challenges were thus viewed as *supplements* to the existing repertoire. In this reaction, the more profound changes we discussed (cf. section 4.4) are not taken into account. In this light, 'precaution' will subsequently appear as merely a radical form of prevention, entailing a 'participative discourse' called for by specific ambiguous risk problems.

In the WRR view, this interpretation not only downplays the concerns and developments that are implied in the new risk approach, but also falls short, as we will see in the next chapter, when taking into account the political issues that present themselves around the new risk approach.

What becomes visible in the new risk approach, according to the WRR, is not so much a supplement to the classical risk approach, but a change of paradigm. In the classical risk approach the key question was: 'how large are the risks with which we are confronted and how can these risks be managed?' In contrast, the new risk approach recognizes, as we described in section 4.4, the complexity of the key concept of 'risk'. Where this complexity is acknowledged, another question becomes central: how should we arrange our organization (and/or society as a whole) so that the uncertainties with which we are faced are turned into risks that may become the object of discussions and, if possible, management?

The new approach considers uncertain and ambiguous risk problems not as extreme, special cases that complicate the classical approach, but takes the presence of uncertainties as a starting point of the whole process in which risk problems are dealt with. The classical approach now becomes the special case, namely suitable for those (simple and complex) risk problems that are loaded with very few uncertainties and ambiguities.

The new risk approach thus opts for another starting point. Where this approach is followed, one will set up an organization that is directed to searching proactively for potential risks. To this end, uncertainties are as much as possible translated into objectified risks. The new approach acknowledges, however, that such translation will not always fully succeed. In many cases, uncertainties will continue to exist – because of lack of experience, conflicting insights or interests, persisting uncertainties and controversies on standards, etc. In the new risk approach it is recognized, then, that risks often have to be weighed under uncertainty, and that for this reason the work implied is not just a matter of making a costs and benefit calculation. Subsequently, the organizational and political consequences are drawn. Procedures have to be developed to make sure that the weighing of good and bad chances, including the uncertainties and ambiguities with which they are potentially loaded, takes place in a reasonable way that is focused on decision-making. This entails, as we will describe in the next chapter, new normative questions.

The new risk approach goes together with another attitude in politics as well as in science. The classical risk approach was connected with a perspective that starts from a social engineering perspective. It assumed that through *analysis* of risks and *instruction* (put down in regulations and other management techniques), it might be possible to realize an adequate and future-proof dealing with hazards. This presumption has proven to be of limited validity. Increasingly, we are confronted with uncertain and ambiguous risk problems for which the classical risk approach is ill-adapted.

As the sociologist Anthony Giddens has written (1999: 26), risk "was supposed to be a way of regulating the future, of normalizing it and bringing it under our dominion. Things haven't turned out that way. Our very attempts to control the future tend to rebound upon us, forcing us to look for different ways of relating to uncertainty." The new risk approach constitutes an expression of the awareness articulated by Giddens. It approaches safety problems from the question of how we can deal and should deal with uncertainties. The central question of the new risk approach therefore should be: *how is it possible to translate the uncertainties that we face into risks that may become the object of discussion and how should the good and bad chances involved – including the uncertainties that still remain – be appraised?* The new risk approach starts from the notion that it is impossible for us to fully know the world in which we operate or the effects of our actions, and that for this reason there will always be uncertainties. With the awareness that the environment in which we operate is vulnerable and in many respects unknown and that therefore our activities can have unexpected effects, the new approach focuses on the question of how we can *learn* to deal with uncertainties.

5 NORMATIVE ASPECTS OF THE NEW RISK APPROACH

5.1 POLITICS BEYOND THE CLASSICAL RISK APPROACH

In the preceding chapters, we have observed that governments and politics are confronted with various generic safety problems. In government circles, the problems of organizational complexity and lack of administrative transparency get priority. Against this background, the need for more coordination, uniformity and rationality is stressed. Moreover, attention is asked for the distribution of responsibilities between government and society.

The analyses in the preceding chapters have also revealed several other problems. They have a broader scope and, in some respects, are more fundamental than the internal problems. Having served as the framework for safety policy for several decades, the classical risk approach is now reaching its limits. The room for political manoeuvring in risk management is significantly decreased by the growing international interdependence of policies and the increasing role of expertise. Furthermore, the classical risk approach has to cope with several intrinsic problems as well as new challenges. Increasingly, it is recognized that apart from the many simple and complex risk problems to which the classical risk approach is tailored, society also faces uncertain and ambiguous risk problems. In response, several parts of the private sector and several sectors of government have already drawn practical, organizational consequences. In the growing body of academic literature on risk governance, the issues that are involved are also widely discussed.

The new challenges have not been ignored by the government. They are explicitly addressed in *Nuchter omgaan met risico's* (Dealing with risks pragmatically, 2003), a MNP report commissioned by the Dutch Ministry of VROM. The MNP recommends that in addressing risks, uncertainty and ambiguity should be treated explicitly. The MNP report argues that the problems involved call for new policy strategies. In line with the risk governance literature discussed in section 4.5, the MNP calls attention to precaution when dealing with uncertain risk problems and to strengthening the role of citizens in decision-making through participation and communication when dealing with ambiguous risk problems. The influence of this report is clear, for instance, in the Dutch Cabinet's position paper, also entitled *Nuchter omgaan met risico's* (TK 2005-2006, 28089, no. 15) and in the Cabinet's stand on nanotechnology (TK 2006-2007, 29338, no. 54).

However, the political and administrative elaboration of the new approach to risk problems is still in its infancy. Fierce debates are conducted, both nationally and internationally, on the precautionary principle and on public involvement in

decision-making on risk policies. We will first review these debates. Next, we will argue the need for a new normative perspective, which we will subsequently discuss in more detail. This chapter is concluded with a brief reflection on the political organization required for rendering the new normative perspective manageable in practice. This perspective will be further elaborated in Chapter 6 which provides policy recommendations.

5.1.1 PRECAUTION: A SIMULTANEOUSLY WIDELY ACCEPTED AND CONTESTED PRINCIPLE

The most authoritative, but also most controversial, formulation of the precautionary principle is laid down in the Rio Declaration on Environment and Development from 1992 (already cited in Ch. 4): "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." In addition, various formulations circulate in national legislation, in international treaties, as well as in jurisprudence (cf. Ewald, Gollier and De Sadeleer 2001; De Sadeleer 2002; Faure and Vos 2003; Whiteside 2006; De Sadeleer 2007). In the EU context the precautionary principle is laid down in the Treaty of Maastricht, while the European Commission (2000) has accepted this principle as an "essential policy instrument". It was initially designed in relation to environmental problems, but gradually its application has been extended to areas such as public health and food safety. The principle also plays a major role in formulating policies for climate change (WRR 2006a) and in the design of new European hazardous substances regulation (REACH). In many areas, then, it has become accepted that when there are indications of potential serious damage, governments can legitimately take measures based on conjectures, and that in such cases they do not have to wait until hard scientific evidence is available.

The precautionary principle is not only widely accepted, it is also contested. The US government has fiercely fought the EU appeal to the precautionary principle in several cases, such as in the context of the World Trade Organization (WTO). "We consider (this principle) to be a mystical concept, perhaps like a unicorn," a representative of the Bush administration declared. Trade promotion, according to the US Secretary of Agriculture in 2002, calls for "the adoption of science-based systems, as opposed to opportunistic ones, such as the precautionary principle" (cit. in Whiteside 2006: 63). The objections against the precautionary principle are not only political, though. A considerable amount of literature has emerged in which aside from many legal complications several fundamental objections are put forward. These objections can be summarized as comprising four main issues (cf. Miller and Conko 2001; Majone 2002; Graham 2003; Marchant and Mossman 2005; Hahn and Sunstein 2005; Sunstein 2005; Hanekamp 2006; Peterson 2006; Pieterman, Hanekamp and Bergkamp 2006).

First, critics argue that based on contemporary philosophical insight, all scientific results are fundamentally uncertain and that therefore full scientific certainty will never be reached. As a normative standard, the critics argue, the precautionary principle thus falls short: it is not distinctive. They argue that the effect will be that science does not get the role in policies it deserves. Where suspicions suffice for taking measures, the need for further research disappears. The precautionary principle is therefore hostile to science, the critics argue.

A second objection is that the principle produces incoherent results. Where there are suspicions of irreversible damage but scientific certainty is absent, the principle calls for measures, but it does not provide clear-cut indications for what principle may be invoked not only by those who claim that a particular form of action may lead to irreversible damage, but also by opponents who argue that not taking action will produce substantial negative effects. Such situations are hardly imaginary. For instance, opponents of GMOs claim that they can cause irreversible environmental damage, but proponents indicate that without deployment of genetic modification, it would prove impossible to feed large portions of the world in the long run. The precautionary principle may be used as an argument for both positions. Sunstein (2005: 29-34) cynically points out that the precautionary principle may require that it not be applied. A third objection levelled against the precautionary principle is that it implies a reversal of the burden of proof and thus conflicts with a generally accepted assumption of the rule of law; it would lead to a rejection of the principle that constraining government measures are justified only if the government can prove the real chance of damage from actions by private parties. A fourth objection is that the precautionary principle incites risk aversion and that it will slow down innovation. Who really takes it seriously will cause social life and economic development to come to a standstill, the critics argue. Often this last argument is accompanied by examples of widely appreciated technologies that never would have made it if, at the early stages of their development, the precautionary principle had been applied.

These are weighty objections. But they pertain largely to a rather strict, if not rigid, interpretation of the precautionary principle – one that in particular the critics seem to prefer. In practice, a weaker interpretation is used, whereby the precautionary principle should be applied as one consideration among others. This weaker, contextual interpretation is used, for instance, by the European Commission (2000). The Commission writes:

The precautionary principle should be considered within a structured approach to the analysis of risk which comprises three elements: risk assessment, risk management, risk communication. The precautionary principle is particularly relevant to the management of risk.

– The precautionary principle, which is essentially used by decision-makers in the manage-

ment of risk, should not be confused with the element of caution that scientists apply in their assessment of scientific data.
– 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.
– 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.

In some cases, the right answer may be not to act or at least not to introduce a binding legal measure. A wide range of initiatives is available in the case of action, going from a legally binding measure to a research project or a recommendation.

The decision-making procedure should be transparent and should involve as early as possible and to the extent reasonably possible all interested parties.

Where action is deemed necessary, measures based on the precautionary principle should be, inter alia:
– proportional to the chosen level of protection,
– non-discriminatory in their application,
– consistent with similar measures already taken,
– based on an examination of the potential benefits and costs of action or lack of action (including, where appropriate and feasible, an economic cost/benefit analysis),
– subject to review, in the light of new scientific data, and
– capable of assigning responsibility for producing the scientific evidence necessary for a more comprehensive risk assessment.

In the weaker interpretation used by the European Commission, the precautionary principle must always be interpreted against the backdrop of other administrative principles. This offers a much more differentiated picture of the way in which considerations are made than the picture to which the critics of the precautionary principle refer. In this light, the abovementioned objections sound significantly less convincing already.

First, the role of scientific advice is less problematic than the critics claim. In all cases risks have to be weighed whereby both the available knowledge and the

existing uncertainties will have to play a role. It is thus quite an exaggeration to speak of a principle that is hostile to science.

The second objection, incoherency, is also invalid of course as soon as in addition to the precautionary principle other considerations come into play. These considerations may serve as a supplement that makes it possible to significantly reduce the indeterminacy of preferences, if not remove it altogether.

It is also possible to put the objection of the reversal of the burden of proof into perspective. Various parties are responsible for providing evidence. The argumentation always has to comprise several parts: determining standards and protocols, isolating and identifying the material or actions assessed, weighing the results vis-à-vis what is known in the literature on similar cases, and extrapolating data from the laboratory to real situations. In most instances not all these aspects will be handled by the same actors, or even under the responsibility of one and the same party. The implementation of the precautionary principle does not so much involve a reversal of the burden of proof, but rather another distribution of this burden. Such redistributions are partly meant to counter the negative effects of information asymmetries: some parties, such as companies that want to start using new materials, may have more access to data that offer insight into uncertainties than other parties, which makes it reasonable to attribute those parties primary responsibility for the burden of proof. Such considerations, fostered by information asymmetries, are also applied regularly in cases of prevention, where they go uncontested. The European Commission's view that "the decision-making procedure should be transparent and should involve as early as possible and to the extent reasonably possible all interested parties" undermines the objection to the reversal of the burden of proof.

One objection is still standing: the precautionary principle encourages risk aversion. Even if other principles are considered as well, the precautionary principle still prescribes that damage should be avoided and that uncertainty as such is enough already to opt for taking measures – such as prohibiting actions that are potentially harmful. Here too, however, things are not as bad as they seem. After all, once other considerations start playing a role in addition to the precautionary principle, automatically a situation emerges in which risks have to be weighed. In this context the European Commission, as we have seen, explicitly claims that the consequences of inaction should also be taken into account.

The weak interpretation of the precautionary principle is faced with a new objection, however. The principle becomes watered down through contextualization. Its specific interpretation, and hence the question of whether in a concrete case good and bad chances have been sufficiently and carefully weighed against each other, will quite quickly become a case about which eventually the court will have

to decide. The precise interpretation and further elaboration of the precautionary principle thus become a matter of – much – juridical discussion. In particular, where courts will decide about the principle's application and national differences start playing a role, this may give rise to legal insecurity.

Strikingly, the critics mentioned and the large majority of those who argue for a more refined application of the precautionary principle meanwhile share an important assumption. Both parties in the debate interpret this principle as one that under special conditions, namely in still unproved suspicions of potential substantial damage, should be guiding in the risk management phase. In other words, both parties interpret the principle as a radical form of prevention. They conceive of the precautionary principle as one that provides a *supplement* to the existing repertoire of preventive measures.

Seen from the new risk approach, this interpretation is too limited. Within the new paradigm the precautionary principle is the leading normative principle for the *entire process* in which uncertainties are as far as possible translated into risks and concerns are weighed (cf. fig. 4.1, section 4.4). The precautionary principle is thus invoked not only when measures for risk reduction are discussed. In the new risk approach, precaution is the normative translation of the basic idea behind the new risk approach that uncertainties need to be pursued actively, that these uncertainties need to be translated as much as possible into objectified risks, that such risks nevertheless may remain loaded with uncertainties, and that one has to reckon with these uncertainties in weighing the concerns involved. Seen from the new risk approach, the precautionary principle implies that society accepts the obligation to take uncertainties seriously and that it creates the conditions that allow various actors – politics and science, government and private parties – to meet this obligation. It is thus a *different* principle than is thought by those who interpret it as a radical form of prevention. In subsection 5.3.1 we will return to this point.

5.1.2 PUBLIC PARTICIPATION

There is also quite some discussion about the idea, propagated by among others the MNP, that uncertain and ambiguous risk problems call for *public participation*; here, too, fundamental and practical problems are entangled.

That scientific researchers do not have the exclusive right to announce uncertainties around safety problems is undisputed. Others may offer contributions as well, and in particular NGOs have also done so extensively in the past. But should scientific voices be weighed differently than the views of non-experts? It is not easy to decide how contributions of divergent parties can be deployed productively and be confronted with each other.

For one thing, the traditional arenas are poorly equipped for it. Experts have their own publication channels and discussion forums; newspapers and broadcasters are soon averse to contributions that assume more than quite elementary knowledge. The existence of separate circuits hampers the debate that should be conducted in society. Although the internet is a medium used by experts and non-experts alike, its drawback is that ripe and green views tend to be juxtaposed without much additional ordering or selection (WRR 2002). This is certainly the case around safety and health issues. Moreover, where the internet plays a role, political issues are disconnected from their local context and, as a consequence, such issues soon take on new dimensions and a dynamic of their own (Marres 2005: Ch. 4). This regularly gives rise to unclear situations whereby many actors move around in many forums, and both cognitive and normative issues – often connected and hard to distinguish from each other – come into play. Time and again, large and often vital interests are at stake, and it is not uncommon for emotions to run high.

The existing forums and administrative institutions seem hardly suitable to offer room for the policy strategy advocated by the MNP. Because this is internationally acknowledged, in the past decades experiments with public participation have taken place in various European countries, and also in Canada and the US. These experiments are meant to discuss problems around uncertain and ambiguous risks in new ways. Often the consequences of new scientific and technological developments are centre stage. Depending on the format, they are called 'public debates', 'consensus conferences', 'hybrid forums', 'citizen juries' or 'constructive technology assessment' (cf. Joss and Durant 1995; Rip et al. 1995; Van Eijndhoven 1997; Callon et al. 2001; Hamlett 2003; Hagendijk 2004; Rowe et al. 2004; Bucchi and Neresini 2007). The initiative for such gatherings lies sometimes with national or local governments and often with institutions partly set up with this goal in mind, such as the Dutch Rathenau Institute. Research institutes or organizations of scientific researchers are regularly involved as well.

Such initiatives offer citizens a say in safety issues that incite public controversies and about which there is still substantial uncertainty also among experts. They provide a context for democratic ideals of citizenship in a society in which science and technology play a central role. Also, the experiments mentioned are often meant to prevent conflicts, as well as to create support for future policy. In this respect such initiatives are comparable to deliberative-democratic processes of interactive policy design, with which there is wide experience at the local level (cf. Akkerman et al. 2004). It will be no surprise that, in addition, the initiatives mentioned sometimes serve objectives not disclosed at the first meeting: to win time to delay painful decisions, to let off steam or to obstruct the political process. Under the guise of democratization and careful dealing with uncertainty, it is also possible after all to practice power politics.

Comparative European research (Hagendijk et al. 2005; Hagendijk and Irwin 2006) has shown that the initiatives mentioned involve a host of problems. For instance, it is not always clear on which grounds participants should be selected. It is often sensible to limit participation to parties that are directly involved, but in practice this may lead to ritual exchanges of predetermined positions between stakeholders and other usual suspects. Regarding issues of general interest, in many instances it is not clear in whose name participating 'spokespersons' are speaking or how representative their input is.

In addition, in such initiatives the proper demarcation of the dispute is regularly challenged. Bringing together experts and other participants to generate new insights collectively proves to be complex in practice. Researchers soon adopt the role of the educator who merely believes to be present to explain things to a lay-audience. This may cause irritation with other participants and may cancel the added value of the non-expert perspective. Moreover, when experts from diverse backgrounds are pitted against each other – as in private sector versus NGOs – soon the hardly productive question may arise who has the best scientific credentials.

In this way initiatives for public participation may reinforce conflicts – even if they are meant to create a way out. Political legitimacy soon comes into play. For example, the Dutch debate on Biotechnology and Food (Eten & Genen) lost political support after NGOs withdrew from its preliminary discussions (Hagendijk and Egmond 2004).

Finally, many governments raise too high expectations about how the results of such deliberative initiatives for the decision process will be implemented. The timing of such exercises reinforces this: often governments organize public participation only at a late stage of what is a rather autonomously evolving policy-making process. This is not always a matter of malice. Public participation involves a pressing dilemma: if it is organized at a too early stage, there is still little insight into what is really at stake; if the initiative is taken later, much has already been invested, and many decisions may be irrevocable. However, undeniably some policymakers are inclined to consider public participation as one time events – or more cynically: as a hurdle that in the current era one simply has to take – and to ignore the role public participation might have for institutional learning.

Although experiences with public participation in risk issues vary, a sceptical attitude seems called for. As of yet, public participation is no panacea for dealing with uncertain and ambiguous risk problems. Still, it should be asked whether the perspective from which proposals are made, or the role played by this strategy, is too limited. After all, this perspective assumes that here, too, the strategy involved is a *supplementary* one, namely for those cases in which the classical risk

approach runs up against its limits because of the occurrence of ambiguous risk problems – problems about which there is social controversy. That problems arise should then hardly come as a surprise. In contrast to the classical risk approach where discussions benefit from input from experts with acknowledged scientific backgrounds and decision-making is legitimized by established procedures and political mandates, mobilizing insights from actors from a wide variety of backgrounds in a context that fails to have a clear role in the established political decision-making procedures is inevitably a rather messy process. In hindsight, it is quite unsurprising that public participation triggers the problems revealed by Hagendijk et al. (2005).

Similar to the precautionary principle, however, it should be asked whether justice is done to public participation when we assess it from the practices of the classical risk approach. Seen from the new risk approach, the expectations are both too high-strung and too low. Too high, because the contribution of public participation to decision-making and risk management will always be modest; too low, because an assessment from that classical perspective obscures the fact that public participation may serve a different objective from consensus formation, namely *articulation* of problems. We will return to this in Chapter 6.

5.2 THE NEED FOR A NEW NORMATIVE PERSPECTIVE

The MNP suggested two strategies for dealing with uncertain and ambiguous risk problems: precaution and public participation. In both cases, however, it is unclear how these strategies play out and controversies arise. Hence they can only be greeted with great reservation. A sound political and policy answer to the new challenges has yet to be found. This observation needs to be added to the observation above (in Chapter 3) that also in dealing with simple and complex risk problems, governments and politics already face substantial problems of organizational complexity and lack of administrative transparency while having limited political room for manoeuvring. The picture that emerges may easily lead to sombre thoughts on what politics in fact can accomplish in the domain of safety. Apart from many domain-specific questions, government and politics are confronted with questions about their own role.

From a distance, however, the emergence of these questions is hardly surprising. After all, in the domain of safety, various taken-for-granted aspects of politics are unsettled. Taking care of safety brings up fundamental themes such as the relation of democracy and expertise, and the connection of political legitimacy and territory. Moreover, in this area questions arise on ideals of rationality that for a long time have guided political thinking in the West.

In the intellectual world, democracy has had a bad press for centuries. From Plato on it has been argued that where at sea you may expect a competent captain to chart the course, it would be absurd to have the ship of state be administrated by a quarrelling crew. The classical argument against this reasoning is that one does not have to be a shoemaker to know where the shoe pinches. Finding solutions may call for expertise, but the people know as no other does which problems have to be tackled and whether solutions work. With regards to safety issues, however, this argument applies to a limited extent only. Many problems in this domain are not perceptible on the basis of everyday experience, or at least not on time; they can only be identified on the basis of sustained scientific research. Where it is common to ask politicians and administrators for concrete solutions to concrete problems, in this area politics finds itself confronted not only with the fact that expertise is needed for finding solutions, but also with the fact that many problems that need attention are known only because experts claim they exist. Stench may be detected by ordinary citizens, but the hole in the ozone layer and climate change are only visible on computer screens, and for their presentation they require calculations and theories with which only experts are thoroughly familiar. A politician who in the domain of safety merely concentrates on the concerns voiced by his electorate would serve the people badly. In this area expertise plays an intrinsic political role. At the same time one cannot steer blindly on expertise. In weighing risks not only technical aspects should be taken into account, but also other considerations and values. Problems in the domain of safety, in other words, imply a classical political-philosophical question: what is the proper role of expertise in a democracy?

In still another respect these problems confront us with thorny political-theoretical issues. From the seventeenth century onwards, political legitimacy has primarily applied to the relationship of citizens and national state. Increasingly, however, risk problems transcend the geography of national states. Environmental pollution does not stop at the border; international trade chains require complex, transnational regulations for risk management. In many cases the 'public' of the public good that governments are deemed to guard is not the national community, but a collective of individuals who potentially have no other ties than being faced with the same risks. Legitimacy thus becomes a precarious matter.

Third, in the domain of safety, politics is confronted with the limits of the social engineering perspective. Dealing with uncertainties calls for a new attitude. Policies have to be formulated with the awareness that governments have to steer their course in a society and a natural environment that they – and also the best advisers – only know and control in part. Historically, this may not be a new condition, but it does raise questions about long cherished views on political rationality (Ezrahi 1990).

Such second thoughts, however, should be counterbalanced with the fact that in the past few decades society has been quite successful in managing risks. Without reservation, the classical risk approach and the associated distribution of responsibilities for safety care should be labelled as a success story. A high safety level has been realized. We live longer and in better health than earlier generations and the populations of most other countries. Although serious incidents have taken place and no doubt society will have to face more unpleasant surprises, in retrospect it would be untruthful to speak in general terms of an approach that has failed.

However, also in this case the truism that past successes do not guarantee future ones applies. What is at issue is not the track record, but the sustainability of the risk approach. The erstwhile successful approach has to operate under new conditions and is faced with new challenges. In the past few decades, managers – in both the private and the public sector – have been confronted with dramatic incidents that indicate the limits of the classical risk approach that for a long time has proved its merits.

From these hard lessons, as described in sections 4.3 to 4.5, a new risk approach has emerged. This new approach starts from the notion that not risks, but uncertainties are given. In order to formulate responsible policies, these uncertainties have to be identified proactively and translated as far as possible into risks. However, in doing so, uncertainties and ambiguities may continue to exist because the translation of uncertainties into risks will not always succeed completely. When subsequently concerns are weighed, one will have to consider not only the known good and bad chances, but also the persisting uncertainties and ambiguities.

This new risk approach calls for an elaboration in political and administrative terms. It requires new organizational measures, and it is in need of an explicit normative formulation that of course should lead to new laws and regulations and appropriate institutional arrangements. Moreover, it requires a new attitude from administrators. While in the classical risk approach a clear-cut demarcation of tasks and well-described procedures for coordination are administrative virtues, as regards uncertain and ambiguous risk problems, they easily turn into vices. After all, where risks are viewed as givens about which science informs us in more detail, after which responsibilities for risk reduction are defined and distributed, the danger emerges that other risks than the ones that have been mapped out, or doubts about them, are ignored. Bureaucratic organizations have blind spots for what escapes the established procedures. Where uncertainty presents itself, often it is not yet clear which agency has to address the problems, and perhaps there is not even an agency in place for adequately addressing them.

Dealing with uncertainties calls for the organization of learning competencies. This primarily requires openness. Uncertainties can only become the subject of discussions where there is room for deviating opinions and to articulate doubt. Where there is no room for *voice* (Hirschman 1970), lessons will be learned only after disasters have occurred. But openness is not simply a given; it has to be organized. A first question that the new risk approach suggests is therefore whether the necessary openness is sufficiently guaranteed. Is the system of science open enough? Is sufficient room allowed to NGOs? Are there ample openings for voicing doubts in the contacts between experts and administrators? Do implicit normative aspects get a sufficient chance to be aired?

That doubts can be voiced is a necessary but not a sufficient condition. Doubts should also be taken seriously, be assessed for their relevance and, where needed, should lead to appropriate measures. Society not only needs *early warners*; there also have to be *early listeners*. This requires an organization in which articulated doubts are listened to, as well as bodies that have the authority to make the necessary judgments and, where needed, to take measures. It requires that responsibilities be allocated, not only for dealing with (known) risks, but also for dealing with uncertainties.

From the angle of the new risk approach, both private and public actors should have an obligation to account for *potential* risks and to include the uncertainties and ambiguities about risk problems that may persist in their assessment of the concerns. This implies, as we will see, a wider notion of responsibility than the one that is fundamental for the classical approach. After all, if it is recognized that also non-calculable risks have to be taken into account, responsibility cannot limit itself to effects of actions that can be deemed to have been foreseeable. Where a major task of safety policy consists in distributing responsibilities for safety concerns, politics is thus confronted with the question of whether, and if so, how, such a wider notion of responsibility can be formulated in legal terms and shaped institutionally. Aside from all sorts of practical problems, the new risk approach thus entails several fundamental new normative problems.

5.3 NORMATIVE FOUNDATIONS OF THE NEW RISK APPROACH

The normative problems posed by the new risk approach to society may be clarified by putting this approach in a historical perspective. It has, after all, to find its place in a context in which dealing with risks is guided by two normative principles already: 'individual responsibility' and 'solidarity' (cf. Ewald 2002). The appearance on stage of the new risk approach has consequences for these two principles.

The oldest principle for dealing with damage is the basic juridical principle mentioned in Chapter 3: loss is left where it falls. In other words: *individual responsi-*

bility comes first. This principle dates back to the nineteenth century. In 1850 the French politician and historian Adolphe Thiers summarized its background concisely: "Without this principle, all activity would come to a halt since, if a man could rely on others than his own to survive, he would gladly leave to others the tasks and difficulties of life" (cit. in Ewald 2002: 274). Where people cause damage or are negligent, those who suffer the damage may try to claim it on those who inflicted it. Liability regulations have been set up in private law aimed at the settlement of damages.

At the end of the nineteenth century, however, it became apparent that the principle of individual responsibility was too limited. Statistical studies revealed striking regularities in the occurrence of industrial accidents, regardless of who was employed by a company. These patterns made it implausible to attribute damage to individual failure. This discovery paved the way for speaking about such accidents in terms of *risks.* The source of damage is basically rendered anonymous, and the direct link between causality and responsibility comprised in the principle of individual responsibility is broken for such cases. One ought to speak of system failure rather than of individual guilt. Responsibility and liability should therefore be put with those who bear responsibility for the system. The legislation involved was amended in this way. For example, the Dutch Industrial Injuries Act of 1901 required employers to insure their employees against harm caused by an industrial accident. Thus, a new type of allocation of responsibility came into fashion. Over the years, in many areas the *strict liability* of system managers has been defined.

The new allocation of responsibility takes place under a new normative principle. Ewald (2002) refers to it as the principle of *solidarity*. Although this term is not a fortunate one in all respects, we will adopt it here. The introduction of this new principle did not mean however that 'individual responsibility' disappeared. Rather, a process of sedimentation is involved, whereby the new layer covered the old one and, in time, the old layer sets. The emergence of 'solidarity' restricts the interpretation of the principle of individual responsibility and also leads to new interpretations of it. Gradually, this concept took on new meanings.

In the course of the twentieth century, the *ex ante* function of 'individual responsibility', of which Thiers still wrote in moral terms, was formulated in terms derived from risk thinking. Action is thereby presented as gambling on a successful outcome whereby also the chance of failure is implied (Honoré 1999). Prior to acting in the shadow of the threat of having to bear losses and perhaps be held liable for harmful effects, an actor will weigh the chances of success (including the concomitant benefits) and the chances of failure (and its associated cost) against each other. 'Individual responsibility' is then interpreted not so much in moral terms but in terms of an economic analysis of law. In this way the cost of preven-

tive measures and their benefits, in terms of a lower chance of damage or reduction of damage amount if a calamity occurs, may be weighed as well (cf. Holzhauer, Teijl and Backhaus 1995). Moreover, by involving the transaction costs in our considerations, an economic analysis of law may help in choosing the *type* of regulation and monitoring that is suitable (cf. Calabresi and Melamed 1972 for a classic formulation, as well as WRR 2000 and Teulings et al. 2005).

Other perspectives may be placed alongside the economics of law. Regulations of responsibilities, for example, also have to be reviewed for the extent to which they invite perverse strategies in what Hood (2002) calls the 'blame game' – the passing on of responsibility to others. Cynically, Hood points out that for administrators who wish to duck their responsibilities, policies formulated by international experts, which are monitored by private organizations and implemented by local authorities, are squarely ideal. After a calamity such an administrator can plead innocence by pointing to all those others involved. This is a threat in particular where complex distributions of responsibilities are in place, which, as we saw in Chapter 3, is quite soon the case. To a considerable extent, a Dutch Supreme Court ruling on tort – which applies not only to wrongful acts or infringement on the rights of others, but also if an action goes against 'due caution proper to social interaction' (Lindenbaum-Cohen ruling, NJ 1919/161) – restricts such ways out. In social life, apart from cost-benefit calculation, prudence also is required.

By the end of the nineteenth century, new scientific developments had introduced thinking in terms of risks and pointed to the limits of the concept of 'individual responsibility'. Studies also indicated the need for a larger role of government. The research by Pasteur and Koch on infectious diseases made it clear that for the prevention of such diseases, it was not enough to take individual preventive measures. Effective prevention could only be collectively organized. Individual responsibility and *laisser faire* liberalism proved insufficient to face the health problems that cropped up in the rapidly growing cities. Local authorities were confronted with the fact that coordination and intervention on a national scale were required. They provided room for national policies only after much struggle and dramatic calamities (Evans 1987). That in many areas effective prevention can only be shaped collectively has meanwhile become undisputed.

The introduction of the solidarity principle thus has had far-reaching effects. It limits the principle that loss is left where it falls and gradually leads to new interpretations of individual responsibility. In addition, the huge number of tasks performed by governments today would have been unthinkable for nineteenth-century theorists. The new principle has major *ex ante* effects as well. It entails that because costs will have to be shared collectively, society as a whole gets a stake in the prevention of diseases and accidents. 'Solidarity' thus stimulates learning how to deal with risks, i.e. how to assess and manage them.

Governments not only provide for collective preventive measures, but also have an interest in learning how to provide these steadily expanding services in an effective and efficient way.

'Solidarity' forms a new layer of normative thinking in the twentieth century that can be said to have 'settled' on top of the concept of 'individual responsibility'. As such this new layer did not cause 'individual responsibility' to disappear. But all sorts of tensions between both principles cropped up, and this has led to much debate. The concerns voiced by Thiers in 1850, for example, have today become known as the problem of *moral hazard*, the question of whether collective regulations and insurances invite individuals to run away from their individual responsibility and to trifle with damage. Where the solidarity principle leads to a steady expansion of government tasks, the question arises of whether the managerial capacities and the financial resources of the government are not overburdened. This matter was widely discussed in the 1980s and 1990s in relation to social security. Today, as we saw in Chapter 1, the same question is now posed in relation to safety regulations and services.

These issues deserve due attention, but, as we observed in the previous chapter, the awareness has grown that in addition to these, new problems require attention. The new risk approach that evolved in reaction to these new problems introduces again a new layer of normative thinking. The solidarity principle was introduced as a reaction to the discovery that in many areas damage and accidents should be discussed in terms of risks, rather than individual responsibility. Likewise, the introduction of the *precautionary principle* can be regarded as the normative counterpart of the notion that society is faced not only with simple and complex risk problems, but also with uncertainties and ambiguities about safety issues.

It is possible to draw this comparison in another respect as well. In this case, too, the introduction of a new normative principle is accompanied by an extension of the scale of politics. If effective risk management frequently requires national rather than local policies, many environmental problems, the climate issue and many potential risks of new technologies show that precaution calls for international measures.

At the start of the twenty-first century, we are facing questions that in several respects are similar to questions that arose at the beginning of the twentieth century, when speaking of risks became common and solidarity was introduced as normative principle. Also in this case, the introduction of a new normative principle is motivated by pragmatic considerations: the awareness that society is confronted with uncertainties and potential risks as laid down in the new risk approach. And also in this case, the new principle has consequences for the prin-

ciples already in place, meaning that tensions between these principles are likely to occur. Introduction of the precautionary principle has implications for the way in which 'individual responsibility' should be conceived. In section 5.4 we will extensively address this issue. It also has consequences for the solidarity principle. The new risk approach reinterprets, as we have seen (in section 4.3), the classical risk approach as a special case, namely as the proper approach when simple and complex risk problems present themselves. Similarly, the precautionary principle, which constitutes the normative counterpart of the new approach, points to the limitations of 'solidarity', the basic normative principle of the classical risk approach. The classical form of solidarity covers known risk problems. The legitimacy of government action fostered by this principle is therefore limited to addressing such risk problems. When governments take measures to avoid anticipated damage without scientific certainty being available yet, they will have to appeal to another principle, namely the precautionary principle. To serve as a basis for legitimate state action, this principle deserves to be formulated explicitly.

5.3.1 THE SCOPE OF THE PRECAUTIONARY PRINCIPLE

Over the years, three major normative principles have been developed to address responsibility for damage, namely individual responsibility, solidarity and precaution. They entered the scene, roughly, in the nineteenth, twentieth and twenty-first century, respectively. However, when a new principle was introduced, the earlier accepted principles were not discarded. Rather a kind of sedimentation process took place, whereby a new layer was added on top of the existing ones, which as a result bedded down – i.e. their scope and interpretation changed. By keeping in mind this image of the relationship between the various normative principles in the domain of safety, a number of issues may be elucidated that in the complex debates on the precautionary principle have remained underexposed.

First, it becomes clear that the precautionary principle is connected to the new risk approach. As stated, it serves as its normative counterpart. Its scope far exceeds the call for not postponing measures in case of suspicions of serious or irreversible damage, even if there is lack of scientific certainty. In that – widely used – formulation, precaution is still conceived as a radical form of prevention. It is framed as an elaboration of the solidarity principle and understood as a supplement to the already available measures. Precaution, however, is a *different* principle than solidarity. It is the normative counterpart of a new paradigm that in various respects and in essence differs from the classical risk approach.

Second, it may be observed that in the same way that solidarity was paired with the notion that society had to learn how to assess risks and organize prevention,

the precautionary principle calls on us to learn to deal with *uncertainties*, i.e. to learn how to proactively face possible threats that may jeopardize our environment, health or society. The precautionary principle, then, applies to *all* phases that come into play when dealing with potential risks. It is not just mobilized when measures eventually have to be decided. 'Precaution', in other words, refers to more than only radical prevention.

In the WRR view, the precautionary principle therefore calls for an interpretation that goes beyond merely the directive that where there is a threat of serious damage, lack of full certainty shall not be used as a reason for postponing measures. It is the *guiding principle* for *all* four phases of Figure 4.1. It entails that uncertainties have to be actively pursued and translated as far as possible into objectified risks, while it is recognized that uncertainties may still remain when decisions about measures have to be taken. As the normative counterpart of the new risk approach, the precautionary principle entails, according to the Council, recognizing that *the vulnerability of people, society and the natural environment demands a proactive approach to uncertainties*.

The precautionary principle differs from the principles of individual responsibility and solidarity in its *focus*. Where the already established principles look at *damage*, the precautionary principle looks at *vulnerability* (Cousy 2006). The precautionary principle and the new risk approach start from the notion that we have to operate in settings that are vulnerable and that we know only in part. The precautionary approach entails that we recognize that due to our own activities or to the setting in which we find ourselves, we may be confronted with unpleasant surprises that may threaten the sustained existence of that setting, be it a company, the society at large, or the natural environment. The need to identify *potential* risks, to actively search for uncertainties and, if needed, to take measures even where uncertainties persist, follows from this.

5.3.2 PRECAUTION CONCRETIZED

In the past two decades the new risk approach has come into being. It is still evolving. To which organizational interventions the precautionary principle will lead is still a question that needs answering in due course. Here too, however, having some historical consciousness will not hurt. At the start of the twentieth century, it could not be foreseen what the solidarity principle would eventually entail; nor is it possible to foretell the full extent of the precautionary principle at the start of the twenty-first century. However, we are not fumbling in the dark altogether. The ways in which the new risk approach has already been deployed in several sectors of the business world and by public authorities may offer us a better notion of its consequences. In a first inventory they can be summarized in seven points (cf. Whiteside 2006: 53 ff):

- First, precaution can mean setting up research programmes whose purpose is to gather further information and to test successive hypotheses about it. Through research one can try to reduce margins of uncertainty or clarify where simple risk problems are at stake and where not. The precautionary principle may also entail, for instance, performing experiments only in confined laboratories rather than in the open air, and adopting special safeguards. In contrast to what many critics claim, the precautionary principle does not imply that scientific knowledge is ignored; the principle in fact calls for more research.
- Second, precaution can mean that long-term environmental and health *monitoring* should be instituted and that in specific areas facilities are set up for *early warnings* of possible harmful effects. Precaution suggests continuing vigilance. This may imply, for instance, that facilities for the *tracking and tracing* of potentially hazardous materials are mandatory, so that if indications of damage present themselves, a prompt and adequate response is possible.
- Third, precaution can mean deliberately orchestrating multidisciplinary expertise and promoting the idea that also voices from outside science – such as of professionals involved in the implementation, individual citizens, and NGOs – need to be taken seriously.
- Fourth, precaution puts demands on the *independence of regulatory bodies*. Where conflicts of interest occur, uncertainties will easily be ignored, and ambiguities will not be noticed.
- Fifth, precaution can mean a *wider assessment of technologies*, whereby not only 'good and bad chances' of a specific technology are at issue, but alternatives are taken into consideration as well. It entails that *best practices* are identified, whereby divergent dimensions are evaluated. To enable such an evaluation, demands will have to be imposed on the way in which various actors, including inspectors, account for their activities to third parties.
- Sixth, precaution can mean explicit research to *reduce* the *vulnerability* of systems and to promote *resilience*. This may entail larger safety margins, devising backup safety systems and requirements to put emergency plans into place.
- Finally, precaution can mean *banning* a technology or strictly minimizing its use. This does not mean that one reacts only on the basis of non-proven fears. It is also possible, for instance, to formulate such prohibitions in terms of a moratorium – limited in time – in combination with the assignment to do further research, or to imply a general prohibition to which licensing exceptions can be made.

Many of the issues listed have already been implemented, or are being discussed in those sectors – like safety of medicines, infectious disease control and food safety – where the paradigm of the new risk approach is followed *in practice* already. Where the precautionary principle as general principle (as defined above) has been *explicitly* accepted, such *best practices* become the standard. In all cases

it involves combinations of new legal provisions, organizational measures, institutional services and new scientific practices.

The list of cases whereby early signals of potential risks were ignored and society had to face substantial damage is quite long (EEA 2001). However, good practices allow one to learn. In the thalidomide (Softenon) affair of the 1960s, society and the pharmaceutical industry learned hard lessons that are reflected in the medicine evaluation board's registration system. Today, the introduction of a new medicine involves a lengthy process of testing that on average lasts fifteen years, while also systematic post-marketing efforts are put in place to track down signals of unexpected side effects. However, in most other sectors, the introduction of new technologies involves a much less cautious process. Why would society deal less cautiously with other new technologies? Proponents of the precautionary principle are accused that they, through irrational risk aversion, cause economic and technological developments to come to a halt. Nothing could be further from the truth. The precautionary principle precisely calls for extra efforts. The example provided refutes the thesis that precaution would slow down innovation or lead to social inertia. Introduction of the medicine evaluation board's registration system did not cause the downfall of the pharmaceutical industry, nor did it stop medical innovation. Various studies suggest that because it forces companies to cast their research nets widely, the system of medicine registration in fact has increased the innovative power of the pharmaceutical industry (cf. e.g. Schmid and Smith 2005). 'Precaution' is a principle that calls for *activity*, rather than induces inertia and laziness.

In yet another respect the historical sketch outlined above is elucidating. When the solidarity principle was introduced as a new layer on top of the principle of individual responsibility, society had to work out the tensions between these two principles. Similarly, the introduction of the precautionary principle will no doubt elicit new tensions. There is no theoretical answer as to how these tensions are to be resolved. This is a topic for political deliberation, whereby apart from political preferences, scientific considerations play a role as well. When science showed that individual responsibility is too limited in some areas (such as infectious diseases) and that for effective prevention collective measures are required, the prevailing political views had to be adapted. Scientific findings prompted new politics. Likewise, insight into the prevalence of uncertainties and the vulnerability of systems may be a reason for advocating implementation of the precautionary principle. Taking this course, rather than sidelining science, politics appeals to a principle that explicitly recognizes that scientific knowledge always has limitations. That however is not foreign to science. In fact, it is one of its driving forces.

5.4 THE PRECAUTIONARY PRINCIPLE AND THE ALLOCATION OF RESPONSIBILITIES

The vulnerability of people, society and the natural environment demands a proactive approach to uncertainties. In this formulation, adopted by the WRR, the precautionary principle is a simple, if not rather prosaic, principle. Contrary to the quite agitated tone in which part of the discussions on this principle is conducted, everyone applies it in a variety of circumstances without reservations. All parents teach their children not to cross the road near a blind bend because of the uncertainties that are involved in this situation. This does not imply, of course, that these children are doomed to be standing along the roadside forever. Rather, they are advised to look for a spot where the risks can be better estimated. They should not stand still, but move. Out of precaution they are expected to walk on a little further, instead of crossing right away.

The precautionary principle generalizes this sensible parental advice. It asks, for example, of a company that introduces a radical new technology to take account of the potential environmental or health risks even if reliable scientific data are not yet available. The precautionary principle claims that because the effects of the new technology on vulnerable systems are still uncertain, companies that want to invest in the new technology should be expected to engage in a proactive search for a position in which the risks can be better calculated and weighed. Companies, too, may be expected to *move*, rather than blindly cross the road.

However, the question of whether, and if so, how, the government can formulate such an expectation in legal terms is all but trivial. In our tradition, responsibility and liability are limited to the harmful effects caused by a (legal) person's action or refraining from action, while this person may be deemed to know that his action may lead to such damage. Under the dominant concept of responsibility, uncertainty counts as an *excusing circumstance*. Liability is limited to those effects of actions that the actor can be deemed to have been able to foresee.

Also for reasons pertaining to public law, responsibilities attributed by governments to private parties are always formulated within narrow margins. In a democratic state it can be expected that the legislator clearly explains which obligations he imposes on citizens and companies. Formulating expectations on how to act in uncertainty is hardly compatible with the rule of law. Where no limits are put on responsibility, the domain of action for which someone can be asked to account extends infinitely, and legal insecurity emerges.

There are good legal and philosophical arguments for this limitation of responsibility. Also the intended *ex ante* effect of allocating responsibilities asks for such limitation. Where the limited responsibility concept invites actors prior to their

acting to reflect on their acts and to consider their possible harmful effects, an unlimited responsibility concept precisely loses this effect. After all, one can only speculate about effects that are unknown or highly uncertain. If they also are held responsible for unforeseeable effects, actors may decide not to act at all – which as such may also have adverse effects – or, confronted with an endless array of possible effects for which later on they may be held accountable, they would simply shut their eyes and jump. Several of the objections levelled against the precautionary principle rest precisely on these considerations (cf. subsection 5.3.1).

Where uncertainty functions as an excusing circumstance, the scope of legal provisions is restricted to situations pertaining to simple and complex risk problems; uncertain and ambiguous risk problems fall outside of its scope. Given the nature of the safety problems society is facing, this is a major deficiency. It is only logical, then, to look for ways to remove this limitation. This calls for more reflection on how responsibility is to be interpreted.

A starting point can be found in ethics. In this discipline, too, the interpretation of responsibility as connected to foreseeable effects of actions has long been the dominant one. Ethicists speak of 'authorship responsibility' or 'outcome responsibility' (Anderson 2008; Honoré 1999). Taking responsibility implies that we confirm we are the author of our actions and that we are accountable for their effects. However, this is only possible if we are capable of foreseeing these effects; if not, we are confronted with *force majeure*.

However, apart from the dominant view that puts author responsibility first, there is a long tradition in ethics and political philosophy that links responsibility not to the outcomes of actions, but to the position held by an actor. The term 'obligation responsibility' is used here (Anderson 2008). In this tradition the connection implied in the notion of authorship responsibility between responsibility and foreseeable effects of actions is dropped, while a specific position – of, say, being an administrator or citizen – entails responsibilities regardless of whether damage is inflicted. Even where it is not possible to speak of guilt, we may be expected to help victims, while passivity is reproachable. And where there is a possibility of damage or injustice, we may be expected to step in to prevent the damage – even if the adverse effects are not directly caused by our own action. "It is not the origin of injury, but the possibility of preventing and reducing its costs, that allows us to judge whether there was or was not unjustifiable passivity in the face of disaster," Shklar writes (1990: 81).

The ruler who, as represented in Giotto's fresco *L'Ingiustizia*, turns his eyes from the murder, homicide and rape that occur under his rule, falls morally short (Shklar 1990: 46 ff). Not because he himself is guilty of these acts, but because he

insufficiently meets the obligations connected to his position. By turning his gaze away from what is going on around him, the ruler shows irresponsible conduct. While authorship responsibility focuses attention on actions and the *damage* they inflict, obligation responsibility focuses on the *vulnerability* of what is found in the setting of he who holds a certain position.

Aside from authorship responsibility, the notion of 'obligation responsibility' has obtained a place in our legal system. Regulations are in place for professionals – e.g. physicians and accountants – that define the specific obligations entailed by practising such professions. Also in Dutch administrative law we encounter instances, for example in the principles of good government. In regulations of strict liability in Dutch private law, the notion is implemented as well that a certain position– such as employer or producer – entails specific responsibilities.

Seen from both ethical traditions, strict liability has an ambiguous position, however. On the one hand, this form of liability is tied to a specific position – such as that of the one who has parental authority or guardianship over a child (art. 6.169 BW), who is the owner of a building (art. 6.174 BW) or who in a legal relation has a subordinate (art. 6.170-171 BW). On the other hand, it still pertains to liability in inflicting foreseeable injury.

How 'foreseeable' should be understood can be interpreted more broadly or narrowly. As laid down in the Dutch Civil Code (BW), the legislator claims in this respect that

"he who in the exercise of his profession or business uses a substance or carries responsibility for it, while this substance *is known* to have such qualities that it poses a particular hazard of a serious nature for persons or goods, is liable when this hazard materializes." (art. 6.175, section 1 BW, italics added)

The formulation for product liability (art. 6.185 par. 1 BW, in accordance with Article 7, sub e of EU directive 85/374/EEC) is wider, however. It claims the following:

"the producer shall not be liable for the damage caused by a defect in his product, if he proves: … e) that the state of scientific and technical knowledge at the time when he put the product into circulation was not such as to enable the existence of the defect to be *discovered*." (art. 6.185, section 1 BW, italics added)

In the case of product liability, a producer can thus not hide behind the argument that he did not *know* the damaging effects of the product he put into circulation. To be excused from liability, he must prove that at the time of putting his product into circulation, the defect that caused the damage could not even *be discovered* with the available scientific means. The European directive mentioned, as the Court of Justice (NJ 1998, 522) claims, is not directed specifically to "the practice and the common safety regulations in the industrial sector in which the producer is active, but to the state of scientific and technical knowledge tout court, therein included the most advanced level at the time when the product involved was put into circulation". Clause article 7 sub e of the directive mentioned, according to the Court, does "not start from the state of knowledge of which the producer involved could be concretely or subjectively informed, but of the objective state of scientific and technological knowledge of which the producer is deemed to be informed". Product liability, then, requires of producers not only 'passive' knowledge of known risks, but also activities, in this case acquiring insight – based on the most advanced scientific and technical knowledge – into *potential* risks.

The decision about whether a given case involved a hazard that could not be deemed to have been known or that could not be discovered is of course up to the court. The legislator's intent, as Spier and Sterk (1995: 4) note in discussing hazardous substances regulations, may be clear, however: one should bear the consequences of risks that one creates. This also applies to risks that cannot be calculated or for damage that is too large and that for one of these two reasons is not insurable. It is not desirable, as the Minister of Justice writes in his Memorandum to article 6.175 of the Dutch Civil Code,

"to let damages, which eventually find their cause in the exercise of a business to which certain damage hazards for which liability cannot be covered by insurance are inherent, not be at the expense of this business, but leave them at the expense of the individual victims, or, inasmuch as the government is concerned about their interests, at the expense of the community." (TK 1988-1989, 21202, no.3, cit. in Spier and Sterk 1995: 5).

Who pursues the benefits of producing products will also have to bear the burden if damage occurs. However, there are exceptions to this rule, such as for producers of nuclear energy, whose liability is legally restricted because of the non-insurability of the effects of a major nuclear disaster. It may be noted in this respect that – notably via the capital market – there are possibilities also for uninsurable risks to obtain protection against possible liability claims (Cousy 2001; Faure 2003, cf. section 4.2).

We may conclude that in regulations of product liability in private law, the role of uncertainty as excusing circumstance is quite limited. Where uncertain risk

problems present themselves, a producer has the obligation to find out, with the available scientific and technical means, whether the risks suspected indeed exist. Only if it was impossible to detect the defect, is he released from liability. In this way product liability shifts quite a bit towards the obligations that follow from the precautionary principle.

In one respect, however, an essential difference persists. Product liability, too, focuses on damage, while, as we have seen, the precautionary principle shifts the perspective toward *vulnerability*. In other words, product liability does ask from producers an awareness of the uncertainties pertaining to the damage their products may inflict and requires them to take on an active stance, but it does not yet direct their attention to the vulnerability of the – social and natural – setting in which these products will circulate. In the *ethical* notion of 'obligation responsibility', such obligation is implied. The ruler in Giotto's *L'Ingiustizia* falls morally short because he turns away *from what happens around him*.

Extensive debates have been conducted on the relation between the precautionary principle and (strict) liability (cf. Cousy 2006). In the light of the considerations above, Cousy's conclusion (2006: 16) that they differ in essence seems to be correct. The perspective is different: liability looks at the damage, precaution looks at the vulnerability. This again underlines that the precautionary principle constitutes a new principle and therefore ought not to be regarded as an elaboration of both already existing principles, those of 'personal' (authorship) responsibility and 'solidarity'. It again stresses, moreover, that the new risk approach – to which the WRR explicitly links its formulation of the precautionary principle – should be seen as a new paradigm, and not as a supplement to the existing paradigm of the classical risk approach.

This makes it of course harder to answer the question of how the precautionary principle should be formulated in legal terms. From the angle of private law, after all, precaution is not an extension of liability, but rather a legal explication of corporate social responsibility. In addition, also for public law, precaution presents delicate issues, such as the question mentioned above of how the precautionary principle relates to principles of the rule of law. Where the government decides to accept the precautionary principle, this will require concrete new legal as well as institutional frames. Although for the reasons indicated this is no easy task, we will discuss suggestions for it in Chapter 6.

5.5 PRECAUTION REQUIRES POLITICAL ORGANIZATION

The precautionary principle presents serious challenges for legislation. Moreover, its deployment will require the introduction of new institutional arrangements. One could seriously wonder whether this does not greatly overburden the capac-

ity of politics and government, which, as we have seen before, already face problems of organizational complexity, lack of administrative transparency and the burden resulting from increasing international dependencies in the domain of safety. Once again it shows that with regard to safety issues, politics has to face not only intrinsic questions, but also questions about its own role.

What that role implies is not controversial. Bearing in mind a classic formulation of Easton (1971: 125–141), the task of politics is 'the authoritative allocation of values for society as a whole.' The questions focus on how this role can be performed. The discussion becomes clearer when we consider that politics may realize its ordering task in various ways.

The first one is what the WRR, in its report *Lerende Overheid* (Learning Government, WRR 2006b), has called 'vertical politics'. Where this road is followed, measures and obligations imposed derive their authority from the fact that they are realized along the path of democratic decision-making in established political institutions such as the Cabinet and Parliament. 'Vertical politics', however, is not the only source of authority. Also deliberation outside established political arenas may lead to authoritative conclusions, if the confidence is warranted that the deliberation evolves in a reasonable way and that the relevant points of view, experiences and interests are given their due. One may then speak of 'horizontal politics' (WRR 2006b: 55-57). Third, an authoritative ordering may be realized by institutions (such as markets) that encourage the idea that the pursuit of private interests also serves public interests, provided that appropriate measures have been taken for securing these public interests (WRR 2000).

In actual political practice these various forms of ordering exist side by side and often in mutual interaction. Once this is acknowledged, the 'displacement of politics' (cf. subsection 4.1.2) becomes a *different* problem than when viewed exclusively from the point of view of 'vertical politics'. Where vertical politics is given priority, the legitimacy of decisions that emerged outside of established procedures for democratic control is questionable by definition. This is not the primary problem, however, once one allows horizontal politics and forms of authoritative ordering, such as markets, to play their ordering role. Then the main question to be asked is whether the conditions are fulfilled under which horizontal politics leads to authoritative decisions and whether the securing of public interests is in order where markets are supposed to also serve public interests.

Within the safety domain all three forms of political ordering operate (cf. also Ch. 3). 'Vertical politics' imposes in the form of laws and regulations all sorts of safety obligations on the conduct of citizens, companies and government. Also, regulated markets take care of many safety concerns, for example in the food

industry. And we encounter 'horizontal politics' in national or international expert committees deliberating about safety issues.

'Vertical politics', then, may disburden itself by handing over questions to institutions that derive their authority from one of the two other mechanisms mentioned. Not every decision has to be developed along the lines of vertical politics to gain authority and legitimacy. What deserves attention, however, are the conditions under which horizontal deliberation and safeguarding of public interests occur. In a democratic state these concerns are inalienably a final responsibility of 'vertical politics'. Infringement of the independence of science not only endangers science, but is also political failure. After all, 'vertical politics' has the task to secure the conditions under which scientific deliberation leads to authoritative conclusions and the trust is warranted that all relevant points of view and interests have been included. Where on account of a politics of deregulation the business sector is allowed self-regulation, government will have to see to it that the regulations not only facilitate the interaction among companies, but also serve the public interest and, for instance, protect consumers.

It would be incorrect therefore to simply assume that the arenas of 'vertical politics' are automatically the arenas of choice for addressing the more politicized risk problems, i.e. the uncertain and ambiguous risk problems that cannot be adequately addressed by the classical risk approach. 'Horizontal politics' will in fact provide a good venue for these risk problems. In both uncertain and ambiguous risk problems, society is confronted with 'wicked' or 'untamed problems', i.e. issues of which it is still unclear how they eventually have to be formulated in policy terms. In such situations cautious experimenting with policies is often more suited than a decision-oriented parliamentary debate. In the past, courts have often played a productive role in handling 'untamed' problems. Also in dealing with uncertain and ambiguous risk problems, they may perform a similar role, and notably the European Court of Justice has already done so in the past. Provided public interests are adequately secured, markets can also contribute to finding innovative solutions to uncertain and ambiguous risk problems. Above, we have already referred to the far-reaching implications of product liability, which requires producers to actively deal with uncertainties, even if the emphasis thereby continues to be on damage rather than on vulnerability.

The paradigm of the new risk approach confronts society and in particular government and politics with complex normative problems. It calls for the formulation and delineation of a new principle, precaution, on top of the already established principles of individual responsibility and solidarity. Through this introduction, as we have seen, the nature of both older principles changes. The precautionary principle requires legal frameworks and a wider notion of responsibility than the common one. This does not imply, however, that the full

burden of this should rest on the existing political institutions. Although in a democracy there can be no doubt about the principle that final responsibility and, eventually, authority and legitimacy rests with the established institutions of 'vertical politics', there are also other ways to reach authoritative decisions. 'Vertical politics' then plays a limited, though crucial, role by creating the proper conditions for deliberation and by securing the public interest. By using this in a sensible manner, government and politics can be disburdened in their task of allocating and ascribing responsibilities for safety concerns.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 TOWARDS A FUTURE-PROOF SAFETY POLICY

This report has addressed some of the generic problems that arise in the extensive domain of safety, in particular in relation to policy designed to prevent harm to people, the environment and society; in other words, policy that is focused on risks. To do this, it proved necessary to differentiate this category further. In line with the practice in contemporary scientific literature, we have drawn a distinction between simple, complex, uncertain and ambiguous risk problems. These differ primarily in the degree to which there is uncertainty surrounding risks.

For several decades an established policy approach concerning risk problems has been in place; in this report we have called it the *classical risk approach*. It comprises two phases: risk assessment and risk management. There are two central principles that guide the allocation of responsibilities in risk management. First, there is the principle of 'individual responsibility', meaning that individuals have to deal with harm on their own. Regarding many risks, however, prevention at the individual level provides little or no relief. In this situation the second principle, 'solidarity', comes into operation: responsibility for prevention of damage is not assigned to the party who will experience harm or whose action constitutes its immediate cause, but allocated to the party regarded as being in the best position to prevent harm. This may be a private party, but also the government. Where public interests are at stake, the government will take on responsibility for public safety. In many cases it thereby limits itself to final responsibility, and will place operational responsibility for safety in the hands of the private sector through legislation and regulation, with the government overseeing compliance. In other cases, the government also takes on operational responsibility for public safety.

All in all, concerns for safety comprise a wide-ranging and complex field of government involvement. Given this context, it is not surprising that time and again questions have cropped up as to the effectiveness of policies. By and large, however, the overall policy has been greatly successful: a high level of safety has been achieved. But what is at stake is not so much the achievements in the past, but the sustainability of current safety policy. This is under threat from two quarters.

First, there is the enormous volume of provisions, regulations and monitoring arrangements that over time have been put in place by the government. This has not only resulted in a high cost level, but also in organizational complexity and lack of administrative transparency. In response to this, the government itself has called for a more integrated approach, while it also has been asked whether

responsibilities that in the past were assumed by the government should not now be placed with the business community and the public.

The problems of organizational complexity and administrative transparency should not be underestimated. They occur in many guises – as lack of efficiency, transparency and options for control; as decreasing legitimacy; and in the form of 'scapegoating' by administrators after a calamity has occurred. At the same time, these problems ought not to be exaggerated. The concern for safety comprises a large and highly diverse domain. It is hardly surprising that such a comprehensive challenge calls for complex arrangements. Furthermore, administrative systems that display substantial overlap and seem disordered at first glance may have obvious drawbacks, but they also come with specific advantages. Provided that sufficient checks and balances are in place, such systems will have a higher potential for learning and adaptability than more uniform systems. Where everything is done in the same way, the same mistakes are likely to be made everywhere as well, and there is no scope for different practices to learn from each other. The safety policy domain embraces a wide range of problems that generally call for specific knowledge. In the WRR view, therefore, *one-size-fits-all* solutions should be regarded with suspicion. Society is not a uniformly designed entity, but an intricate ensemble of networks of activities. It is not to be expected, therefore, that risks that are intrinsically tied to divergent social activities can best be tackled using an approach based on the idea of a central actor capable of having full control.

Where the emphasis is on the internal unity of government, the international dimensions of risk problems can easily be underestimated. However, taking stock of the different policy areas, one has to conclude that national states have had to give up much of their sovereignty in this domain. At the European level, policy design invariably involves a decision process that appears to be all but transparent, but that precisely through its complexity can be claimed to have the flexibility needed to adequately respond to changes regarding risks and the uncertainties that arise as a result (Sabel and Zeitlin 2007). Whether this happens to a sufficient degree is difficult to establish empirically – and also has to be investigated for each policy area individually. It is unlikely that this question can be meaningfully answered in a comprehensive, domain-transgressing way.

Furthermore, the issue of whether government responsibilities can be transferred to society is complicated by the limited room for manoeuvre of national politics. The international entwinement of policy processes as indicated above cannot be ignored. Many risk-related activities take place in networks with links branching off beyond national borders. Consequently, in many cases it will only be possible to change policy in an international context. What is more, redistributing responsibilities in complex networks is not a zero-sum game, whereby transferring tasks

and responsibilities to society automatically implies a corresponding reduction in the tasks and burdens of the government. The freedom of politicians to act is also limited by their dependence on expertise, which is larger in the domain of safety than in most other sectors. A great number of threats cannot be identified, or cannot be identified in time, by means of the resources offered by everyday experience. Such threats can only be identified on the basis of scientific research. The input of experts, then, is not just crucial when it comes to solving safety problems; many safety issues are recognized as problems only because they have been identified as such by experts. In many cases, then, the ways in which experts articulate problems anticipate the design of the policy. Debates about the allocation of responsibilities in relation to safety should be conducted against the backdrop of these facts of life. After all, a political system that claims to have more capacity to act than it is able to deliver is bound to undermine its own authority.

However, not just problems associated with organizational complexity and administrative lack of transparency require our attention. A number of serious incidents in the past two decades have made it clear that there is a *second* threat to the sustainability of the classical risk approach and its ensuing policies. When confronted with a number of unpleasant surprises, leaders in both private and public sectors have had to acknowledge that they operate in settings that they – and even their best advisers – know only partially. The social engineering perspective, which underlies the classical risk approach, has reached its limits. In response, a *new risk approach* was developed, based on the principle that society is confronted not so much with risks as with uncertainties. Significantly, this new risk approach discards the presumption that we already know on which risks a policy should focus. Instead, policy explicitly aims to identify potential risks and is given form in organizations whose purpose is to translate uncertainties into objectified risks. It is acknowledged that such a translation will not always be complete and that uncertainties and ambiguities may persist. Simple, complex, uncertain and ambiguous risk problems demand different policy strategies.

The new risk approach has already been put into practice into a number of government policy domains and within some large companies. It is widely discussed in the scientific literature. Regardless, its normative elaboration and its translation in political terms are still in their infancy. Two major policy strategies suggested in this context – application of the so-called precautionary principle and involvement of non-experts in divergent forms of public participation – have sparked off several controversies and have given rise to a host of practical problems.

In the WRR view, however, a thorough explication of the normative implications of the new risk approach is essential for a future-proof safety policy. A first step consists of recognizing that the new risk approach does not so much serve as a

supplement to the established, classical, approach, but that it represents a new paradigm. Second, it should be recognized that this new paradigm is accompanied by the introduction of a new normative perspective. It is up to politics to flesh out this new perspective.

The vulnerability of people, society and the natural environment demands a pro-active approach to uncertainties. When put this way, the WRR believes that the precautionary principle reflects the normative basis of the new risk approach. In the WRR view, this principle consequently constitutes the appropriate normative basis for a future-proof safety policy. If in the late nineteenth century individual responsibility served as the common standard and in the twentieth century solidarity emerged as a new normative foundation for safety policy, then the concept of precaution provides a new normative basis at the start of the twenty-first century. As elaborated in Chapter 5, this new principle builds on the already existing principles of individual responsibility and solidarity. Rather than replacing them, the new principle limits their scope while they also acquire a new interpretation.

The new risk approach and the precautionary principle, then, do not render the classical risk approach and its policies obsolete. They retain their value for those – still frequently occurring – cases that involve risk problems not marked by uncertainties, or only minor ones: the categories of simple and complex risk problems. In the WRR view, however, safety policy as a whole should be considered from the new perspective. Existing measures and distributions of responsibility should be assessed also from this overarching perspective.

6.2 THE NEW RISK APPROACH AND THE PRECAUTIONARY PRINCIPLE AS A STARTING POINT FOR POLICY

The WRR recommends adopting the paradigm of the new risk approach and accepting its associated normative perspective, the precautionary principle, as a basis for policies focusing on those safety issues that can be considered to touch on public interests.

This chapter explores the detailed implications of this recommendation. We will address various legal instruments that could foster an adequate distribution of final and operational responsibilities. Adoption of the new paradigm and its associated normative perspective will have specific consequences not only for government, but also for firms, civil-society organizations and citizens. Given the role played by science in nearly all safety issues, the WRR will discuss this role in a separate section of this chapter.

In the distribution of responsibilities for safety, the two prevailing principles – individual responsibility and solidarity – retain their importance. Their role and interpretation, however, will be determined by the precautionary principle. As discussed in section 5.4, the notion of individual responsibility acquires a wider meaning. Whereas traditionally such responsibility was primarily concerned with foreseeable (harmful) effects of individual action, the focus now shifts to the vulnerability of the environment in which the individual operates, while the individual, because of this vulnerability, is expected to adopt a proactive approach to uncertainties. The precautionary principle implies, then, that responsibility involves an active stance rather than a passive attitude.

The WRR preferred definition of the precautionary principle was provided above. Its formulation differs from definitions used in numerous international treaties and in both EU and national policies. Although these other definitions vary, most of them conceive of precaution as a radical form of prevention. The precautionary principle figures as a supplement to the existing package of measures for risk management, namely for those cases where there is a perceived potential for substantial harm, but about which there is as yet no scientific certainty. In the WRR opinion, however, this interpretation is too limited. It assumes that precaution offers a *supplement* to the classical risk approach, instead of viewing this principle as the normative counterpart of a new *paradigm*. As such, it insufficiently takes into account that the focus of the new risk approach shifts from harm to the vulnerability of systems. The proactive policy demanded by the precautionary principle as advocated by the WRR is accordingly not restricted to the risk management phase; rather, it has a guiding function during the entire process of translating uncertainties into tangible risks and assessing the various options.

Although the WRR thus opts for a new formulation of the precautionary principle, it still continues to use the old term. This naturally raises the real danger that the prevailing interpretation (cf. sections 5.1 and 5.2) will continue to resonate or that discussions of this principle will continue to be tainted by the controversies associated with this interpretation. Moreover, one has to take into account treaty texts and jurisprudence that make use of earlier formulations. Despite these reservations, the WRR will continue to use the term 'precautionary principle' for the definition introduced in this report. That today many formulations of the principle are circulating internationally merely underscores its role as an evolving concept. The WRR seeks to contribute to this development by explicitly establishing a connection with the new risk approach and by emphasizing that this new approach involves a different paradigm. The formulation chosen is tailored to this new paradigm. It can also make clear that the interpretation of precaution as a supplementary measure within the classical approach is too limited and leads to needless confusion.

The precautionary principle will need to be fleshed out in greater detail in both public law and private law provisions, as well as in institutional arrangements. The obligations this principle entails for government and private actors can be further clarified in this process. Detailed proposals in this respect fall outside the scope of this report. Moreover, they will have to be developed gradually. As far as the practical significance of the new risk approach is concerned, in many respects we find ourselves still at the beginning of a development. The fleshing out of this approach at the political level is still in its infancy. This does not, however, mean that we are completely in the dark. Regarding major concerns, it is possible not only to outline the foreseeable direction, but also to identify problems that will emerge when the precautionary principle is further elaborated. This will be addressed in the subsequent pages of this chapter.

In the WRR view, acceptance of the precautionary principle as the normative basis for safety policy marks the awareness that both politically and scientifically a new situation has emerged. Over a century ago, thinking in terms of risks began to make inroads, and the realization took hold that the principle of individual responsibility cannot be reasonably applied in each and every situation. Likewise, we now need to recognize that society and the natural environment are vulnerable and that in the domain of safety we are faced with uncertainties. The WRR believes that the new risk approach and the precautionary principle provide the proper frame for learning to deal with this, from both a practical and a normative perspective.

6.3 ORGANIZING PRECAUTION: THE NEW RISK APPROACH

The new risk approach puts addressing uncertainties centre stage. This requires *organization*. A number of measures potentially relevant in this regard were discussed in subsection 5.3.2. Precaution implies initiating *active research* aimed at translating uncertainties into objectified risks. The very presence of uncertainties first needs to be identified, and this requires systems for early warnings, early listening and monitoring. In addition, a diversity of perspectives needs to be accommodated.

Actors involved in actions that potentially pose a risk to matters of public interest should therefore be expected to take the necessary steps. They will have to unfold activities aimed at transforming uncertainties into risks that can become the object of discussion. To do so, they will have to inform themselves of what is reported in the scientific literature on the products and processes they work with, and they must investigate in which respects both their own activities and the environment in which they operate are vulnerable. For this, they should know what goes on in the chain of production in which they operate and what their suppliers are sending them – and in order to reduce uncertainties, they can compel suppliers through

contracts to supply semi-manufactures that meet agreed specifications. They should also be informed about the issues that are playing in their direct environment and will consequently have to inform themselves of what stakeholders expect.

A first requirement for making well-founded judgements is adequate information management. Precaution implies, moreover, that also the uncertainties that remain after sustained study are taken into account in the ultimate decisions, and that in weighing the good and bad chances, potential alternatives are considered. Consideration also needs to be given here to whether additional measures are needed, such as wider safety margins or measures aimed at enhancing the resilience of vulnerable systems.

Proper accountability in this regard – internal, within companies, or external, to the public, regulators or possibly the courts – may imply additional obligations, for example standards that must be met when reporting on activities, for example notification of mistakes or near misses, and standards for the transparency of the decisions made. Statutory rules and permits granted may also contain more detailed obligations for both public and private organizations. Regulators will not only focus on the question of whether the actual *conduct* of those they are regulating meets the standards, but they can also monitor the – broader – issue of whether the *expectations* are being met which are associated with dealing with uncertainties in a responsible way. For example, they can assess whether or not a company adequately deals with uncertainties and whether its information management system functions properly.

Through legislation and institutional measures, government policy that starts from the new risk approach will have to encourage both private actors and government to take the necessary actions and deploy the resources needed. The awareness that a future-proof and responsible safety policy requires careful consideration also of uncertainties and ambiguities will need to be articulated in new measures and provisions, as well as new forms of regulation and supervision.

It should be emphasized, however, that many institutions and statutory frameworks that support this new risk approach are in place already. Apart from the functioning of specifically created bodies and legal frameworks, the question of whether a sound and future-proof safety policy is in place depends first and foremost on the quality and functioning of existing basic institutions such as the political system, the legal system, science and the public communication systems (the media).

The consequences of shortcomings in these basic institutions cannot be overstated. Where scientific knowledge is ignored, or where such knowledge is

corrupted due to conflicts of interest, no responsible policy is possible, while also the public's trust in science and politics will evaporate. In this regard the United Kingdom has learned hard lessons in the BSE crisis (Phillips 2000). Similarly, a society where law enforcement is inadequate exposes itself to unnecessary risks, as evidenced by the catastrophic earthquake that hit Turkey in 1999, which claimed many victims because corruption had led to irregularities with building regulation compliance. And where the media insufficiently distinguish between real and phantom risks, political attention will not be focused on the issues that really matter.

6.4 LEGAL INSTRUMENTS

As argued in Chapter 5, the precautionary principle represents a broadening of the way in which responsibility is commonly framed and discussed. It not only demands responsibility for the foreseeable harmful effects of individual behaviour, but it also calls attention to the vulnerability of people, society and the natural environment and in this light demands a proactive approach to uncertainties. Both government and private parties are thereby called to account.

For private parties the precautionary principle constitutes a more detailed specification of what is understood by the (often vaguely defined and uncommitted) notion of 'corporate social responsibility'. It amounts to asking companies to recognize that their actions do not merely serve their private interests, but that public interests may be at stake as well. Protecting these interests is no longer a responsibility of the government alone, but also of the private sector. The meaning of the precautionary principle should therefore be fleshed out in both public and private law.

6.4.1 PUBLIC-LAW MEASURES

Regarding the implementation of the precautionary principle in public law, the WRR primary recommendation is to incorporate provisions in the General Administrative Law Act that articulate specific public-law obligations for the government to deal proactively with uncertainties in the domain of safety. The government may be expected to set a good example to others.

It cannot be taken for granted, however, that government through public law can enforce the broader responsibilities that belong to the precautionary principle. At first glance, as observed in section 5.4, the precautionary principle is at odds with the notion that obligations imposed on citizens and companies in a democratic state of law should be articulated clearly. The significance of this principle is obvious: it provides legal certainty and protects citizens and companies against arbitrary actions by the government. However, the precautionary principle is

motivated by the idea that citizens not only need protection against the government, but also against companies or other – private or public – actors that harm social and public interests. As Scheltema (2002: 6) observes, this calls for another approach to the principles of administrative law. It implies the recognition that the government alone is not capable of safeguarding all public interests.

Dealing with uncertainties is by definition an open assignment. The fact that the vulnerability of people, society and the natural environment demands a proactive approach to uncertainties is a notion that is difficult to reconcile with ideals of central control and strict monitoring of the compliance with norms that have precisely defined standards of conduct. No single actor can pretend to oversee all details implied by this assignment. However, what government *can* do is accept responsibility for helping to ensure that such details are known in time and, where relevant, made public. This implies that apart from the existing strict forms of regulation, other forms of public law regulation and monitoring have to be explored.

Safety policy is not the only domain where alternative forms of regulation and inspection are pursued. It has become a subject in several debates on legislation and regulation (TK 2003-2004, 29279, no. 9; Witteveen 2007; cf. the special issue of *Nederlands Juristenblad* on alternative regulation 2007). This interest is usually motivated by the objective of relieving government or cost reduction, rather than by interest in precaution. There is, however, a common ground: also where alternatives are pursued primarily for the reasons given, this is often based on the view that in a knowledge-society, government can no longer pretend to foresee every detail that touches on public interests (Scheltema 2002). To protect public interests adequately, the government will have to make use of expert knowledge available elsewhere in society. In the domain of safety, it is largely companies that have such knowledge. They are best acquainted with the technical details of the products and processes they rely on, and the uncertainties pertaining to them. What it comes down to, then, is to develop forms of regulation that actively tap into this knowledge reservoir.

The safety policy domain is already moving in this direction. This expresses itself in particular in a growing interest in open norms and corresponding adjustments in inspection regimes (Mertens 2006; cf. subsections 3.4.1 and 3.4.4). Generally, this will involve activities that require a permit. Where open standards are introduced, the government sets frameworks, but it leaves the specifics to the private parties involved in the risk-related activities. This puts the onus of responsibility more on companies for dealing with the risks associated with their activities. It implies that supervision focuses more on whether companies meet the expectations as regards their risk policy than on whether their actual conduct infringes the norms set by the government. This leads to a reversal of the burden

of proof: rather than the government having to detect infringement of norms, companies now have to demonstrate that they are acting responsibly. Regulatory bodies and inspectors can thereby follow a differentiated policy: companies that can demonstrate that their risk policy is well implemented will have to face detailed inspections less frequently than companies that perform below standard in this respect. This should not lead to inequality before the law, of course. We shall return to this issue in the discussion of private law measures.

The rationale behind this form of regulation is twofold: on the one hand, it relieves government because no detailed code of conduct needs to be formulated and inspections take on a different form; on the other hand, the considerations that invariably have to be made are put where detailed knowledge about the risk-related activities is available, while it is also easier to take into account the specific context of these activities.

Discussions about open norms centre (generally implicitly) on ways of dealing with the handling of known – i.e. simple or complex – risk problems. The arguments put forward in these discussions, however, also fully apply to dealing with uncertainties. The associated supervision can also be tailored accordingly.

Open norms particularly offer advantages for large companies that have their own research departments and that therefore are able to formulate a comprehensive risk policy. Smaller businesses, as observed in subsection 3.4.1, often benefit more from a detailed code of conduct. Alternative regulations require facilities that quite soon exceed their capacities. Although such differences may lead to inequality before the law, this objection should be put into perspective. For the private sector the precautionary principle, including its legal detailing, is important mainly (though by no means exclusively) in relation to dealing with new technologies. Smaller companies that are involved with new technologies will also possess the necessary knowledge and research capacities. Furthermore, the standards applied are the same for all parties; the only differentiation is in the forms of monitoring and supervision, with companies that deal with uncertainties in a transparent and therefore verifiable way perhaps facing a more flexible compliance verification regime. Differentiation such as this is not unusual in other fields (the Tax and Customs Administration, for example). Naturally, the standards set will remain the same for everyone.

Open norms thus entail alternative forms of oversight. That oversight will have a strong focus on content and will generally set higher standards in terms of expertise than the more usual forms of supervision. In cases in which the government does not have the necessary expertise at its disposal, it may delegate inspection tasks to accredited agents. The government will have to carry out adequate 'meta-supervision' in order to safeguard the public interest.

It is striking that despite the broad interest in new forms of inspection, virtually no empirical evaluations of their effects are available (cf. subsection 3.4.4). It is still not known whether the promises comprised in the rationale outlined above are realized in practice – and therefore whether such regulations indeed lead to a robust safety policy and help reduce the financial and managerial burden for the various parties. The WRR therefore recommends that experiments based on such forms of regulation and supervision be set up and that these experiments be explicitly evaluated. Where the policy has already been set in motion, timely evaluations are called for.

It remains to be seen what the outcome of these evaluations will be. In the meantime, it is worth reiterating that the move towards open standards and the associated forms of supervision is important for a variety of reasons. This shift fits in a knowledge society in which the government can no longer pretend to be omniscient; it holds the promise of reducing costs and the administrative burden; and it suits a government policy that takes the new risk approach as its starting point. Within such an approach, it is only natural that the government articulates the responsibilities of private parties in terms of expectations about their handling of risks and uncertainties, instead of verifying that their conduct conforms to the specifically formulated norms. Of course, supervision is relevant here.

6.4.2 PRIVATE LAW MEASURES

The precautionary principle needs to be fleshed out also in terms of *private law*. In addition to the provisions of Section 12 of Book 3 of the Netherlands Civil Code – "When establishing the demands of reasonableness and fairness, allowance shall be made for generally accepted legal principles, the *opinio juris* prevailing in the Netherlands and the social and personal interests involved in the case in question" – the WRR recommends that a formulation be included regarding proactive dealing with uncertainty in relation to safety. When establishing the demands of reasonableness and fairness in relation to safety, consideration will also have to be given to whether the legal entity, given its position in society, has taken adequate account of the vulnerability of people, society and the natural environment.

As pointed out in the discussion of public law instruments, a more detailed concretization is hardly a trivial matter. The private law instruments deployed, after all, have to be evaluated not only in terms of their intended *ex ante* effect, but also from the perspective of legal certainty. Moreover, the question has to be asked whether they can play a productive *ex post* role in conflict resolution, in other words, whether they offer the courts sufficient support.

The thrust of precaution will be clear by now. Adoption of the precautionary principle implies that also private parties are encouraged to proactively seek out uncertainties. They must subsequently translate these uncertainties as effectively as possible into objectified (preferably, calculable) risks. This will not always be wholly possible, which means that judgments have to be made and decisions taken while there is still uncertainty. Taking uncertainties seriously therefore does not imply that those uncertainties can always be eliminated. Actors who behave in an exemplary fashion from the perspective of the precautionary principle can still be confronted with unpleasant surprises. In that case the question that has to be answered in conflict resolution is to what extent the actor can justifiably seek recourse to *force majeure*.

In this respect, the existing legal arrangement (cf. section 5.4) implies a certain range for delivering a defence against (strict) liability claims. To illustrate this range, it is possible to juxtapose three model defences an actor could use against such a claim.

First, an actor could argue that at the time he brought his product into circulation, it was not *known* to him that his action could result in the harmful effect that occurred (cf. Civil Code concerning liability for hazardous substances). Second, he could argue that on the basis of the existing scientific and technical knowledge this harmful effect could not be *discovered* at the time he brought his product into circulation (cf. Civil Code provision on product liability). Third, he could argue that prior to performing his activities, he extensively and proactively tried to identify *potential risks*, that to this end he consulted a variety of sources, that he considered the limitations of each of those sources, that the possible effects in a variety of circumstances were examined, and that also after performing the activities, serious monitoring had been carried out to detect harmful effects. Despite all these efforts, however, the harmful effect did not come to light earlier. That this damage occurred therefore came as a surprise to everyone.

Strictly reasoning from the angle of the precautionary principle, the first defence falls short. But also the second defence, which suggests a more proactive attitude, is insufficient from this angle because the actor failed to take divergent circumstances into account. By contrast the third defence, provided of course that it can be adequately substantiated, could be a persuasive reason for indemnifying against liability. The actor providing this third type of defence has done what he is expected to do on the basis of the precautionary principle. He has given tangible form to his 'social responsibility', and in his conduct and considerations he has seriously taken full account of the existing uncertainties. Given his precaution-based policy, the harm that has nonetheless occurred can reasonably be deemed to constitute *force majeure*.

A first consequence of the WRR recommendation that the precautionary principle should be accepted as a starting point for safety policy is that existing arrangements in respect of strict liability, for example in relation to hazardous substances (see Book 6 of the Netherlands Civil Code) will have to be reappraised from this perspective and that where European directives apply, for example in relation to product liability, efforts will need to be made to ensure that they are formulated in accordance with the precautionary principle. It should be stressed yet again that explicitly banning certain activities (such as the development of radically new technologies which are still hedged in by uncertain or ambiguous risks) is not the primary objective here. According to the WRR interpretation, the precautionary principle entails stressing the need to undertake more activities than would be expected if this principle were not applied. The principle involves learning to deal with uncertainties and therefore also demands innovation. Care and caution are required, however, and actors may be expected to translate that duty into specific organizational measures and policy.

A second consequence, according to the WRR, involves the introduction of a system of (public law) permits pertaining to innovations and new technologies that are suspected of possibly impinging on the public interest. This is of course nothing new: permits are required already for an array of activities associated with known risks. For example, laboratories where scientists do innovative research considered to be risky have to meet special safety standards. What is new is the need, as the WRR proposes, to include a stipulation that requires the recipient of a permit to go and search for uncertainties actively. Where particular uncertainties give rise to problems in relation to insurance, the granting of permits could be tied to the obligation to obtain substantial coverage through the capital market for possible later liability claims (cf. Faure 2003; Cousy 2001). Such a system would have a number of advantages. It would give companies the necessary financial security when dealing with uncertain risk problems, and it would avoid public funds having to be used where harmful effects ensue. Also where uncertain risk problems arise, the basic assumption is met that, as claimed in section 5.4, one should bear the consequences of the (potential) risks one creates. The WRR recommends considering enshrining such a system of permits and capital fund requirements in a new framework act, for example a New Technologies Framework Act. This would obviate the need to adopt directives every time a new technology emerges.

By amending legislation as suggested above, it would be possible to allow private parties (within politically defined margins) to undertake activities tied to uncertain risk problems. It would allow them to continue research into the development of a technology even where there is a suspicion (as yet uncertain) that it could generate substantial safety risks. Their activities could be supervised. The terms of the permit, moreover, would form a guideline for the interpretation by

the court in specific cases when deciding on the degree of liability of companies in the event of harmful effects. A system such as this would provide a framework whereby innovation is linked to a layered system of checks and balances. As a result, considerations of potential risks (as yet uncertain) and opportunity costs (equally uncertain) are made by different parties (politics, business, insurers or capital providers) at various levels and within a variety of assessment frameworks. By introducing a permit system, politics defines the frames in which companies can further pursue their research of a new technology; within those frames firms (because they bear liability for as yet uncertain consequences) are forced to carefully weigh the various – uncertain – pros and cons, while insurers or capital providers, in their decision to cover or not cover the liability risk, once more evaluate the various considerations independently. Such a layered system of checks and balances promotes carefully developed decisions. Given these benefits, the WRR recommends the introduction of such permit systems.

6.4.3 INDEPENDENT JUDICIARY

Finally, in the context of the proposed legal measures, it is important to point out the special role of the courts in enhancing precaution. In interim injunction proceedings the judge can prohibit that irreversible decisions are taken and order that for the time being the status quo is maintained, which will create room for further deliberations. Court considerations may also provide a normative framework or agenda for forthcoming legislation or further negotiations, or they could constitute a supplementary consideration in arguments about the content of other, non-legal instruments.

In addition to conflict settlement in which existing law is applied, the judiciary – as is recognized both nationally and in a European context – may also contribute to developing future legislation. For example, where regulation on a supranational level is needed or the dynamic of the subjects entails that for the time being it is preferable to design regulation that limits itself to broad norms, the legislator may deliberately decide to take a backseat role. In such situations the courts can offer authoritative normative pointers for dealing with uncertainty. Where a technology is developing rapidly, for instance, the legislator will often have to rely on using fairly general terms, which are subsequently interpreted in greater detail through jurisprudence. In the past the European Court has thus played a major and welcome role in interpreting the precautionary principle.

The advantages of this function of the judiciary are obvious. It offers a way of gradually learning how 'wicked' issues can be addressed (WRR 2006b). Legal principles are often a somewhat unspecific legal source; they frequently tend to suggest a certain solution direction rather than dictating a specific solution. Moreover, national differences in legal systems and traditions play an important

role here. Internationalization of the problem places heavy demands on the ability to harmonize European and national law in particular (cf. Werner 2005). Ultimately, then, requirements that have developed gradually will have to be ratified by politics through codification in legislation and regulation.

6.5 INSTITUTIONAL CONDITIONS: THE ROLE OF POLITICS, SCIENCE AND CITIZENS

At the end of section 6.3 we referred to the importance of the quality of society's basic institutions. This quality, however, has to be secured under new conditions. Regarding risk issues, the boundaries of basic institutions have become more fluid than the image of modern, rationalized societies, which has dominated our thinking for years, would have us believe. Max Weber's (1968; 1988) classic doctrines on the relationship between science and politics – science should deliver value-free advice about means, while decisions on goals are the prerogative of politics – hardly offer a useful basis. In this area cognitive and normative issues are closely intertwined, and *de facto* science fulfils roles that in Weber's view belong to politics, while politics is faced not only with scientific facts but also with its uncertainties (cf. also Pielke 2007).

The notion that in a democratic society, making final judgments and taking decisions on matters of public interest are the inalienable prerogative of politicians should continue to hold sway. This assumption, however, should not blind us to the fact that actual safety policies largely take shape outside the official bodies of representative democracy. In this field, as we observed above, the 'displacement of politics' occurs as in no other, due to the inherent role of expertise and the recurring entwinement of cognitive and normative issues (cf. subsections 4.1.2 and 4.2.2). The internationalization of activities with their intrinsic risks also contributes to this; the approach to risks and uncertainties is largely determined within international bodies where political accountability mechanisms operate at best indirectly. The long chains of modern production, including its international branching, make it necessary to have international agreements on risk policies, whereby states partly have to surrender their sovereignty.

From a view that associates political legitimacy primarily with the 'vertical' lines of delegation of authority and accountability that mark the national political system, one will soon identify a 'democratic deficit'. If it is recognized, however, that authoritative allocation of values to society as a whole can also be realized along other lines and mechanisms, this need not automatically be the case. Instead, the issue will rather be if the *conditions* under which 'horizontal politics' can lead to authoritative decisions have been met and whether the *safeguarding* of public interests is assured (cf. section 5.4).

The quality of politics as a basic institution, which is of vital importance to the risk issue, does not primarily pertain to the much discussed gap between citizens and government. It is much more concerned with whether politics succeeds in creating and upholding the conditions facilitating evaluations whose impartiality justifies the confidence that they adequately represent the public interest. In this respect the autonomy of science deserves special attention.

6.5.1 SCIENCE

In a knowledge-intensive policy area such as safety, independence of science constitutes an essential prerequisite for the proper functioning of democracy. Furthermore, the uncertainties that play a major role in this area require specific attention.

The quality of science involves more than merely the observation that good safety policy requires society to have a high level of knowledge and an adequate scientific infrastructure. This is self-evident, as is the fact that the government must be able to assure itself of access to the necessary knowledge and be informed about prevailing uncertainties, also if such knowledge or information is available primarily in the private sector. The government must be able to call upon its own expertise, and where this is not available, it must be able to call on independent advisers or take steps to compensate for the information asymmetry between government and industry (such as mandatory safety reports and other forms of regulation which provide insight into companies' risk policy).

If these requirements may seem rather trivial, actual practice, unfortunately, shows they are not. In the past decades the research landscape has radically changed. Apart from independent academic research, universities increasingly engage in contract research. In the process of setting up the EFSA, one of the key problems cited was the limited availability of independent experts (James, Kemper and Pascal 1999). In today's scientific world, it seems, the rule appears to apply that those who have sufficient expertise have developed ties with industry and those who have not developed such ties (evidently) do not have sufficient expertise. Such ties are not just financial. In what has come to be known as 'Mode-2 science' the problems that have scientific importance, as well as the standards that solutions have to meet, are no longer primarily determined by disciplinary traditions but by questions formulated outside of science. It is by no means self-evident that the conditions cited above for ensuring sufficient quality of the basic institution 'science' can be realized in this context.

The dangers imposed by 'Mode-2 science' are widely recognized in the scientific world itself (cf. subsection 4.2.2). In response, explicit measures aimed at strengthening the independence of science are advocated. In parts of the scientific world this has meanwhile led to several concrete measures.

First, the scientific world itself pursues greater transparency. Today many scientific journals – notably in the medical sector – require authors to disclose potential conflicts of interest, while also taking these into account in organizing the peer review system. Scientists with ties to companies which make products that are central to their research – drugs, for instance – have to state this. A similar requirement applies to referees. Such measures are also implemented in research proposal evaluations by funding organizations.

Second, more than in the past there is attention on issues of intellectual property. That academic research generates patents that are commercially exploited by the scientists involved, or by their departments or universities, is a common trend, but its wisdom can be disputed (Sulston and Ferry 2002; Vandenbroucke 2007). Although the Dutch government promotes this trend, as the website of the Ministry of Education, Culture and Science suggests, scientific knowledge inalienably belongs to the public domain. Patent protection and the market introduce mechanisms that are at odds with the core values of academic research. That business deploys these tools to protect investments in research is understandable; that publicly funded science uses them is all but a self-evident matter.

Finally, the significance of independent, publicly funded research should be underlined. In many safety-relevant areas, relevant knowledge is primarily in the hands of private companies. It is crucial that also the government has access to its own expert opinions. Where the government does not have the relevant knowledge available, well-equipped academic groups can supply that knowledge, provided of course that the independence of their research is guaranteed. This is why public-private cooperation in the area of research relevant to safety issues should be reviewed critically and, at any rate, be subject to strict conditions. The minimal requirement that the results of (wholly or partially) publicly funded research are published via the usual scientific channels should be systematically applied. That publications are shown in advance to private financiers for approval or that during a certain period they have the exclusive right to use results are conditions that ought not to be accepted. The WRR advises the Cabinet to point this out to the publicly funded universities and, if needed, articulate it in legal stipulations. In many cases the funding and capacity problems that today are solved partly through private funding of research can be better addressed through more intensive European collaboration in the field of independent research.

Independence of science, after all, constitutes an inalienable good to a society in which knowledge is power. Democracy requires criticism that can be articulated. Where technical issues are at stake, as is the case with safety concerns, in many cases counter-voices are bound to come primarily from independent science. If its independence is not sufficiently guaranteed, not only does this pose dangers for science and lead to erosion of public confidence in expertise, but also it represents

a failure of democracy. A modern democracy cannot do without the buttress (Schuyt 2006) of independent science.

Moreover, uncertainties arise time and again in fields of research that are relevant for safety policy. Even the best experts will occasionally have to acknowledge that they do not have the answer to pressing questions. Situations such as these create a new role for experts and raise the question of how responsible decisions can be taken in the absence of robust scientific knowledge. Learning how best to deal with experts is often difficult enough for policymakers as it is; dealing with experts who do not know the answers – or who perhaps have yet to discover that they do not know the answers – raises the bar even higher.

The traditional view of the political function of scientific advice is concisely summed up in the title of a much-quoted book by Wildavsky (1979): *Speaking truth to power*. This is not to say, however, that experts should keep their mouth shut when having to recognize that on major points they are still in the dark or do not yet have scientific certainty. It can even be called a scientist's duty to articulate and make public the uncertainties that may pertain to particular public interests (Pielke 2007). The WRR recommends investigating whether this duty could be established in law as a professional standard for scientists or can find acceptance through test cases in court. For many protected professions, regulations are of course in place already. These could be extended. It would be sensible to seek the advice of the Royal Netherlands Academy of Arts and Sciences (KNAW) on this point. Likewise, in scientific education more attention can be paid to this issue than is currently done. In this light it is regrettable that the provision for the task of academic education to contribute to the development of social responsibility, which was still part of a former University Education Act, was dropped in more recent legislation on higher education.

It should of course be borne in mind that scientists employed by universities have more liberties than those who work in the private sector or in non-academic civil service organizations. But they too can be asked to take responsibility where important public interests are at stake. The government can support them by providing good whistleblower regulations. Because the existing regulations are outright inadequate, the WRR recommends their improvement as well as their introduction where they do not yet exist. The government has a duty to provide and protect the space that citizens need to undertake the activities that are expected of them on the grounds of the precautionary principle.

The obligation to make uncertainties public takes on various forms, depending on whether complex, uncertain or ambiguous risk problems are involved. Complex risk problems will primarily have to be reported in the scientific literature. In the case of uncertain and ambiguous risk problems, other media are relevant in

addition. Scientists should be expected to express clearly whether in their view there are doubts about the existing knowledge, the suitability of approaches or methods, or that there is reason for normative uncertainty. The typology introduced by Funtowicz and Ravetz, mentioned in subsection 4.2.2, can help to distinguish the various roles of scientists in this context.

6.5.2 PUBLIC PARTICIPATION

The literature on risk governance refers to the need to extend the dialog on risk problems, especially in the case of ambiguous risk problems, and to involve a wider public than experts alone. The MNP provided the same advice (cf. subsection 5.1.2). In line with this proposal, forms of public participation have been organized in several countries, particularly concerning ambiguous risk problems associated with new technologies. This has happened in the Netherlands, too. In the past few decades large projects were set up, such as the so-called Broad Social Debate on nuclear energy and the Food and Genes debate, but in many fields smaller-scale initiatives were taken as well, among others by the Rathenau Institute.

Where uncertain risk problems emerge, and especially where ambiguous risk problems are present, there are good reasons to widen the circle of people who are capable of addressing the relevant issues involved. Apart from experts, others, either individually or in organizations – such as NGOs – can make key contributions. The reason, however, is not that non-experts have access to a mysterious source of knowledge inaccessible to experts or that non-experts would have more reliable insight into the possible harm or likelihood of it. Their role is driven by other considerations.

Scientific disciplines necessarily imply a specific worldview and action programme. They present a view on which dimensions of a problem are relevant and which are not, and under what conditions matters that at first glance appear to be different can on closer inspection be treated as identical. To be sure, where no distinction is made between key and side issues, no science is practised. This necessary constraint for the pursuit of science does however bring the danger that what later prove to be relevant aspects are ignored at the outset.

Opposing voices are essential where there are uncertainties, even if they are expressed outside the scientific circle and in a form that is inaccurate in terms of the established scientific opinions. They are important not because they are a substitute for the opinions of experts, but because they highlight possible limitations in the assumptions on which those opinions are necessarily based. Particularly where science is itself still in the dark, these opposing voices should provide a trigger for a further critical examination of the assumptions that drive the worldview and action programme of the experts. The image of the scientific

expert as an indulgent teacher addressing what they regard as an ignorant public is, to put it mildly, of little help in creating a more enlightened discussion about uncertain and ambiguous risks. It is known from research that sceptical reactions to experts who claim that there are no serious risks or uncertainties in a given domain are often fuelled more by suspicion of scientists than by ignorance (Wynne 1980, 1989, 2001; Hagendijk 2004).

A second role that voices from outside of science can play pertains to the raising of issues that have remained outside the scope of scientists. Precaution requires a focus on the vulnerability of the environment, not just attention for the possible damage caused by actions (cf. subsection 5.3.1). In this respect, too, voices from outside of science can contribute to a widening of the focus. In the past, non-experts have played an important role in putting issues deserving attention on the agenda (see subsection 4.1.3 for examples).

A third potential role of counter-voices pertains to keeping regulatory bodies and supervisory bodies alert by underlining the tasks they need to perform under the precautionary principle. Especially in areas where high-grade expertise is needed for regulation and supervision, regulators and those who are subject to supervision can easily form too close-knit a group. The EEA (2001: 179), for instance, argues that this so-called regulatory capture significantly contributed to the BSE crisis: "one factor in the slow UK response to BSE was that the government regulatory body was responsible first to industry and only second to consumers." Similar observations are made by the EEA in the case of asbestos. An active role of non-experts in risk problems can be a modest means to prevent regulatory capture.

Next, experiences of non-experts may supplement the insights of experts. That problems in the controlled setting of the laboratory are manageable does not automatically imply the same outside of that setting. Once again the BSE crisis is a good and much-discussed example. As the official Phillips report was later to observe, the initial policy of the British government to contain the BSE crisis proved ineffective because the advising experts failed to have sufficient insight into the everyday practice in slaughterhouses: it proved impossible to implement the measures they had proposed. Scientific expertise does not automatically entail expertise on the specific conditions under which the scientifically described processes function. Local knowledge of relevant details may offer a major supplement or correction to scientific insights, which are necessarily formulated in general terms (cf. Wynne 1996; Scott 1998).

Non-experts may supply important contributions, not because they serve as substitutes for experts and their insights, but because they may offer corrections to those opinions. As Jasanoff (2003: 397) concisely puts it, "Public engagement is

needed in order to test and contest the framing of the issues that experts are asked to resolve." Involving non-experts, especially where there are uncertain and ambiguous risks, can also be defended by a different kind of argument, namely that public engagement is also called for based on democratic considerations. Where uncertain and ambiguous risk problems surface, it still has to be discovered what the common good amounts to. A democracy has no other way to find out but through debate and deliberation.

Acknowledging that the views of the non-scientific public should be solicited, especially where there are uncertain and ambiguous risks, does not automatically point to the best way of organizing that engagement in a fruitful way. As said, the various forms of public participation have produced quite uneven results in the past (cf. subsection 5.1.2). In some cases their ineffectiveness seems caused by insufficient recognition that public participation plays divergent roles in the different phases of the cycle of addressing uncertainties. Where there is the expectation that public participation brings in solutions for uncertain problems, soon scepticism will develop as to the particular value of the suggestions supplied by non-experts, as well as questions on representativeness, the relationship between government and citizens, and the relationship between deliberation and the policies already initiated. In the ensuing maelstroms it is easy to be driven off course. The situation will become more orderly, however, if the various possible roles of public participation in dealing with uncertainties are distinguished from each other.

First, non-experts can play a role in *articulating* problems, meaning, helping to translate uncertainties into risks that can be discussed. Their role is primarily in the words of Jasanoff, "to test and contest the framing of the issues that experts are asked to resolve" (Jasanoff 2003: 397-398). The exchange of arguments, then, does not have to end in univocal representative recommendations at the service of a particular policy, but should lead to the exploration and elucidation of questions and problems that are arising or will come up in the future (Lezaun and Soneryd 2006). In this context the *articulating* and *making public* of the uncertainties at stake are intended to contribute to developing a reasonable basis for making judgments. Articulation is thus not aimed at resolving or eliminating uncertainties; rather, it aims to identify as clearly as possible those issues on which there is insufficient knowledge or about which it is unclear which normative perspectives are relevant.

From the observation that in dealing with uncertain and ambiguous risk problems, articulation is essential and non-experts can play a major role, it does not yet follow, however, how articulation processes should be organized. Deliberation is an essential element of democracy, about that there can be no misunderstanding. But, as the political philosopher Walzer (2007: 144) has argued, "there is no

setting in the political world quite like the jury room, in which we don't want people to do anything *except* deliberate." Those who advocate deliberation too easily ignore the question, Walzer argues, whether *in addition to* the existing political institutions in which deliberation already occurs, there is actually a need for *new*, separate forums that are specifically set up for deliberation. The WRR subscribes to this observation. Where basic institutions are functioning better, NGOs find room and resources to perform their tasks, the media functions properly, and experts realize their task is to identify where uncertainties materialize, there will be less need for new forms of deliberation. Where that need does arise, the question must be asked as to whether the existing institutions are functioning properly, and efforts should in the first place be directed towards improving them.

"Deliberation is not an activity for the demos … I don't mean that ordinary men and women don't have the capacity to reason, only that 100 million of them, or even 1 million or 100,000 can't plausibly 'reason together'. And it would be a great mistake to turn them away from the things they can do together. For then there would be no effective, organized opposition to the powers-that-be. The political outcome of such a move is readily predictable: The citizens who were turned away would lose the fights they probably wanted, and may have needed, to win." (Walzer 2007: 145)

The WRR endorses this view and therefore recommends restraint in deploying the instrument of large-scale forms of public participation, such as the Broad Social Debate on nuclear energy and the Food and Genes debate. Such sweeping initiatives create expectations that can never be realized. Initiatives on a smaller scale which have been used in the recent past (cf. subsection 5.1.2) do by contrast warrant further experiment. However, there should be no misunderstanding about their aim. It should be clear that their primary aim is *articulation* of problems, not decision-making. Decisions should be made by democratically elected political bodies – or at least controlled by them – and not, be it implicitly or explicitly, by *ad hoc* forums. Such forums, however, can still play an important role in preparing decisions, by helping to gain better insight into which normative views are at stake in a given case. In this respect the Rathenau Institute has played a useful role in the past, and it should continue to do so in the future. Fruitful contributions to dealing with uncertainty, however, will rarely be achieved over a weekend in which citizens and experts meet to confer. Typically, the articulation of uncertain risk problems, and especially of ambiguous ones, involves a lengthy process. The new forms of public participation tested in experiments over the past years can thereby play a constructive yet limited role. It is up to political bodies to make the final considerations and be able to account for them.

Parliament could itself play a more active role in the articulation of uncertain and ambiguous risks. The practice in the US Congress of holding public hearings on prominent subjects may serve as an example here. However, this would require

a considerably better staffing of the Dutch parliament than is currently the case. Another US example is the Office of Technology Assessment (OTA), which was set up in 1972 and which for decades has provided Congress with scientific information on a wide range of technical and scientific topics, thereby also exposing uncertainties. In 1995, however, the OTA fell prey to the climate of cutbacks and deregulation. Since 1983 France has had its *Office parlementaire d'évaluation des choix scientifiques et technologiques* (see website OPECST), which comprises members of both the Senate and the Assemblée and organizes expert meetings and public hearings. Likewise, the British government, in the wake of the Phillips report that evaluated the BSE crisis, concluded that a more proactive policy was necessary. The WRR advises the Dutch Parliament to take similar initiatives. To this end, an extension of the instruments of parliamentary inquiry and parliamentary investigation could be considered. Parliamentary inquiries have in recent times been directed mainly towards problems that occurred in the past. Bearing in mind the saying 'bolting the stable door after the horse has bolted', there are gains to be made from adopting a more forward-looking approach. Inquiries and investigations should also focus on topics that are of vital importance and which are currently still hedged in by great uncertainty. In this respect the domain of safety offers a host of topics. As the examples mentioned in Chapter 2 illustrate, society is facing major challenges. The climate problem and nanotechnology, for instance, will continue to require substantial attention for years, if not decades.

6.6 PRECAUTION AS CONSTITUTIONAL TASK

"Public interest in safety issues is substantial and this is likely to persist", the Dutch Cabinet wrote in its request for advice that formed the basis of this report. As the WRR has argued, when it comes to actual policymaking, this attention will have to be cast in a new form. This is not to say that the policy pursued in the past can generally be described as a failed policy; on the contrary, despite the occurrence of specific incidents, the classical risk approach and the policies based upon it can be designated as a remarkable success story. For the reasons given in this report, however, the WRR has doubts as to how future-proof that policy framework is.

The WRR therefore believes that policy in the area of safety in the coming decades will have to be developed within the context of a new paradigm. This *new risk approach* starts from the normative perspective of the precautionary principle. In the WRR view this principle means that the vulnerability of people, society and the natural environment requires a proactive approach to uncertainty. This approach pertains to all phases of policy formation: from identifying potential risks and weighing the options to the eventual measures adopted. The precautionary principle demands that uncertainties be taken seriously and that the realization that there are uncertainties be translated into action. As the WRR has

indicated, in various sectors of government policy and in parts of the business world, this new risk approach is *de facto* already implemented. These practices should explicitly be posed as an example to sectors where this does not yet happen. This is possible through explicit definition and adoption by politics of the new risk approach and the precautionary principle that serves as its guiding normative perspective. Where public interests may be at stake, ensuring safety requires application of the precautionary principle.

Given its general character, it is natural to formulate the precautionary principle as a general, binding effort. With this in mind, the WRR recommends that an adequate and engaging formulation of the precautionary principle be included in the Dutch constitution and that efforts are made to have a corresponding formulation also adopted as foundation for EU policy. Thus, the Dutch government and the EU, respectively, would clearly and acutely mark that the basic tenet of the new risk approach, the notion that where vulnerable systems are confronted with uncertainties a proactive approach is required, is adopted as binding in the domain of safety policy.

Incorporating such a formulation in the Dutch Constitution is appropriate not only because of the importance that should be attached to a future-proof safety policy. It is also called for in light of the importance of government concern in this area for the legitimacy of the State. Although the State, in articles 21 and 22 of the constitution, has been assigned aspects of that responsibility, it is striking that a theme which is so central to the legitimacy of the government has to date not acquired an independent place in the Constitution.

The WRR notes here that comparable steps have been taken elsewhere. In 2000 the European Commission already adopted the precautionary principle as an 'essential policy instrument', even if it did not offer a more detailed stipulation. In France, the precautionary principle has been included in the *Charte de l'environnement de 2004*, which (besides the *Déclaration des Droits de l'Homme et du Citoyen de 1789*) is part of the French constitution, as article 5:

"Lorsque la réalisation d'un dommage, bien qu'incertaine en l'état des connaissances scientifiques, pourrait affecter de manière grave et irréversible l'environnement, les autorités publiques veillent, par application du principe de précaution et dans leurs domaines d'attributions, à la mise en oeuvre de procédures d'évaluation des risques et à l'adoption de mesures provisoires et proportionnées afin de parer à la réalisation du dommage."

Moreover, the WRR points to the fact that major segments of the private sector have meanwhile adopted the precautionary principle explicitly. In response to the UN initiative *Global Compact*, for example, Shell has declared that it supports

the precautionary principle as a guideline for its environmental policy (see website Shell).

Adoption of the new risk approach does not mean abandoning the policies of the past. The classical risk approach retains its considerable value, notably for simple and complex risk problems. Yet by starting from precaution as the guiding principle, the classical risk approach is viewed from another normative perspective, and it loses its self-evident character. The classical risk approach becomes a special case, namely applicable when no uncertainty about risks, or hardly any, is available. Likewise, the previously guiding principles of the classical risk approach, individual responsibility and solidarity, are seen in a new light. Responsibility acquires a broader meaning under the precautionary principle; it no longer refers only to the potential harmful consequences of actions, but requires a proactive awareness of the vulnerability of the environment in which an actor operates.

Through organizational measures the new risk approach gives shape to the broadening of responsibilities comprised in the precautionary principle. Various tools discussed above – tied to both private law and public law – may thereby have a binding and structuring effect.

Giving priority to the precautionary principle involves a recognition that public interests in safety cannot be guaranteed by the government alone. In a knowledge-intensive domain such as the concern for safety, where uncertainties play a major role, the government can no longer pretend to be the omniscient central actor that can determine in advance in detail how responsibilities are best arranged – nor should it want to have the ambition to be such an actor. To a large extent its responsibility consists of adequately regulating that responsibilities are taken in society. The precautionary principle most definitely does not mean that decisions on issues relating to safety should be taken mainly via vertical political structures and that the government acquires more tasks. It does, however, imply that politicians have a task in ensuring that the conditions under which horizontal policy formulation takes place generate confidence and adequately safeguard public interests. In this respect, the WRR has mainly called for attention to the conditions that have to be met for a proper functioning of science and a sensible deployment of public participation.

Traditionally, the concern for safety has served as one of the cornerstones of the legitimacy of national states. By incorporating the precautionary principle in the Constitution, government and politicians would be giving a contemporary meaning in the new century to an old Dutch saying about the role of the state: ‘The State, that’s the dikes’.

REFERENCES

Abraham, J. and C. Davis (2007) 'Deficits, expectations and paradigms in British and American drug safety assessments: Prising open the black box of regulatory science', *Science, Technology and Human values* 32, 4: 399-431.

Akkerman, T., M.A. Hajer and J. Grin (2004) 'The interactive state: Democratization from above?', *Political studies* 52: 82-95.

Ale, B. (2003) *Risico's en veiligheid. Een historische schets*, achtergrondstudies VROM-raad, nr. 14, www.vromraad.nl.

Anderson, J. (2008) 'Verantwortung' in S. Gosepath, W. Hinsch and B. Rössler (eds.) *Handbuch der politischen Philosophie und Sozialphilosophie*, Berlijn: De Gruyter.

Angell, M. (2000) 'Is academic medicine for sale?', *The New England journal of medicine* 342: 1516-1518.

Angell, M. (2004) *The Truth about Drug Companies*, New York: Random House.

Aronowitz, R.A. (1998) *Making Sense of Illness. Science, society and disease*, Cambridge: Cambridge University Press.

Asselt, M.B.A. van (2000) *Perspectives on Uncertainty and Risk*, Dordrecht: Kluwer.

Asselt, M.B.A. van and A. Petersen (2003) 'Niet bang voor onzekerheid – epiloog', 133-147 in M.B.A. van Asselt and A. Petersen (eds.) *Niet bang voor onzekerheid*, RMNO Voorstudies en achtergronden no. V-01, Utrecht: Lemma.

Asselt, M.B.A. van and A. Petersen (eds.) (2003) *Niet bang voor onzekerheid*, RMNO Voorstudies en achtergronden no. V-01, Utrecht: Lemma

Asselt, M.B.A. van and E. Vos (2006) 'The precautionary principle and the uncertainty paradox', *Journal of Risk Research* 9, 4: 313-336.

Bakker, E. de and G. Overbeek (2005) *Van passiviteit tot passie: Een rijkdom aan drijfveren voor natuurbeleid*, The Hague: LEI.

Beck, U. (1986) *Risikogesellschaft. Auf dem Weg in eine andere Moderne*, Frankfurt am Main: Suhrkamp.

Beck, U. (2007) *Weltrisikogesellschaft. Auf der Suche nach der verlorenen Sicherheit*, Frankfurt am Main: Suhrkamp.

Bijker, W. (2007) 'Dikes and dams, thick with politics', *Isis* 98, 1: 109-123.

Bijl, D. et al. (2006) 'Symposium geneesmiddelenbulletin', *Geneesmiddelenbulletin* 40, 10: 109-121.

Bishop, P.G. and R.E. Bloomfield (1998) 'A methodology for safety case development', Safety-critical systems symposium, Birmingham.

Bodewitz, H.J.H.W., H. Buurma, and G.H. de Vries (1987) 'Regulatory science and the social management of trust in medicine', 243-260 in W.E. Bijker, T.P. Hughes and T.J. Pinch (eds.) *The Social Construction of Technological Systems*, Cambridge, Mass.: MIT Press.

Boer, E. de (2003) 'Morgen gebeurt het! Commissie Luteijn doet aan sciencefiction', *Land + water: Magazine voor civiele- en milieutechniek* 43, 1/2: 20-23.

Borrás, S. (2006) 'Legitimate governance of risk at the EU level? The case of genetically

modified organisms', *Technological Forecasting and Social Change* 73, 1: 61-75.
Bovens, M.A.P. (1989) 'De veelvormigheid van verantwoordelijkheid', 17-41 in M.A.P. Bovens, C.J.M. Schuyt and W.J. Witteveen (eds.) *Verantwoordelijkheid: Retoriek en realiteit. Verantwoording in publiek recht, politiek en maatschappij*, Zwolle: W.E.J. Tjeenk Willink.
Bovens, M.A.P., W. Derksen, W.J. Witteveen, F. Becker and P. Kalma (1995) *De verplaatsing van de politiek: Een agenda voor democratische vernieuwing*, Amsterdam: Wiardi Beckman Stichting.
Bressers, J.Th.A. (2004) 'Vuurwerkramp verandert handhavingsprocessen: Een empirische analyse met behulp van de contextuele interactietheorie', *Bestuurswetenschappen* 58, 6: 472-494.
Briggs, R. and C. Edwards (2006) *The Business of Resilience, Corporate security for the 21st century*, London: Demos.
Brink, A. van den (2007) *Gevaarlijke stoffen*, WRR-Web publication no. 36. www.wrr.nl.
Bucchi M. and F. Neresini (2007) 'Science and public participation', 449-473 in E. Hackett, O. Amsterdamska and M. Lynch (eds.) *Handbook of science and technology studies – Third edition*, Cambridge, Mass.: MIT Press.
Bundesverwaltungsamt (2003) *Neue Strategie zum Schutz der Bevölkerung in Deutschland*, Bonn-Bad Godesberg: Akademie für Krisenmanagement, Notfallplanung und Zivilschutz im Bundesverwaltungsamt.
Calabresi, G. and A.D. Melamed (1972) 'Property rules, liability rules and inalienability: One view of the cathedral', *Harvard Law Review* 85: 1089-1128.
Callon, M., P. Lascoumes and Y. Barthes (2001) *Agir dans un monde incertain. Essais sur la démocratie technique*, Paris: Seuil.
Carson, R. (1962) *Silent Spring*, Boston: Houghton Mifflin.
Centre d'analyse stratégique (2007) 'Dossier veille et sécurité sanitaires', *Horizons stratégiques* 3.
Collins, H.M. and R. Evans (2002) 'The third wave of science studies: Studies of expertise and experience', *Social Studies of Science* 32, 2: 235-296.
Cousy, H.A. (2001) 'Van verzekering tot "alternative risk transfer (ART)": Een stap vooruit of een stap terug?', 703-722 in K. Bernauw, P. Colle, M. Dambre and I. Demuynck (eds.) *Liber Amicorum Yvette Merchiers*, Bruges: Die Keure.
Cousy, H.A. (2006) 'Risks and uncertainties in the law of tort', 2-26 in H. Koziol and B.C. Steininger (eds.) *European Tort Law 2006*, Vienna/New York: Springer.
Dijstelbloem, H. (2007) *De democratie anders. Politieke vernieuwing volgens Dewey en Latour*, Enschede: Ipskamp.
Dorbeck-Jung, B.R., M.J. Oude Vrielink-van Heffen and G.H. Reussing (2005) *Open normen en regeldruk – Een onderzoek naar de kosten en oorzaken van irritaties bij open normen in de kwaliteitszorg*, Enschede: Universiteit Twente, www.justitie.nl/onderwerpen/recht_en_rechtsbijstand/bruikbare_rechtsorde/documenten_bruiro/onderzoek/.
Dreyer, M., O. Renn, A. Ely, A. Stirling, E. Vos and F. Wendler (2007) *A General Framework for the Precautionary and Inclusive Governance of Food Safety –*

Accounting for risks, uncertainties and ambiguities in the assessment and management of food safety threats, Stuttgart: Dialogik.

Duyvendak, J.W. (1997) *Waar blijft de politiek? Essays over paarse politiek, maatschappelijk middenveld en sociale cohesie*, Amsterdam: Boom.

Easton, D. (1971) *The political system*, New York: Knopf.

Ebrecht, J., C.J.J. Eijgenraam and H.J.J. Stolwijk (2005) *Kosteneffectiviteit van maatregelen en pakketten. Kosten-batenanalyse voor Ruimte voor de Rivier*, CPB-document 83, 2, The Hague: CPB.

Ecotec (2005) *Preliminary analysis of the contribution of EU information society policies and programmes to the Lisbon and sustainable development strategies*, Birmingham.

Eijndhoven, J.C.M. van (1997) 'Technology assessment: Product or process?', *Technological Forecasting and Social Change* 54, 2-3: 269-286.

Est, R. van and B. Walhout (2007) *Verslaglegging workshop nanovoedselveiligheid*, The Hague: Rathenau Instituut.

Est, R. van, I. Malsch and A. Rip (2004) *Om het kleine te waarderen. Een schets van nanotechnologie: Publiek debat, toepassingsgebieden en maatschappelijke aandachtspunten*, werkdocument 93, The Hague: Rathenau Instituut.

European Commission (2000) *Communication from the Commission on the Precautionary Principle*, COM (2000) 1 final, 2-2-2000.

European Commission (2001) *White paper on governance. Democratising expertise and establishing scientific reference systems*, report of the working group 1b, May 2001.

European Commission (2004) *Communication from the Commission on Flood Risk Management. Flood prevention, protection and mitigation*, COM(2004) 472 final, 12-7-2004.

European Commission (2005) *i2010 – A European information society for growth and employment*, COM(2005) 229 final, 1-6-2005.

European Environment Agency (2001) *Late lessons from early warnings: The precautionary principle 1896-2000*, Copenhagen: European Environment Agency.

Evans, R.J. (1987) *Death in Hamburg – society and politics in the cholera years 1830-1910*. Oxford: Clarendon Press.

Ewald, F. (2002) 'The return of Descartes' malicious demon. An outline of a philosophy of precaution', 273-301 in T. Baker and J. Simon (eds.) *Embracing Risk. The changing culture of insurance and responsibility*, Chicago: University of Chicago Press.

Ewald, F., C. Gollier and N. de Sadeleer (2001) *Le principe de précaution*, Paris: PUF.

Ezrahi, Y. (1990) *The Descent of Icarus – Science and the transformation of contemporary culture*, Cambridge, Mass.: Harvard University Press.

Faure, M.G. (2003) 'De meerwaarde van het aansprakelijkheidsrecht voor het milieu', 223-334 in T. Hartlief and S. Klosse (eds.) *Einde van het aansprakelijkheidsrecht?*, The Hague: Boom Juridische Uitgevers.

Faure, M.G. and E. Vos (eds.) (2003) *Juridische afbakening van het voorzorgsbeginsel: Mogelijkheden en grenzen*, publicatie A03/03, The Hague: Gezondheidsraad.

Felsted, A. (2006) 'Doing business in a dangerous world', *Financial Times*, 24 April 2006.

Fischer, A.R.H., A.E.I. de Jong, R. de Jonge, L. J. Frewer and M.J. Nauta (2005) 'Improving food safety in the domestic environment', *Risk Analysis* 25, 3: 503-517.

Fischhoff, B., S. Lichtenstein, P. Slovic, S.L. Derby and R.L. Keeney (1981) *Acceptable risk*, Cambridge: Cambridge University Press.

Fombrun, C. and V. Rindova (2000) 'The road to transparency: Reputation management at Royal Dutch/Shell', 77-96 in M. Schultz and M.J. Hatch (eds.) *The expressive organization*, Oxford: Oxford University Press.

Friends of the Earth Australia, Europe and USA (2008) *Out of the laboratory and on to our plates. Nanotechnology in food & agriculture*, www.foeeurope.org/activities/nanotechnology/Documents/Nano_food_report.pdf.

Funtowicz, S.O. and J.R. Ravetz (1992) 'Risk management as a postnormal science', *Risk Analysis* 12, 1: 95-97.

Funtowicz, S.O. and J.R. Ravetz (1993) 'Science for the post-normal age', *Futures* 25, 7: 735-755.

Funtowicz, S.O., I. Shepherd, D. Wilkinson and J.R. Ravetz (2000) 'Science and governance in the European Union: A contribution to the debate', *Science and Public Policy* 27, 5: 327-336.

Gardner, J. and A. Oswald (2004) 'How is mortality affected by money, marriage, and stress?', *Journal of Health Economics* 23, 6: 1181-1208.

Gezondheidsraad (2006) *Betekenis van nanotechnologieën voor de gezondheid*, publicatie 2006/06, The Hague: Gezondheidsraad.

Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott and M. Trow (1994) *The New Production of Knowledge: The dynamics of science and research in contemporary societies*, London: Sage.

Giddens, A. (1999) *Runaway World: How globalisation is reshaping our lives*, London: Profile.

Gigerenzer, G., Z. Swijtink, T. Porter, L.J. Daston, J. Beatty, and L. Krueger (1989) *The Empire of Chance – How probability changed science and everyday life*, Cambridge: Cambridge University Press.

Gillespie, B., D. Eva, and R. Johnston (1982) 'Carcinogenic risk assessment in the USA and UK. The case of Aldrin/Dieldrin', 303-335 in B. Barnes and D. Edge (eds.) *Science in Context. Readings in the sociology of science*, Milton Keynes: The Open University Press.

Graham, J.D. (2003) 'The perils of the precautionary principle: Lessons from the American and European experience', Washington DC: Regulatory Forum.

Gunsteren, H.R. van (1992) *Eigentijds burgerschap*, Wetenschappelijke Raad voor het Regeringsbeleid, The Hague: Sdu.

Gunsteren, H.R. van and E. van Ruyven (eds.) (1995) *Bestuur in de ongekende samenleving*, The Hague: Sdu juridische en fiscale uitgeverij.

Gusfield, J.R. (1981) *The Culture of Public Problems. Drinking-driving and the symbolic order*, Chicago/London: The University of Chicago Press.

Hagendijk, R.P. (2004) 'The public understanding of science and public participation in regulated worlds', *Minerva* 42, 1: 41-59.

Hagendijk, R.P. and M. Egmond (2004) *The GM food debate in the Netherlands 1999-2002*, STAGE discussion paper, www.stage-research.net/STAGE/content/case_ studies.html.

Hagendijk, R.P and A. Terpstra (2004) *Technology, risk and democracy: The Dutch nuclear energy debate (1981-1984)*, STAGE discussion paper, www.stage-research.net/STAGE/content/case_studies.html.

Hagendijk, R.P., P. Healey, M. Horst and A. Irwin (2005) *Science, technology and governance in Europe: Challenges of public engagement*, www.stage-research.net.

Hagendijk, R.P. and A. Irwin (2006) 'Public deliberation and governance: Engaging with science and technology in contemporary Europe', *Minerva* 44, 2: 167-184.

Hahn, R.W. and C.R. Sunstein (2005) 'The precautionary principle as a basis for decision making', *The Economists' Voice* 2, 2.

Hajer, M.A. (2003) 'Policy without polity? Policy analysis and the institutional void', *Policy sciences* 36: 175-195.

Hajer, M.A. and A. Loeber (2006) *Assessing the institutional role of civic participation after food scandals and food scares*, Participatory Governance and Institutional Innovation (PAGANINI), deliverable nr. 15, www.univie.ac.at/LSG/paganini/.

Hale, A. (2006) *Method in your madness: System in your safety*, farewell lecture TU Delft, repository.tudelft.nl/file/338155/202780.

Hamlett, P.W. (2003) 'Technology theory and deliberative democracy', *Science, Technology and Human Values* 28, 1: 112-140.

Hanekamp, J.C. (2006) 'Precaution and cholera: A response to Tickner and Gouveia-Vigeant', *Risk Analysis* 26, 4: 1013-1019.

Hasler, C. (2002) 'Functional foods: Benefits, concerns and challenges – A position paper from the American Council on Science and Health', *Journal of nutrition* 132: 3772-3781.

Havinga, T. (2003) 'Private regulering voedselveiligheid. De supermarkt als regelgever en handhaver', 189-212 in H. Weyers and J. Stamhuis (eds.) *Zelfregulering*, themanummer Recht der Werkelijkheid, Reed Business Information.

Hessels, L.K. and H. van Lente (2008) 'Re-thinking new knowledge production: A literature review and a research agenda', *Research Policy*, doi:10.1016/j.respol.2008.01.008.

Heumer, S. (2005) *Traceerbaarheid en de Codex Alimentarius. De stand van zaken*, www2.minlnv.nl/lnv/algemeen/vvm/codex/nieuws/artikelen/downloads/codex-11.pdf.

Hirschman, A.O. (1970) *Exit, Voice and Loyalty: Responses to decline of firms, organizations and states*, Cambridge, Mass.: Harvard University Press.

Hoefnagel, F.J.P.M. (2007) *ICT en internet*, WRR web publication no. 37. www.wrr.nl.

Holzhauer, R.W., R. Teijl and J.G. Backhaus (1995) *Inleiding rechtseconomie*, second edition, Arnhem: Gouda Quint.

Honoré, A.M. (1999) *Responsibility and Fault*, Oxford: Hart.

Hood, C. (2002) 'The risk game and the blame game', *Government and Opposition* 37, 1: 15-37.

Hood, C., H. Rothstein and R. Baldwin (2001) *The government of Risk. Understanding risk regulation regimes*, Oxford: Oxford University Press.

Horstman, K. and R. Houtepen (2005) *Worstelen met gezond leven. Ethiek in de preventie van hart- en vaatziekten*, Amsterdam: Het Spinhuis.

Hunt, G. (2006) 'Nanotechnologies and society in Europe', 92-105 in G. Hunt and M.D. Mehta (eds.) *Nanotechnology – Risk, ethics and law*, London: Earthscan.

International Risk Governance Council (2005) *Risk Governance. Towards an Integrative Approach*, White Paper no. 1, Geneva.

Iyengar, S. (1990) 'Framing responsibility for political issues: the case of poverty', *Political behavior* 12, 1: 19-40.

James, P., J. Kemper and G. Pascal (1999) *A European Food and Public Health Authority. The future of scientific advice in the* EU, europa.eu.int/comm/food/fs/sc/future_food_en.pdf.

Jasanoff, S. (1990) *The Fifth Branch: science advisers as policymakers*, Cambridge, Mass.: Harvard University Press.

Jasanoff, S. (2002) 'Citizens at risk. Cultures of modernity in the US and EU', *Science as culture* 11, 3: 363-380.

Jasanoff, S. (2003) 'Breaking the waves in Science Studies', *Social Studies of Science* 33, 3: 389-400.

Jasanoff, S. (2005) *Designs on Nature – science and democracy in Europe and the United States*, Princeton: Princeton University Press.

Jonkers, A.P. (2007) *Voedsel en geneesmiddelen*, WRR web publication nr. 38. www.wrr.nl.

Joss, S. and J. Durant (eds.) (1995) *Public Participation in Science: the role of consensus conferences in Europe*, London: Science Museum.

Klinke, A. and O. Renn (2002) 'A new approach to risk evaluation and management: risk-based, precaution-based, and discourse-based strategies', *Risk Analysis* 22, 6: 1071-1094.

Knight, F.H. (1921) *Risk, Uncertainty, and Profit*, Boston/New York: Houghton Mifflin.

Köhler, W. (2007) 'Niets stopt AIDS', *NRC Handelsblad*, 1 December 2007.

Koninklijke Nederlandse Academie der Wetenschappen (2004) *Hoe groot kan klein zijn? Enkele kanttekeningen bij onderzoek op nanometerschaal en mogelijke gevolgen van nanotechnologie*, Amsterdam: KNAW.

Koops, B.J., R.E. Leenes, R.C.P. Marbus, C. Stuurman and J.M. Verschuuren (2005) 'Een heel klein artikel met grote gevolgen. Eerste verkenning van nanotechnologie & recht', *Nederlands Juristenblad* 80, 30: 1554-1559.

Koops, B.J. and A.B.M. Lips (2003) 'Wie reguleert het internet? Horizontalisering en rechtsmacht bij de technische regulering van het internet', pp. 261-314 in H. Franken (ed.) *Zeven essays over informatietechnologie en recht*, The Hague: Sdu.

Kooreman, P. and Prast, H.M. (2007) 'What does behavioral economics mean for policy? Challenges to savings and health policies in The Netherlands', paper prepared for the Netspar Panel on April 26, 2007, www.netspar.nl/research/output/pp/.

Krapohl, S. (2004) 'Credible commitment in non-independent regulatory agencies: a

comparative analysis of the European agencies for pharmaceuticals and foodstuffs', *European Law Journal* 10, 5: 518-538.
Latour, B. (1988) *The Pasteurization of France*, Cambridge, Mass.: Harvard University Press.
Latour, B. (1999) *Pandora's Hope. Essays on the reality of science studies*, Cambridge, Mass.: Harvard University Press.
Latour, B. (2005) *Reassembling the Social – an introduction to Actor-Network-Theory*, Oxford: Oxford University Press.
Leeuw, F.L. and F. Willemsen (2006) 'Toezicht en inspectie: trends, kosten en baten', *Nederlands Juristenblad* 81, 37: 2108-2116.
Leeuwe, P.J.H. van (2007) *Waterbeheer en waterveiligheid*, WRR web publication nr. 39. www.wrr.nl
Lezaun, J. and L. Soneryd (2006) *Government by Elicitation. Engaging stakeholders or listening to the idiots?*, discussion paper 34, London: Centre for the Analysis of Risk and Regulation.
Loo, I.H. van and F.R. Mooi (2002) 'Changes in the Dutch Bordetella Pertussis population in the first 20 years after the introduction of whole-cell vaccines', *Microbiology* 148: 2011-2018.
Luijf, H.A.M. (2004) 'De kwetsbaarheid van de ICT-samenleving', *Justitiële Verkenningen* 8: 22-33.
Luhmann, N. (1995) *Risk: A sociological theory*, New York: Aldine de Gruyter.
Lupton, D. (1999) *Risk*, London: Routledge.
Majone, G. (2002) 'What price safety? The precautionary principle and its policy implications', *Journal of Common Market Studies* 40, 1: 89-109.
Marchant, G.E. and K.L. Mossman (2005) *Arbitrary and Capricious – the precautionary principle in the European Union courts*, London: International Policy Press.
Marres, N.S. (2005) *No Issue, No Public. Democratic deficits after the displacement of politics*, dissertation University of Amsterdam.
Maynard, A.D. et al. (2006) 'Safe Handling of Nanotechnology', *Nature* 444, 7117: 267-270.
Meer, J.W.M. van der, and B. de Kruijff (2005) 'Conclusions and recommendations', pp. 9-10 in B. de Kruijff, J.W.M. van der Meer and L.H.W. Noor (eds.) *The Bleak Future of Antibiotics*, Amsterdam: Royal Netherlands Academy of Arts and Sciences.
Mensink, A. (2007) *Infectieziekten en veiligheid – toekomstige uitdagingen voor maatschappij en beleid*, WRR web publication nr. 40, Bilthoven: RIVM.
Mertens, F.J.H. (2006) *Toezicht in een polycentrische samenleving*, inaugural lecture TU Delft.
Michiels, F.C.M.A. (2006) *Houdbaar handhavingsrecht*, inaugural lecture University of Tilburg, Deventer: Kluwer.
Milieu- en Natuurplanbureau (2003) *Nuchter omgaan met risico's*, Bilthoven: MNP.
Milieu- en Natuurplanbureau and Rijksinstituut voor Volksgezondheid en Milieu (2004) *Risico's in bedijkte termen. Een thematische evaluatie van het Nederlandse veiligheidsbeleid tegen overstromen*, Bilthoven: RIVM.
Miller, H.I. and G. Conko (2001) 'The perils of precaution – why regulators' "precautionary

principle" is doing more harm than good', *Policy Review* June & July: 25-39.
Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2006) *Project Nationale Veiligheid. Geïntegreerde rapportage interdepartementale zelfevaluatie digitale verlamming*.
Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2007) *Strategie Nationale Veiligheid*.
Ministerie van Sociale Zaken en Werkgelegenheid (2004) 'Verslag Workshop Ketenverantwoordelijkheid RIVM', 25 april 2004, vast.szw.nl/index.cfm?fuseaction=dsp_document&link_id=49477.
Ministerie van Verkeer en Waterstaat (2004) *Veiligheid in transparante afweging*. www.rijkswaterstaat.nl/dvs/Images/veiligheidstransparantafweging_tcm178-163589.pdf.
Ministerie van Verkeer en Waterstaat (2006) *Veiligheidsbeleid doorgelicht. Een globale beschrijving, vergelijking en verklaring van het veiligheidsbeleid op verschillende terreinen*.
Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (1989) *Nationaal Milieubeleidsplan*.
Morel, C. (2002) *Les décisions absurdes – sociologie des erreurs radicales et persistantes*, Paris: Gallimard.
Nagel, T. (1979) *Mortal Questions*, Cambridge: Cambridge University Press.
Nederlands Juristenblad (2007) jaargang 82, nr. 21, Special issue alternative regulation.
Nestle, M. (2002) *Food Politics – how the food industry influences nutrition and health*, Berkeley: University of California Press.
Nieuwkamer, R. and E. van Tuinen (2004) *Overzicht normen veiligheid en wateroverlast*, report 2004/05, Utrecht: STOWA.
Noordegraaf, M., M. van Twist and H. Wesseling (2003) 'Kennisintensief bestuur. Bestuurlijke verschuivingen en institutionele verankeringen', *Bestuurskunde* 12, 4: 147-151.
Nowotny, H., P. Scott and M. Gibbons (2001) *Re-thinking Science. Knowledge and the public in an age of uncertainty*, Cambridge: Polity Press.
O'Malley, P. (1996) 'Risk and responsibility', pp. 189-207 in A. Barry, Th. Osborne and N. Rose (eds.) *Foucault and Political Reason. Liberalism, neo-liberalism and the rationalities of government*, Chicago: University of Chicago Press.
Oosterveer, P.J.M. (2005) *Global Food Governance*, dissertation Wageningen University and Researchcentrum.
Peterson, M. (2006) 'The precautionary principle is incoherent', *Risk analysis* 26, 3: 595-601.
Phillips, Lord (2000) *Report of the inquiry into BSE and variant CJD in the United Kingdom*, www.bseinquiry.gov.uk.
Pidgeon, N., R. Kasperson and P. Slovic (eds.) (2003) *The Social Amplification of Risk*. Cambridge: Cambridge University Press.
Pielke, R.A. (2007) *The Honest Broker – Making sense of science in policy and politics*. Cambridge: Cambridge University Press.

Pieterman, R., J. Hanekamp and L. Bergkamp (2006) 'Onzekere voorzorg bedreigt rechtszekerheid', *Nederlands Juristenblad* 1, 7: 2-8.

Polder, J.J. (2008) *Veelkleurig grijs. Economische aspecten van volksgezondheid en zorg*, Bilthoven: RIVM.

Pot, C.W. van der and A.M. Donner (1977) *Handboek van het Nederlandse staatsrecht*, tenth edition, Zwolle: W.E.J. Tjeenk Willink.

Power, M. (2004) *The Risk Management of Everything. Rethinking the politics of uncertainty*, London: Demos.

Power, M. (2007) *Organized Uncertainty: designing a world of risk management*, Oxford: Oxford University Press.

Privy Council Office (2004) *Securing an Open Society: Canada's national security policy*, Ottawa.

Projectorganisatie Ruimte voor de Rivier (2007) *Planologische Kernbeslissing Ruimte voor de rivier* 4, The Hague: Ministerie van V&W, Ministerie van VROM en Ministerie van LNV.

Quigley, K.F. (2005) 'Bug reactions: considering US government and UK government operations in light of media coverage and public opinion polls', *Health, Risk & Society* 7, 3: 267-91

Raad voor Ruimtelijk, Milieu- en Natuuronderzoek (2004) *Nieuwe risico's in het vizier*, RMNO Voorstudies en achtergronden no. V-05, Utrecht: Lemma.

Raad voor Verkeer en Waterstaat en VROM-raad (2003) *Verantwoorde risico's, veilige ruimte*, The Hague.

Resnik, D.B. (2007) *The Price of Truth. How money affects the norms of science*, Oxford: Oxford University Press.

Rijksinstituut voor Volksgezondheid en Milieu (2004) *Ons eten gemeten*, Houten: Bohn Stafleu van Loghum.

Rip, A., T.J. Misa and J. Schot (eds.) (1995) *Managing Technology in Society – the approach of Constructive Technology Assessment*, London/New York: Pinter.

Rowe, G., R. Marsh and L.J. Frewer (2004) 'Evaluation of a deliberative conference', *Science, Technology and Human Values* 29, 1: 88-121.

Royal Society and Royal Academy of Engineering (2004) *Nanoscience and nanotechnologies: opportunities and uncertainties*, London: Royal Society.

Sabel, C.F. and J. Zeitlin (2007) *Learning from Difference: the new architecture of experimentalist governance in the European Union*, European Governance Papers C-07-02.

Sadeleer, N. de (2002) *Environmental Principles: from political slogans to legal rules*, Oxford: Oxford University Press.

Sadeleer, N. de (2007) 'The precautionary principle in community health and environmental law: sword or shield for the nordic countries?', pp. 10-58 in N. de Sadeleer (ed.) *Implementing the Precautionary Principle. Approaches from the nordic countries, EU and USA*, London: Earthscan.

Savage, L.J. (1954) *The Foundations of Statistics*, New York: John Weiley & Sons.

Scheltema, M. (2002) 'Publieke en private verantwoordelijkheid in een kennissamen-

leving', pp. 1-7 in M.V.C. Aalders and M.N. Boeve (eds.) *De werkelijkheid van het milieurecht*, Alphen aan den Rijn: Kluwer.
Scheufele, D.A. et al. (2007) 'Nanotechnology: scientists worry about some risks more than the general public', *Nature Nanotechnology* 2: 732-734.
Schlich, T. (2004) 'Objectifying uncertainty: history of risk concepts in medicine', *Topoi* 23: 211-19.
Schmid, E.F. and D.A. Smith (2005) 'Keynote review: Is declining innovation in the pharmaceutical industry a myth?', *DDT* 10, 5: 1031 – 1039.
Schneier, B. (2003) *Beyond Fear. Thinking sensibly about security in an uncertain world*, New York: Copernicus Books.
Schuyt, C.J.M. (2006) *Steunberen van de samenleving*, Amsterdam: Amsterdam University Press.
Scott, J.C. (1998) *Seeing Like a State: how certain schemes to improve the human condition have failed*, New Haven, Conn.: Yale University Press.
Shklar, J.N. (1990) *The Faces of Injustice*, New Haven: Yale University Press.
Soneryd, L. (2007) 'Deliberations on the unknown, the unsensed, and the unsayable? Public protests and the development of third-generation mobile phones in Sweden', *Science, Technology and Human Values* 32, 3: 287-314.
Spier, J. and C.H.W.M. Sterk (1995) *Aansprakelijkheid voor gevaarlijke stoffen. Gevaarlijke stoffen, stortplaatsen, boorgaten en vervoer gevaarlijke stoffen*, Deventer: Kluwer.
Stevens, L.G.M. and M.P.L. Adriaansen (2006) 'Focus op toezicht', *Nederlands Juristenblad* 81, 20: 1108-1111.
Strategy Unit (2002) *Risk. Improving government's capability to handle risk and uncertainty*, London.
Sulston, J., and G. Ferry (2002) *The Common Thread: a story of science, politics, ethics and the human genome*, London: Bantam Press.
Sunstein, C.R. (2005) *Laws of Fear: beyond the Precautionary Principle*, Cambridge: Cambridge University Press.
Teeuw, W.B., H.J.G. de Poot and E.C.C. Faber (2008) 'De impact van convergerende technologieën op security toepassingen', *Justitiële verkenningen* 34, 1: 11-30.
Tetlock, P.E. (2005) *Expert Political Judgement*, Princeton: Princeton University Press.
Teulings, C., L. Bovenberg and H. van Dalen (2005) *De cirkel van goede intenties: de economie van het publieke belang*, Amsterdam: Amsterdam University Press.
Tielemans, P. (2004) *Tracking en tracing in de voedingsmiddelenindustrie. Hoe het kan en wat er moet*, Utrecht: Capgemini.
TNO (2003) *Inventarisatie: beoordeling van gezondheid in woningen in relatie tot energiegebruik*, Delft.
Tweede Kamer (2003-2004) *Brief van de minister van Justitie over Rechtsstaat en Rechtsorde*, vergaderjaar 2003-2004, 29279, nr. 9.
Tweede Kamer (2005-2006) *Brief van de staatssecretaris van VROM met kabinetsvisie 'Nuchter omgaan met risico's'*, vergaderjaar 2005-2006, 28089, nr. 15.
Tweede Kamer (2005-2006) *Motie van het lid Aptroot c.s. voor realisatie van één inspectie- en controledienst*, vergaderjaar 2005-2006, 29362, nr. 77.

Tweede Kamer (2005-2006) *Brief van de minister voor Bestuurlijke Vernieuwing en Koninkrijksrelaties en de staatssecretaris van Economische Zaken ter aanbieding van het Projectplan Eenduidig Toezicht*, vergaderjaar 2005-2006, 29362, nr. 107.

Tweede Kamer (2006-2007) *Brief aan de Tweede Kamer over Wetenschapsbudget 2004, kabinetsvisie nanotechnologie*, 16 november 2006, vergaderjaar 2006-2007, 29338, nr. 54.

Tweede Kamer (2006-2007) *Brief van de minister van Binnenlandse Zaken en Koninkrijksrelaties over de aanpak en stand van zaken met betrekking tot een strategie voor nationale veiligheid*, vergaderjaar 2006-2007, 30821, nr. 1.

Uyl, J.M. den (1978) *Inzicht en uitzicht: opstellen over economie en politiek*, Amsterdam: Bert Bakker.

Vandenbroucke, J. (2007), 'Einde van ware wetenschap nadert: marktwerking onderzoek bedreigt objectiviteit', NRC *Handelsblad*, 22 August 2008.

Verhoeven, I. (2004) 'Veranderend politiek burgerschap en democratie', pp. 55-78 in E.R. Engelen and M. Sie Dhian Ho (eds.) *De staat van de democratie. Democratie voorbij de staat*, WRR verkenning nr. 4, Amsterdam: Amsterdam University Press.

Verhoeven, I. (2006) 'Alledaags politiek burgerschap en de overheid', pp. 119-143 in P.L. Meurs, E.K. Schrijvers and G.H. De Vries (eds.) *Leren van de praktijk. Gebruik van lokale kennis en ervaring voor beleid*, WRR verkenning nr. 12, Amsterdam: Amsterdam University Press.

Voedsel- en Warenautoriteit (2008) *Nanodeeltjes in consumentenproducten*, The Hague: VWA.

Vreede, W. de (2003) 'Regulering van reclame voor receptgeneesmiddelen. Een geschiedenis van de interactie tussen zelfregulering en overheidsregulering', pp. 55-106 in H. Weyers and J. Stamhuis (eds.) *Zelfregulering*, special issue on Recht der Werkelijkheid, Reed Business Information.

Vyvyan Howard, C. and D. Ikah (2006) 'Nanotechnology and nanoparticle toxicity: a case for precaution', pp. 154-166 in G. Hunt and M.D. Mehta (eds.) *Nanotechnology – risk, ethics and law*, London: Earthscan.

Waarden, B.F. van (2005) *Where to find a 'demos' for controlling global risk regulators*, paper ECPR, Granada.

Waarden, B.F. van (2006) 'Werk in een wantrouwende wereld. Omvang en oorzaken van een uitdijende controle-industrie', *Beleid en maatschappij* 33, 4: 232-251.

Walzer, M. (2007) 'Deliberation, and what else?', pp. 134-146 in *Thinking politically. Essays in political theory*, New Haven, Conn.: Yale University Press.

Weber, M. (1968) 'Wissenschaft Als Beruf', pp. 582-613 in *Gesammelte Aufsätze zur Wissenschaftslehre*, Tübingen: J.C.B. Mohr.

Weber, M. (1988) 'Politik als Beruf', pp. 505-560 in *Gesammelte politische Schriften*, Tübingen: J.C.B. Mohr.

Werner, W.G. (2005) 'Responding to the undesired. State responsibility, risk management and precaution', *Netherlands Yearbook of International Law* 36: 57-82.

WRR (2000) *Borgen van publiek belang*, Rapporten aan de regering nr. 56, The Hague: Sdu.

WRR (2002) *Van oude en nieuwe kennis: de gevolgen van ICT voor het kennisbeleid*, Rapporten aan de regering nr. 61, The Hague: Sdu.
WRR (2004) *Naar nieuwe wegen in het milieubeleid*, Rapporten aan de regering nr. 67, The Hague: Sdu.
WRR (2005) *Focus op functies: uitdagingen voor een toekomstbestendig mediabeleid*, Rapporten aan de regering nr. 71, Amsterdam: Amsterdam University Press.
WRR (2006a) *Klimaatstrategie – tussen ambitie en realisme*, Rapporten aan de regering nr. 74, Amsterdam: Amsterdam University Press.
WRR (2006b) *Lerende overheid. Een pleidooi voor een probleemgerichte politiek*, Rapporten aan de regering nr. 75, Amsterdam: Amsterdam University Press.
Whiteside, K.H. (2006) *Precautionary Politics: principle and practice in confronting environmental risk*, Cambridge, Mass.: MIT Press.
Wiering, M.A. (2004) 'De watertoets: nieuwe spelregels voor water en ruimte', *Bestuurswetenschappen* 58, 5: 391-405.
Wildavsky, A. (1979) *Speaking Truth to Power: the Art and Craft of Policy Analysis*, New Brunswick: Transaction.
Wildavsky, A. (1988) *Searching for Safety*, New Brunswick: Transaction.
Wilde, R. de (2000) *De voorspellers. Een kritiek op de toekomstindustrie*, Amsterdam: De Balie.
Witteveen, W.J. (2007) 'Alternatieve regulering: de vele gezichten van de wetgever', *Handelingen der Nederlandsche Juristen-Vereeniging* 137, 1: 1-66.
Wood, S., R. Jones and A. Geldart (2003) *The Social and Economic Challenges of Nanotechnology*, Swindon: ESRC.
World Economic Forum (2007) *Global risks*, Geneva.
World Health Organization (2002) *The World Health Report 2002. Reducing risks, promoting healthy life*, Geneva: WHO.
World Health Organization (2003) *Consultation document to guide development of a WHO Global strategy for diet, physical activity and health*, Geneva: WHO.
World Summit on the Information Society (2005) 'Tunis Commitment', Document WSIS-05/TUNIS/DOC/7–E, 18 November 2005, www.itu.int/wsis/docs2/tunis/off/7.pdf.
Wynne, B. (1980) 'Risk, technology and trust: on the social treatment of uncertainty', pp. 83-117 in J. Conrad (ed.) *Society, Technology and Risk*, London: Arnold.
Wynne, B. (1989) 'Sheep farming after Chernobyl: a case study in communicating scientific information', *Environment* 31, 2: 10-39.
Wynne, B. (1996) 'Misunderstood misunderstandings: social identities and public uptake of science', pp. 19-46 in A. Irwin and B. Wynne (eds.) *Misunderstanding Science? The public reconstruction of science and technology*, Cambridge: Cambridge University Press.
Wynne, B. (2001) 'Creating public alienation: expert cultures of risk and ethics on GMOs', *Science as Culture* 10, 4: 445-482.

WEBSITES CITED

Action committee Hoogwaterplatform: www.hoogwaterplatform.nl
Activities of the European Union – summaries of legislation – the precautionary principle: http://europa.eu/scadplus/leg/nl/lvb/l32042.htm
Internet Governance Forum (IGF): www.intgovforum.org
American Chemistry Council – Responsible Care Initiative: www.responsiblecare.com
Office parlementaire d'évaluation des choix scientifiques et technologiques: www.senat.fr/opecst
Research programme Nanoned: www.nanoned.nl
Shell – Reporting in line with the UN Global Compact: www.shell.com/home/content/envirosoc-en/approach_to_reporting/un_global_compact/un_global_compact_000407.html
UK Resilience – Chartered Management Institute Business Continuity Survey 2008: www.ukresilience.info/news/cmi_survey_2008.aspx
Waarschuwingsdienst.nl: www.waarschuwingsdienst.nl
World Summit on the Information Society (WSIS): www.itu.int/wsis/index.html

Flood prevention, food safety, the transport of hazardous substances, infectious diseases, the risk of new technologies and many other threats to public health and the environment call for ongoing public alertness. However, the ways in which these safety risks are currently assessed and managed fall short in addressing the uncertainties of future threats. The Scientific Council for Government Policy, the official think-tank for the Dutch government, argues that in order to ensure future-proof safety policies, a new paradigm should be adopted. This paradigm is based on the *precautionary principle*, i.e. the notion that the vulnerability of humans, society and the natural environment requires a proactive approach to uncertainties. In this report, the Council suggests ways to embody this principle in both private and public law and in various institutional arrangements.

ISBN 978 90 8964 181 6

Amsterdam University Press • www.aup.nl