Towards integration and differentiation in environmental health risk governance

An international comparative quick-scan of policies

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Abstract

Over the past decades several shifts can be identified in the field of environmental health risk reduction policies in the Netherlands. In response to the shortcomings of traditional sector-based (environmental) policy, the government has proposed a new approach to deal with health risks that encourages an integrated as well as differentiated approach. This implies an increased desire to enhance cross-sectoral and stakeholder negotiations and achieve greater transparency, take levels of attainability and area -based factors into consideration, and assess the cumulative impact of risks. There is also a strong drive to incorporate cost-benefit assessment and public perception as part of the 'concern' assessment in decision-making practices alongside quantitative risk estimates of physical effects. Although some progress has been made in moving towards this new 'rational' mentality, it appears that there are still several obstacles in governmental decision -making that need to be overcome (e.g. relating to risk appraisal and the assessment of stakeholder opinions).

In the light of recent trends observed in the Dutch context – and the associated problems experienced – it was chosen to conduct an international evaluation of various national approaches to environmental health risk reduction policies, in order to assess whether similar trends (and possible solutions) can be seen elsewhere. The 12 countries included (the United States, Australia and ten nations in different parts of Europe) were evaluated on the basis of a set of indicators that can be used to measure integration and differentiation.

In general, this study demonstrates that countries are indeed showing similar shifts in integrated and differentiated risk assessment and risk governance to those witnessed in the Netherlands, although several of these changes are still in the initial phases and could therefore be developed further. A lack of scientific and other data, difficulties in weighing diverging sectoral ambitions, the quantification of health risks, budgetary constraints and insufficient communication (between risk assessors and risk managers; amongst different sectors, and with stakeholders) were mentioned as the primary barriers for implementation of more targeted and differentiated health risk reduction strategies. Most countries also expressed a desire for a more coherent and standardised approach to tackling environmental health risk. This paper therefore outlines the main trends in environmental health risk reduction at the international level, brings forward several elements that could form part of a new approach to risk, and gives some advice for future research.

The study should be seen as a quick-scan and should therefore not be considered comprehensive as such.

Samenvatting

In de loop van de afgelopen decennia kunnen in Nederland verscheidene verschuivingen in de aanpak van milieugezondheidsrisico's worden geïdentificeerd. Als reactie op de tekortkomingen van het traditionele sectorale (milieu) beleid heeft de overheid een nieuwe risicobenadering voorgesteld die een geïntegreerde en gedifferentieerde benadering aanmoedigt. Dit impliceert een verhoogde belangstelling voor: inter-sectorale communicatie, de haalbaarheid van normen, een gebiedsgerichte aanpak, het cumulatieve effect van risico's en (maatschappelijke) kosten-batenanalyses als basis voor besluitvorming. Verder wordt er veel aandacht besteed aan het bereiken van een meer transparante besluitvorming, waarin rekening wordt gehouden met de meningen van belanghebbenden (d.w.z. kwalitatieve gegevens) naast de kwantitatieve metingen van een bepaald risico.

Hoewel er al wel wat vooruitgang met betrekking tot deze 'rationele' mentaliteit is geboekt, blijkt het dat er nog verscheidene hindernissen overwonnen moeten worden (hoe weegt men de meningen van belanghebbenden in besluitvorming, bijvoorbeeld?). Gezien de recente tendensen die in de Nederlandse context zijn waargenomen – en de problemen waarmee men kampt – werd besloten om een internationale evaluatie van diverse nationale benaderingen rondom milieugezondheidsrisico's te ondernemen. Dit om enerzijds te beoordelen of er vergelijkvare trends elders zichtbaar zijn en anderzijds om te zien of er mogelijke oplossingen voor de Nederlandse problemen gevonden konden worden. De 12 bekeken landen (de Verenigde Staten, Australië en 10 landen in verschillende delen van Europa) werden geëvalueerd op basis van een reeks indicatoren die integratie en differentiatie meten. In het algemeen blijkt het dat de landen inderdaad verschuivingen vertonen die vergelijkbaar zijn met de Nederlandse situatie – hoewel een deel van deze veranderingen zich in de beginfase bevinden en zouden daarom nog verder ontwikkeld kunnen worden.

Een gebrek aan (wetenschappelijke) gegevens, complexiteit rondom het wegen van botsende sectorale ambities, de getalsmatige weergave van gezondheidsrisico's, begrotingsbeperkingen en te weinig communicatie (tussen leden van het risicoevaluatie-team en beleidsvormers; tussen verschillende sectoren en met belanghebbenden) werden vermeld als de belangrijkste barrières. De meeste landen hadden ook behoefte aan een meer coherente en gestandaardiseerde benadering voor het aanpakken van milieugezondheidsrisico's. Dit document schetst de belangrijkste tendensen in het internationale milieugezondheidsrisicobeleid, brengt verscheidene elementen naar voren die de basis van een 'nieuwe' benadering zouden kunnen vormen en geeft advies voor toekomstig onderzoek.

Dit onderzoek is slechts een vluchtige bespreking en kan daarom niet als uitvoerig beschouwd worden.

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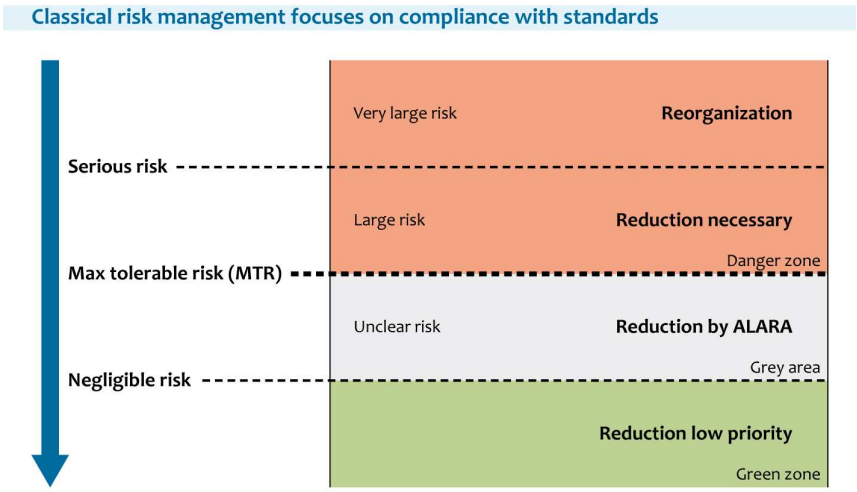
Chapter 1: Introduction and concepts

1.1. Introduction

In recent years, several significant shifts have occurred within environmental and health management domains in many countries of the developed world. In the Netherlands, for example, developments in the field of environmental and other health risk mitigation portray less reliance on sectoral regulation and increased use of more differentiated, area -based approaches. These trends can be clarified in light of the shortcomings of traditional sector -based regulation, and the increased complexity of modern-day society. Not all risks (and the people or areas they affect) are the same, which implies they must also be tackled differently (in a differentiated manner).

Most classical health risk management strategies focus on compliance with standards, limiting values or health--based guidelines, and aiming to prevent exposures from severe pollution. The traditional approach can be visualised as displayed below:



These classical, more sector-based risk management goals (including the pollution sector) focus on control and protection, having the same environmental health policy for chemical substances, industrial and transport safety, food, air and water, and on checking ‘quantified risks’ against standards, limit values or health-based guidelines. These goals are based on a general principle of equal, rights-based protection for every citizen, such as set out in the 10E-6 risk standard for mortality. Environmental problems with relatively large risks have indeed been controlled or at least substantially reduced in many countries. Remarkably, it has also become apparent that standards are not a goal as such, but instrumental to risk reduction policy!

However, this classical, technological health risk strategy to manage the probability, extent, and costs of risks has numerous limitations, as indicated below:

- Different sorts of risks seem incomparable
- Standards have different motives and safety margins
- Risks have varying levels of uncertainty
- Public health meaning of exceedance of standards is uncertain
- Control measures to achieve compliance with standards have different costs and benefits
- Political and societal support to pay for control measures are therefore often subject of debate

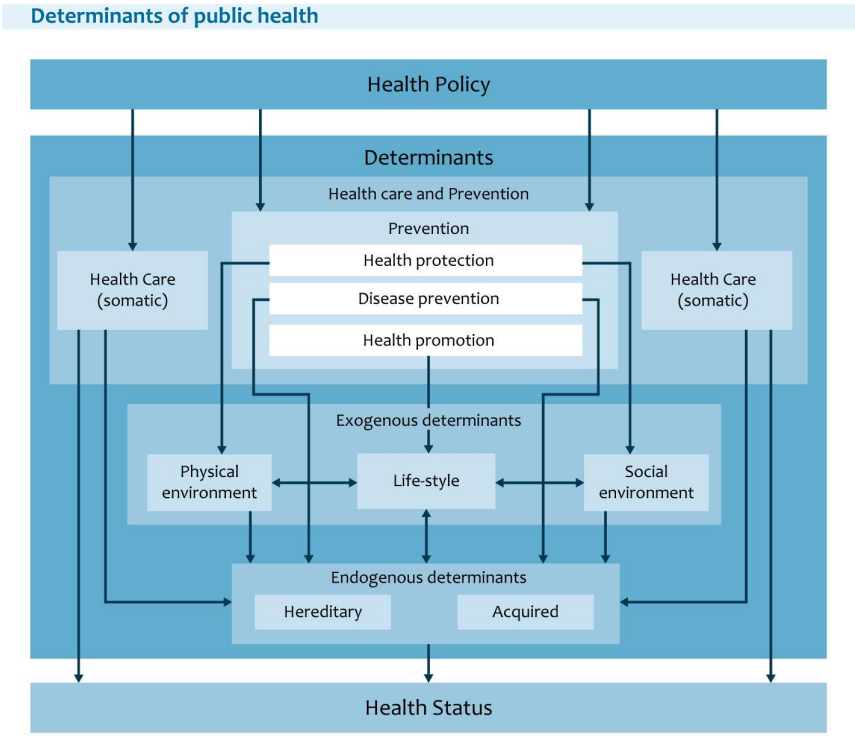
Current trends indicate a shift in risk assessment and risk management strategies from a 'technological' to a more 'societal' type of approach (Renn). Besides risk assessment with risk as a function of the probability, severity, and extent of effects, characterised by the 'technological' risk quantification, risk management is nowadays increasingly considered as concern assessment, in other words, how values and emotions affect risk perception and economic costs and benefits. 'Concern' has become an additional risk metric in risk assessment, not only through the perspective of scientists, but also through those of stakeholders, citizens and policy makers.

It is interesting to note that, as desirability and fairness of equal protection against environmental health risks have to be increasingly balanced against efficient use of sometimes limited public expenditure, the current Dutch environmental health risk policy has adopted the new Netherlands Environmental Assessment Agency's risk appraisal framework. This framework includes post-modern, more integrated risk assessment and concern assessment approaches and corresponding evaluation and appraisal tools, as indicated below:

1. **'Triptych of risk rationalities'**:
    - technological risk (no. of people, life years lost, burden of disease)
    - socio-economic consequence (costs and benefits)
    - public concern (risk perception and acceptance)

2. **'Policy deficits'**
    - to assess and monitor trends, performance, efficiency, distance to targets, and uncertainties

The newest development is to make a link between the areas of public health and environment policy through modelling environmental health effects in models for public health and chronic diseases. The Netherlands Environmental Assessment Agency and the Dutch National Institute for Public Health and the Environment are currently developing a 'Chronic Disease Model' in which exogenous, including the physical environment, and endogenous driving factors are included into a multi-determinant analysis. For details of this type of model, see the figure below:



According to these new insights, various experts (see Klinke & Renn, 2002 and MNP-RIVM, 2003) suggest the development of more integrated and differentiated risk characterisation and management concepts according to which risks are categorised by their complexity, uncertainty (including public perceptions) and severity (i.e. level of danger). Moreover, the level of ambiguity in the interpretation of the risk assessment and modelling results, which determines how controversially the risk is perceived and accepted to be, also plays a role (Renn, 2004). On the basis of the characteristics the risks possess, an adequate management strategy can then be chosen to tackle them. This line of thinking has also been incorporated into the Dutch national government's approach to environmental health risk (2004).

This does not mean to say that the successes achieved by sector -based environment and health policies over the past decades have gone unnoticed. It has been successful in both the reduction of large environmental problems from the 1950s to the1970s, and the prevention of large, sometimes new negative environmental health effects up to now. This strategy sooner signifies the beginning of an era in which policymakers are searching for additional strategies that may *accompany* and *enhance* traditional sectoral regulation. This is felt to be necessary because several persistent environmental problems still need to be solved adequately, and because strict sector -based norms could lead to excessively expensive risk management interventions (particularly in the Netherlands since risk management has always been geared towards achieving 'equal protection for all'). A new approach to tackling risk is deemed desirable from a governmental perspective (through improved consideration for the overall societal costs and benefits of proposed risk management strategies),

together with an augmented focus on developing a more 'integrated' mentality[1] and encouraging a differentiated risk management approach (allowing an approach to be tailored to a specific area or to the characteristics of a particular risk).

It is widely recognised that environmental and health issues are strongly influenced by activities in other sectors. This implies that cross-sectoral integration is necessary to achieve targets for lasting environmental health risk reduction and their corresponding strategies. Some experimentation has taken place in the Netherlands regarding the integration of environmental ambitions (and health concerns) in the early stages of spatial planning. By focusing explicitly on the availability of green space or safe recreational locations, for example, environmental ambitions were integrated with other spatial considerations early on in the planning phase. Such an approach also allows area -based aspects to be taken into consideration, generating a differentiated risk management strategy that is tailored to the local situation (and the particular risk being tackled).

Standards are generally -based on estimated levels of danger, which were traditionally founded on scientific evidence, in combination with economic feasibility and the best available techniques. However, with today's increasingly diverse and empowered stakeholder domain, the societal perception and acceptance of risk is becoming an important consideration in decision-making. There has therefore also been a tendency to integrate more qualitative information in risk management decisions (by explicitly considering public opinion), which is seen to go hand in hand with better risk communication and increased transparency. The integration of qualitative data, local area -based considerations and focal points from other sectors is therefore occurring more frequently.

The danger of integrated approaches lies in the fact that diverging ambitions from different sectors (and stakeholders) are considered simultaneously, which can easily lead to a situation in which other ambitions are favoured over environmental goals. It is thus likely that the need for some top-down regulation will always remain, in order to maintain at least a baseline level of environmental quality. Furthermore, certain risks (particularly those with direct cause-effect relations) can still be dealt with through traditional regulation. This implies that a balance needs to be found between sector -based regulation and more area-based, integrated approaches (geared at tackling more complex risks). This is by no means a simple task, and the shift towards the implementation of these latter strategies in the Netherlands has therefore been very gradual.

In view of the challenges experienced in the Dutch context with the implementation of integrated environmental health risk policy principles, an international comparison of several national approaches centred on environmental health risks was perceived as being potentially enlightening. By conducting such an analysis, it would be possible to explore whether the trends outlined above were visible elsewhere, as well as identifying whether innovative approaches exist elsewhere that the Netherlands could learn from. Such an analysis could ultimately lead to some valuable conclusions and advice regarding the formulation of a more coherent approach to tackling

[1] Please note the concepts of integration and differentiation will be discussed in further detail in *Section 1.4.5; Page 14* of this paper.

environmental health risks (whereby the concepts of integration and differentiation play a central role). This approach formed the basis of our research, which was aimed at answering the research questions set out below.

1.2. Research questions & structure

This study focuses specifically on the dynamics surrounding the development and implementation of national, integrated approaches that tackle the health risks associated with environmental factors. More specifically, it is aimed at answering the following central research questions:

In light of experiences in the Dutch context, can similar shifts towards more integrated and differentiated approaches for tackling environmental health risk governance be identified in other countries?

To what extent have these shifts occurred and what have the experiences taught us? (i.e. what successes have been achieved and what are the primary barriers?)

Is there a general desire to make further changes in risk governance policies? Where do these changes stem from and how is their implementation envisaged?

In the first chapter, the concepts of risk and risk management are discussed in further detail, followed by a more detailed description of the research strategies employed in this study. The second chapter briefly evaluates the Dutch situation in order to provide a good basis for answering the first research question set out above. This chapter culminates with a set of indicators (characteristic of a more integrated and differentiated environmental health risk approach) that may be used to assess the approaches used in other countries. The third chapter brings forward an international quick-scan of approaches in various other contexts whilst comparing these to the Dutch context where relevant. The final chapter is aimed at answering the research questions set out above, as well as providing advice for future research.

1.3. The concept of risk

1.3.1. International developments in health risk reduction

The World Health Organisation (WHO) played an important role in placing environmental health risks on the international agenda. The 1977 'Health For All by 2000' (HFA) action programme put the environment forward as being a key determinant of health. According to the WHO, 'environmental health comprises those aspects of human health, including quality of life, that are determined by physical, chemical, biological, social, and psychosocial factors in the environment' (WHO statement cited in de Hollander, 2004: 166). The physical environmental components considered to be most influential in this regard are air, water, hazardous waste, food safety, human ecology & settlements (including indoor air) and occupational health & safety.

In 1997, the United Nations Environment Programme (UNEP) published the first Global Environment Outlook (GEO-1), which concluded that health risks relating to many environmental factors have significantly decreased on a global basis. However, a subsequent report (GEO 2000) showed that there are two primary areas of environmental risk that are posing an *increased* threat to human health: the increased occurrence and greater geographical extent of forest fires, and the increased severity and frequency of natural disasters (Passchier Vermeer et al., 2001: 16). This by no means indicates that these are the *only* risks that should be focused on; they are merely the risks that have *increased* the most in recent years.

1.3.2. EU health risk policy development

In 1984, the European Union (EU) member states formulated 38 health related goals on the basis of the HFA strategy. Eight of these goals were specifically related to the environment (focused primarily on preventing potential damage caused by biological[2], chemical[3] and physical[4] agents). Ten years later, at the 1994 European Conference on Environment and Health in Helsinki, all EU countries agreed to generate a National Environmental Health Action Plan (NEHAP). One of the aims of the NEHAP was to achieve greater cross-sectoral integration by ensuring environmental and health related goals were developed in cooperation with the agricultural, energy, industry, transport and tourism sectors (Passchier Vermeer et al., 2001).

The EU published its sixth environmental action programme entitled 'Environment 2010: Our future, Our choice' in 2001. The main goal relating to environmental health risks was to create an environmental quality in which the levels of man-induced polluting agents, including various forms of radiation, do not generate risks for human health (Passchier Vermeer et al., 2001: 17). Many of the member states' national environmental policies have therefore been developed along the same line of thinking. EU regulations govern emissions, ozone, activities influencing UV radiation, certain dangerous substances (mostly industrial chemicals) and genetically modified organisms. The approaches taken by member states in tackling these risks therefore have several features in common.

1.3.3. Conceptualising risk

There is no universal agreement regarding the scientific assessment of risks, but according to the Netherlands Environmental Assessment Agency (PBL[5]), risk is a 'multidimensional concept' that is made up of both quantitative (objective) aspects, as well as a more qualitative dimension (de Hollander & Hanemaaijer, 2003).

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[2] Such as bacteria and viruses

[3] For example, pesticides and heavy metals

[4] *For example*, noise and radiation, whereby radiation can be either ionising (stemming from outer space and terrestrial sources such as building materials, nuclear power stations, radioactive waste and soil) or non-ionising, such as low frequency electromagnetic fields, GSM and UV radiation (Passchier Vermeer et al., 2001: 186).

[5] Planbureau voor de Leefomgeving (PBL) (formerly the Milieu- en Natuurplanbureau (MNP, see now www.pbl.nl).

Quantitative elements may involve the physical measurement of certain environmental conditions, or calculating the number of deaths that can be attributed to a particular risk across a certain time span and in a specific geographical location. On the other hand, qualitative data can be collected by, for example, surveying stakeholder opinions (i.e. assessing the societal perception of risk). Several factors that play a role in subjective risk perception are uncertainty, the level of familiarity (i.e. has there been any previous contact with this type of risk), voluntariness[6] and the degree of trust in authoritative bodies (Passchier Vermeer et al., 2001: 25). Aside from these quantitative and qualitative aspects, the following conceptualisation of the *magnitude* of risk is often put forward (Neumann & Politser, 1992):

RISK = Probability (of the event) x Consequence

By and large, it appears that risks are conceptualised in terms of causal chains (whereby a certain situation or action has a specific predictable or undesirable effect). Many risk problems do not, however, involve a simple cause and effect relationship - based on only one element, but rather a complex accumulation of various different cause and effect chains (Dutch Health Council, 1995). In most countries, national approaches to risk increasingly attempt to take this complexity into consideration.

Ultimately, the development of national legislative systems along with changes in cultural perspectives will have influenced risk-management strategies throughout the world. However, it generally remains the task of the national governments to make decisions regarding the social and economic cost of risk prevention (on the basis of a trade-off with the potential damage of taking no action).

1.4. Generating an understanding of the process of tackling risks

The approach to tackling risks is increasingly conceptualised in the form of various, often overlapping and iterative phases. One of the most recent and comprehensive models was proposed by the International Risk Governance Council (IRGC[7]) in their White Paper: *Risk governance: Towards an integrative approach* (2006: 13):

[6] It appears that people tend to perceive activities that involve involuntary exposure to risk more negatively than those activities based on voluntary choices regarding risk-taking behavior (de Hollander & Hanemaaijer, 2003). This implies that environmental risks are generally weighed more heavily than risks associated with issues such as traffic safety.

[7] See www.irgc.org

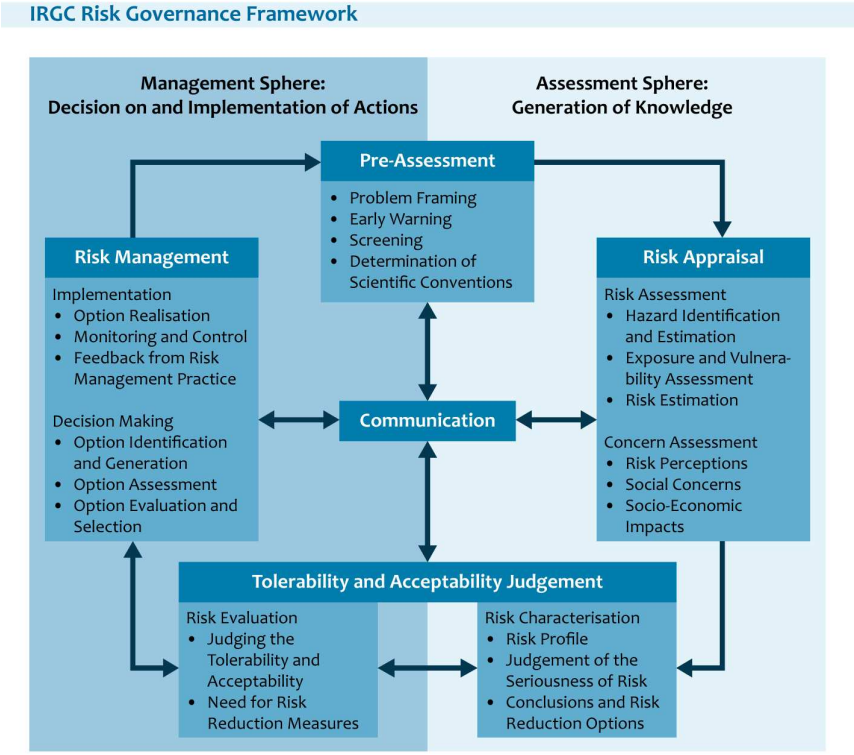

Figure 1: The IRGC Risk Governance Framework

The diagram above clearly illustrates the importance of communication throughout the various suggested phases (i.e. pre-assessment, risk appraisal, tolerability & acceptability judgment and risk management). Furthermore, it illustrates a focus on more qualitative forms of information (i.e. risk perceptions) throughout the risk appraisal phase, which indicates that several of the trends identified in the Netherlands (as put forward in the introduction) are clearly in line with this mentality.

A more generalised view of the phases included in the process of tackling risks was used in this paper (this is highlighted in further detail below) in order to leave the research more open-ended. In general, the manner in which risks are dealt with varies in different contexts, which may be partly attributed to historical developments/changes that have occurred in society (such as the evolution of risk communication – many governments used to simply impose top-down regulation, whereas interactive dialogue with stakeholders is now deemed necessary in many cases). In order to identify any relevant trends in the field of health risk reduction at international level, the 'traditional' approach to health risk in the various contexts was examined briefly before assessing the current 'modern' approach.

In theory, the approach to risk can be subdivided into two main components: the preparatory phase (consisting of risk assessment, the setting of priorities and defining norms) and the risk management phase (involving the implementation of certain tools and strategies to attain the goals defined in the preparatory phase). These phases will be explained in further detail below. All the factors discussed in the following section

have been evaluated for both traditional and current (modern) approaches to health risk reduction.

1.4.1. The preparatory phase

The preparatory phase involves a risk assessment[8], which is usually based on a scientific approach composed of various steps including the identification of biological, chemical or physical sources of risk, an assessment of possible exposure and at what levels, and risk characterisation (Passchier Vermeer et al., 2001: 25). 'Risk assessment is a term used widely across many different disciplines' (Fisher, 2000: 15) and generally involves an evaluation of exposure to environmental and other stressors, and an estimate of their effects, based on the knowledge available (Dutch Health Council, 2003). This report only considers the assessment of potential direct damage to human health (not ecosystem related damage).

The assessor has a large degree of impact on the outcomes of a risk assessment, as choices need to be made regarding the use of different knowledge sources and the delineation of the scope of factors that will be considered. Furthermore, 'risk assessments are always uncertain to some extent' (de Hollander & Hanemaaijer, 2003: 5); however, the weight of this uncertainty – and the types of uncertainty that are considered relevant – have a direct impact on the form (and evaluation) of risk policy. If uncertainty has been dealt with explicitly, or in an innovative way, this is discussed in further detail.

In this initial phase risks may also be prioritised; therefore the environmental factors considered being the primary stressors on human health in the various policy contexts will be compared (i.e. whether policy is geared at specific environmental dossiers). Furthermore, norms may be formulated to tackle the most prominent risks. These standards 'are concerned with changing the *status quo* through either banning or altering behaviour' (Fisher, 2000:113).

Determining acceptable levels of risk (and the degree to which one wishes to influence behaviour) are often subjective matters. Nevertheless, quantitative analyses may support the process of setting standards. For example: the WHO generated a measure called the Disability Adjusted Life Year[9] (DALY) that is used commonly in the field of health and environmental management (World Health Organisation – WHO, 2007). This methodology has been used to assess the extent of the impact of risks in premature death and (disabling) injury-related terms; some of the case studies use similar assessments.

1.4.2. The risk management phase

[8] In some instances referred to as a *risk evaluation*

[9] The DALYs for a population are calculated by adding the years of life lost (YLL) due to premature death to the years lost to disability (YLD) caused by exposure to a particular risk (World Health Organisation – WHO, 2007).

Risk management involves assessing various political alternatives on the basis of the preceding evaluation and, if necessary, implementing and monitoring the necessary measures for risk abatement (Passchier Vermeer et al., 2001). The US EPA (2007) defines the concept as: 'The process of evaluating and selecting alternative regulatory and non-regulatory responses to risk. The selection process necessarily requires the consideration of legal, economic, and behavioural factors.

Several tools may be used to supplement this process (cost/benefit analyses, interactive methods, expert panels, etc.). The methods currently being used in the countries assessed will be highlighted briefly and the risk management strategies employed discussed in further detail. Some common examples include the use of monitoring (including environmental monitoring), the installation of warning and early warning systems, the implementation of legislative requirements that guide development projects, and the use of permits to control potentially damaging activities.

Various factors are applicable to both the preparatory and the risk management phase, and therefore receive explicit attention in the following section.

1.4.3. Other relevant areas of assessment

According to de Hollander and Hanemaaijer (as cited in de Hollander, 2004: 74), modern risk policy decisions are often a mix of four principles; approaches in the various countries may exhibit a number of the following characteristics:

1. Rights based approach: risks should not be imposed on certain groups for the benefit of others (equal protection for all above a certain risk level)
2. Utility based approach: maximizes benefits for society as a whole (with greatest increase in overall public health for lowest cost)
3. Technology based approach: requires the best available techniques (and must therefore constantly evolve to incorporate new developments)
4. The precautionary principle[10]: ensures a cautious approach in light of complexity, uncertainty and irreversibility

References are made where any of these principles can be used to typify the approaches used in the assessed cases. The roles and responsibilities of the various parties involved may vary in the assessment and risk management phases. For this reason, some specific attention will be paid to the functions (and relative power) of different players in these processes. In order to allow the public and the business sector to play an active role in tackling risks, risk communication is essential as it 'enables stakeholders to make an informed judgment about a risk and its management' (enHealth, 2004: xvi). Risk communication, in this case the interactive exchange of information between relevant parties (i.e. risk assessors, risk managers and stakeholders), can be an important element in tackling risk (Passchier Vermeer et al., 2001). It can occur to varying degrees and at different points throughout the risk assessment and management phases.

[10] This concept suggests that scientific uncertainty regarding the possible effects of an activity cannot be used as an argument against implementing measures to prevent possible harm (VROM, 2004: 20).

Different societal standpoints on an issue could perhaps be partly attributed to the media (including the Internet) as they 'do not only have the power to inflate concern over minor hazards: they may also dull concern over serious ones' (de Hollander and Hanemaaijer as cited in de Hollander, 2004: 72). Interestingly, research has also shown that people's perceptions often involve an implicit evaluation of the possible benefits alongside the negative side effects of a particular risk (Vlek & Stallen, 1981). It appears that individuals often attempt to visualise the possible effects of a risk (and the likelihood of it occurring); in order to generate a risk scenario (De Vries, 2002). The content of this scenario will be greatly influenced by the amount of available information. Risk communication can therefore play an important role in shaping peoples perceptions (by providing more 'scenario' information).

Specific attention is given if and where certain (sometimes innovative) strategies are used to achieve risk communication, or if any problems have arisen surrounding this process. A description of the successes and pitfalls of the traditional and modern approaches taken in various countries will also be given, together with a brief description of how policy success is assessed at national level. The most important elements of the discussion have been summarised in the simplified analytical framework below.

1.4.4. The analytical framework

The factors mentioned above can be summarised graphically as follows:

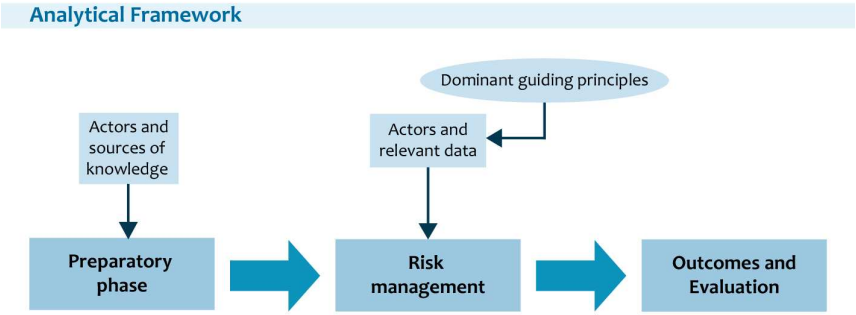

Figure 1: The Analytical Framework

This is, of course, a very generalised and basic representation of the phases occurring in an approach for tackling environmental health risks (and it does not illustrate the process of risk communication, which can occur throughout the assessment and management phases as shown in the IRGC model depicted earlier). However, it does illustrate the various components that will be discussed in the context of this paper (which were discussed in detail above), and indicates that decisions taken in the risk management phase may be guided by several overlapping principles. Examples of such principles may include 'obtain an equal protection for all', 'focus on implementing the most cost efficient strategy' or 'ensure protection of the most sensitive population groups' – to mention but a few.

A focus on increased integration and differentiation has often been witnessed in the preparatory as well as the risk management phase. These concepts therefore warrant some specific attention (followed by a brief discussion of the research strategies).

1.4.5. Integration and differentiation

The term 'integration' regularly appears in modern-day discussions relating to environmental management, often with differing interpretations. Essentially, the term means 'to form, coordinate or blend into a functioning or unified whole; to unite with something else; to incorporate into a larger unit' (Merriam-Webster's Collegiate Dictionary as cited in Persson, 2004: 10). This definition implies that integration can occur at different levels (and to varying degrees), whilst suggesting that integration can refer to the unification of individual parts into a new coherent whole, or to the incorporation of smaller parts into a larger, pre-existing element (or 'unit').

In the context of this paper, integration can occur at various levels (including decision-making levels); the environmental domain is used here as an illustration. At the lowest level it can refer to increased integration *within* an environmental component (e.g. the calculation of the overall hindrance caused by different frequencies of noise experienced simultaneously[11], rather than formulating separate norms for each different source of noise hindrance). One level higher one would find integration *between* environmental components (e.g. by taking an approach that tackles risks such as noise and air pollution simultaneously).

Besides integration within a certain *sector*, it is deemed increasingly desirable these days to attempt taking goals in *other* sectors into consideration whilst tackling sectoral risks (in this case we are looking specifically at the integration of the environmental and health goals, but another example would be tackling environmental problems, and thereby indirectly health-related risks, through spatial planning). This process can be termed *cross-sectoral* integration and can occur at various levels of government. Furthermore, one can also identify trends that suggest greater integration *between* different levels of government (i.e. between local, provincial, national and international governmental levels), although no specific terms have been coined for this phenomenon.

This research focuses on the approaches to risk at *national* level. However, different sources of knowledge can be consulted to support decision-making at each of these levels. A certain degree of integration between quantitative and qualitative information can be achieved by including information from outside the scientific domain (i.e. focussing on more qualitative forms of information such as stakeholder perceptions, or including financial considerations). Working towards greater integration of knowledge sources and cross-sectoral coordination will ultimately lead to an outcome that takes other needs besides environmental ambitions into consideration.

[11] Another example is the overall measure of 'air quality' that takes into consideration the varying levels of different atmospheric pollutants and constituents.

Lastly, the integration of considerations such as cost efficiency and the attainability of norms (e.g. by the business sector) can be an important factor in modern-day decision-making. This report assesses whether approaches in the selected countries aim to achieve any of these forms of integration, and whether there are any factors standing in the way of achieving these goals. However, some countries may be making shifts towards differentiation in addition to focusing on integration.

Morales & Gilner (2002) define differentiation as 'discrimination between things as different and distinct'. In the context of this paper, differentiation (or a *differentiated* risk management approach) can be achieved in two different ways, as was outlined briefly in the introduction. It is possible to generate a risk management strategy that is either -based on the local characteristics of a certain area (i.e. the creation of an area -based approach), or tailored to the specific risk being tackled (i.e. supporting the idea that not all risks are equal and should therefore be approached in different ways). This research will briefly evaluate whether a differentiated risk management approach is possible within the national policy context, as well as assessing whether differentiated approaches are indeed implemented if this option is available.

1.4.6. Research strategies

The international data for this report was collected through the distribution of an e-mail questionnaire (see *Appendix 1*), which was sent to European national environmental government agencies through the Dutch Environment and Planning Agency (MNP) contact network. Contact with countries outside Europe was established using a general e-mail, after which the same questionnaire was distributed to relevant contact persons. The countries that responded to the questionnaire were included in this report (although a telephone interview was conducted for Hungary and Slovenia). This implies that the sample was chosen purely on the basis of the availability of information obtained through questionnaire and interview responses. The countries included in the analysis were the UK, Ireland, Scotland, Flanders (Belgium), Denmark, Germany, Malta, Hungary, Slovenia, Iceland, the United States and Australia.

Flanders is the most densely populated region of Belgium (Vlaamse Milieumaatschappij, 2007); and – uniquely – this province has its own parliament. Decision-making is similar to that of the federal government, although the Belgian national government can still impose certain restrictions. The most detailed information on environmental health risk strategies was obtained from the Flanders environment agency and was therefore included as a case study. This is the only country for which the process occurring at *provincial* level was highlighted rather than a detailed description being given of the *national* approach (although the unique situation in Belgium, with a parliament at provincial level and the province expressing a clear desire to become more independent warrants the inclusion of the Flemish approach).

In order to assess the Dutch situation, several interviews were conducted with experts in the field of environmental health risk reduction. Furthermore, a thorough literature review was performed, which involved an analysis of government reports, advisory policy documents, relevant websites and academic articles published on risk

management and integration. A wide array of data sources was consulted in order to reduce bias. In most cases the questionnaires were sent in by one individual, although answers were given on the basis of information provided by people performing a wide range of functions within their agency. This does not, however, eliminate the fact that several of the responses obtained from the questionnaires and interviews could be influenced by personal experiences and opinions. Due to the short time span of this research (approximately two and a half months), there was insufficient time to verify the information, which means that some of the data may be incomplete. Nevertheless, it is felt that this report provides a good basis for further research in this area.

Chapter 2: The Dutch situation

2.1. Introduction

The first evidence of environmental health risk being included in Dutch policymaking dates back to the 1980s (VROM, 2004). The first real legislative basis for tackling environmental health risk was published in 1985[12] and subsequently revised in 1989 in a section of the first Dutch National Environmental Management Plan (NMP[13]) entitled 'Dealing with Risk'[14]. Interestingly, one of this document's primary objectives is said to be 'sustainable development' (Hanekamp, 1999: 28), which implies that from the onset an 'integrated' approach was taken by embedding the concept of risk in a broader theoretical framework (even though this 'integrated' mentality had not yet visibly been put into practice). In the following section, the traditional and modern Dutch approaches to risk will be further explained in line with the analytical framework provided in the first chapter[15].

2.2. Traditional approach

The approach to risk has traditionally involved a quantified analysis of the predicted consequences of a particular event (e.g. a potential industrial hazard or the release of a chemical into the environment), whilst attempting to adhere to the concept of 'equal protection for all'. This indicates that it was largely a rights-based approach. Risk was defined as 'the undesirable effects of a particular activity tied to the likelihood of the these effects occurring (Dutch Health Council, 1995: 20).

2.2.1. Preparatory phase

i. Risk assessment and categorisation

The steps needed to prepare for tackling risks, as suggested in the 1989 environmental risk policy document, are as follows (Hanekamp, 1999: 29):

- Determine the dangers (for people and environment)
- Estimate or calculate the scope of potential negative effects and the probability of these occurring now or in the future

These two steps were conducted mainly by academics/researchers. The importance of the societal perception of risk is mentioned, but no concrete advice is given on how this factor may be included in decision-making. It is also acknowledged that

[12] Tweede Kamer (1985) *Indicatief meerjarenprogramma milieubeheer 1986-1990* (Dutch Health Council, 1995); the Netherlands also designed the global 'WHO – Health for All' strategy (see *Chapter 1; Section 1.2.1*) by creating the Nota 2000 in 1986 (VROM, 2004)
[13] Nationaal Milieubeleids Plan (NMP)
[14] In Dutch: 'Omgaan met risico's' (Tweede Kamer – TK, 1988-89, 21 137, nr. 5)
[15] See *Chapter 1; Section 1.3.4*

cumulative effects can occur, but that large gaps in knowledge available on the synergistic effects of various risks occurring simultaneously complicate this factor significantly (Tweede Kamer – TK, 1988-89: 10).

No explicit attempts were made to categorise risks on the basis of their characteristics or the perceived extent of their impact. However, a distinction was made between individual and group risks[16] relating to external safety (TK, 1988-1989: 9). A measure for group risk was included to take account of all non-quantifiable factors that do not have an individual risk limit (as well as considering the relatively large societal impact of a group of people dying at once versus the death of one individual). Another distinction was made between risks relating to new initiatives and those in existing situations (TK, 1988-1989: 11). The aim was to achieve the same level of protection in both scenarios, but it was discovered that this may not always be feasible for the latter. The prioritisation of risks was necessary to allocate resources efficiently.

ii. Prioritisation

In general, all risks were treated equally and expressed in quantified form to enable prioritisation. The initial focus on risk involved three main areas: ionising and non-ionising radiation, exposure to harmful substances and the probability of accident-related death (or external safety). In the Netherlands, external safety risk management is geared specifically at controlling the use, storage and transport of dangerous substances, as well as air traffic (Passchier Vermeer et al., 2001: 187). Specific norms were therefore formulated for these risk factors (it is not indicated why these elements were prioritised, suggesting the decisions surrounding focal points were made in a non-transparent manner).

iii. Goals and norms

The 1989 strategy suggests that environmental policy consists of two complementary management approaches, one focused on *sources* and the other on *effects*. The source related component of the strategy prevented unnecessary environmental pollution and was built on the 'stand still' (i.e. levels should not increase) and the As Low As Reasonably Achievable (ALARA) principles. ALARA is aimed at reducing the negative effects and side effects of human activities on people, plants, ecological functions and goods (TK, 1988-89: 8). The principle was initially geared primarily at controlling the effects of radiation.

Effect -based management[17] proposes two quantitative levels: a 'Maximum Tolerable' level of risk (MTR[18]) and a 'negligible' risk level (VR[19]), the latter being the level at

[16] A group risk is the probability of a group of people of a particular size becoming the victim of an accident over the span of a year (TK, 1988-1989: 12).

[17] According to the Dutch House of Commons (Tweede Kamer, 1988/89: 8), the 'effects' that need to be managed are negative effects on health (death, illness and physical irritation); finance (corrosion, loss of environmental functions and space) and well-being (which cannot be expressed monetarily). However, although the potentially negative effects on well-being are recognised, it is stated that the inclusion of this factor in environmental policy would not yield any added benefit (and therefore policy should focus on the effects on health and money).

[18] Maximaal Toelaatbaar Risiconiveau (MTR)

[19] Verwaarloosbaar Risiconiveau (VR)

which the government considers no further risk reduction measures to be necessary (i.e. regarding the desired level of quality). To obtain the VR level, the MTR is simply divided by one hundred[20], which is a random methodology, not -based on any concrete scientific principles. The MTR and VR were used to set exposure levels for radiation, hazardous substances and external safety (see *Appendix 2.1* for further detail). This approach to health risks can be considered quite uniform (due to the equal treatment of all risks) and rigid (exceeding the norms was not allowed).

From the 1970s, emission standards and sector -based laws were also generated for separate environmental domains such as soil, air and water (*e.g.* limits were set for the discharge of fluoride and nitrates into drinking water). Environmental health risks were therefore also controlled through the use of other judicial instruments specifying minimum norms[21]. Furthermore, genetically modified organisms were recognised as a risk, but norms were decided upon empirically per case. The document does not specify how the minimum standards for these risks compared (in strictness and level of protection) to the MTR and VR levels identified for the other three risk categories.

2.2.2. Risk management

i. Tools, strategies, and responses

The choices regarding risk management were -based on the idea that knowledge stemming from the natural science domain would be capable of solving all health risk related problems (Passchier, 2007). In 1989, the government put forward the following risk-response guidelines (TK, 1988-89):

- Decide to what extent the determined risks are acceptable[22]
- Prevent risks entirely where possible, otherwise implement source or effect-oriented strategies
- Maintain situations in which an *acceptable* level of risk has been reached, and attempts to reach a *negligible* level of risk where possible

In principle, an equal level of protection was to be achieved for all citizens. Due to this strong focus on equity, compensation (which technically involves allowing lower levels of quality for a certain environmental component in exchange for improvement elsewhere – a mechanism that was being used widely in France from the 1970s to compensate citizens for nuclear power plants being installed in their villages) used to be considered a taboo in the Netherlands as it inadvertently led to an unjust level of environmental protection for certain segments of the population (Passchier, 2007).

[20] There is a strange inconsistency in risk related policy here, because the *risk* is divided by one hundred to achieve the level of VR (as mentioned above) for the identified human risk levels, whereas the *concentration of the relevant substance* is divided by one hundred for ecosystem related risks (Hanekamp, 1999: 33).

[21] Noise and odour, for example, were already regulated (with a maximum level of 55-65 dB and 1 odour unit per m^3 respectively).

[22] It must be remembered that identifying an 'acceptable' level of risk greatly depended on which criteria were included in the decision making process (and therefore approaches to risk have always been somewhat subjective).

2.2.3. Defining responsibility

Decisions were taken in a top-down fashion, whilst being supplemented by academic research. Scientists were therefore in charge of the preparatory phase, whilst the political domain handled risk management. The government was ultimately responsible for health risk reduction and risk communication was limited, with stakeholders and the public only being informed after decisions had been made (according to the 'decide – announce – defend' principle).

2.2.4. Integration and differentiation

It should be explicitly mentioned that the approach to risks outlined above is only applicable to environmental issues. However, tackling health risk by setting environmental standards does indicate some integration between the areas of health and environmental management. Although the strategy states that people's perceptions of risk should play an important role, no indication is given on how such qualitative information can be used to generate more integrated risk assessment content.

The 1989 risk strategy does, however, mention the importance of trying to generate approaches that tackle various environmental components simultaneously (thus achieving increased integration within the environmental sector). In line with this mentality, the government started experimenting with the *Integrated Environmental Zoning*[23] method, which was aimed at integrating noise, odour, air and external safety standards. The idea was to create one coherent index (by dividing the existing level of exposure by the associated norm) that could be used to create a common measure for each risk (Van den Berg, 2007). These could then be added to achieve the overall level of exposure for a certain area. However, it soon became clear that different environmental risks could not simply be added together and the method encountered many problems in the implementation phase. After applying the method to eleven case studies, there were many consequences for spatial planning (including breaking down large portions of certain cities to reduce the environmental impact of industry). Many municipalities therefore saw the process as potentially threatening to future spatial developments and the method was not deemed attainable (De Roo & Visser).

2.2.5. Outcomes of the traditional approach

i. Successes

The traditional approach outlined in the first half of this chapter, whereby concrete norms were formulated and subsequently implemented in a top-down manner, was able to tackle the 'simple' environmental issues (where direct cause-effect relationships could be identified). This led to a significant improvement in environmental conditions in many regards. However, it became clear over time that certain problems (such as indoor Radon pollution and risks surrounding high voltage

[23] In Dutch: Integrale milieuzonering (TK, 1988-89: 26)

power lines) were too complex to be tackled adequately through this approach (Passchier, 2007).

ii. Problems and shortcomings

The traditional norms were based on the idea that the same limits must be imposed for each equal negative effect, regardless of the source or agent (Tweede Kamer, 1988 to 1989), in the hope that this would facilitate the comparison and prioritisation of health goals. There was no indication, however, of how one could determine whether effects were indeed 'equal', and this generated several problems over time. Additionally, tackling issues in a sector -based manner did not take the cumulative impact of problems into consideration. It became clear that focusing on tackling problems independently was no guarantee that the problems arising from the interaction of different elements would also be addressed. Moreover, many of the standards formulated were not attainable on economic grounds, and it became clear that norms could not be set without stakeholder input (from the business sector in particular). Uncertainty was also dealt with only indirectly, which led to criticisms over the lack of transparency (Dutch Health Council, 1995).

The rigid structure that formed the basis of risk-related decision-making (with numerically permissible levels of risk aimed at achieving an equal amount of protection for all) did not allow for alternative, creative options for risk management to be explored (Dutch Health Council, 1995: 50). This suggests that the overall economic and social costs and benefits of different approaches were not considered, but that there was a strict focus on adhering to the MTR. Furthermore, the risk assessment and risk management phases were distinctly separated (Passchier, 2007). From a policy and stakeholder perspective, it was desirable to implement a more flexible approach in which the overall societal benefits were considered alongside quantified measures of risk (and more communication took place between risk assessors and managers). A more extensive and detailed risk analysis was therefore preferable to merely prohibiting activities that exceeded the MTR (Passchier, 2007).

2.3. The modern approach

In 2001[24], the Netherlands produced their own version of the NEHAP (see *Chapter 1, Section 1.2.2*), which was aimed at reducing environmental health risk and improving risk communication (Dutch Health Council, 2004). The Dutch government's most recent policy document relating to risk, entitled '*Dealing Sensibly with Risk – decision-making with a feeling for uncertainty*[25]', was -based on research conducted by the National Institute for Public Health and the Environment[26] (RIVM). This document is seen as being part of a broader debate about risks and safety (including perceived risks and safety), the distribution of responsibility, and transparency in political decision-making (van Geel, 2004).

[24] The document was entitled *Gezondheid en Milieu: opmaat voor beleidsvernieuwing* (Dutch Health Council, 2004:11).
[25] In Dutch: '*Nuchter omgaan met risico's – beslissen met gevoel voor onzekerheden*' (VROM, 2004)
[26] Rijksinstituut voor Volksgezondheid en het Milieu (RIVM) – see www.rivm.nl

2.3.1. Preparatory phase

i. Risk assessment and categorisation

One of the aims of the new approach to risk assessment is to include a more in-depth evaluation of the level of risk perceived by society (partly to ensure the government is addressing those issues causing the greatest public unrest). This indicates a shift towards focusing on more qualitative forms of information, which is particularly relevant for issues causing public concern (perhaps due to a high degree of uncertainty about issues such as the possible effects of radiation from mobile phone transmitting stations). Moreover, the collection of data for some risks is more qualitative right from the onset. Estimates of malodour levels, for example, are made on the basis of telephonic interviews, documented complaints and 'smell patrols' (which can be highly subjective), together with calculated odour concentration percentiles (Passchier Vermeer, 2001:185).

The cumulative effects of various risks (e.g. the effect of simultaneous exposure to various chemicals) will still be included in decision-making[27] (VROM, 2004). Some progress has been made in identifying the cumulative effects of certain substances, although much scientific uncertainty remains in this regard.

In 2003, the VROM created an assessment framework to assist policymakers in evaluating risk (see *Appendix 2.2*), as well as presenting a possible categorisation of risks and risk levels that could be used to structure decision-making processes. According to the NMP4, there are four basic types of risk[28], namely, risks that are (VROM, 2004: 14):

1. predictable, and to a certain extent controllable and preventable
    - Risks that are known and can be tackled adequately (such as the known effect of exposure to certain substances)
        - *Approaches vary according to the level of exposure that is deemed acceptable*
2. predictable, yet difficult to control and sometimes unavoidable
    - Risks that are not easily controlled from a government perspective (such as risks relating to Radon in housing, but also large scale accidents like Chernobyl)
        - *Approaches vary according to the level of exposure that is deemed acceptable, but adequate signal/warning systems are deemed necessary for unpredictable risks*
3. unpredictable, difficult to control & almost unpreventable

[27] Interestingly, in VROM's 2004 policy document on environment and health risk, taking cumulative effects into consideration is put forward as a 'new' element (VROM, 2004: 21), but this phenomenon was also already mentioned in 1989 and therefore cannot be considered truly 'new'.

[28] RIVM published a report called '*Dealing Sensibly with Risk*' (MNP – RIVM, 2003: 12-13) in which they provide a guideline for placing risks in one of four categories (ranging from simple, operational risks to complex, ambiguous risks) on the basis of the costs of action required, perceptions and the certainty/uncertainty of the risk (VROM, 2004: 13). Although perceived as somewhat useful, the method does not produce any concrete solutions to existing problems and was therefore not included (not in the same form in the government report.

- Risks that the government can scarcely prevent (such as HIV epidemics and Legionella outbreaks)
    - *Here the focus is primarily on generating adequate warning systems and creating a plan of action to be used in the event of a risk becoming reality.*

4. a combination of the above
    - Risks for which accurate data is currently lacking (such as the combined effect of simultaneous exposure to different substances)
        - *The first step taken to deal with such risks usually involves further research into their possible effects.*

Although this categorisation of risks has been put forward by VROM, assigning a certain risk to one of these categories is still somewhat subjective (as no concrete criteria are given that would allow one to place a risk in a specific category without hesitation).

VROM (2004) perceives risk as being interdisciplinary in nature, affecting various sectors (such as health, spatial planning, traffic, etc.). The 2004 risk policy, however, is only geared towards environmental management and in particular the dossiers that are subject to a high degree of societal discussion. These are some of the primary focal points of the Dutch approach to environmental health risks.

ii. Prioritisation

A lack of concrete decision-making on behalf of the government regarding several environmental dossiers[29] gave the discussions surrounding risk new impetus. Dealing with these problems had been continually delayed because there was no simple or straightforward solution for tackling them (e.g. because the risk is a combination of multiple stressors, or because it is present inside people's homes, making data collection difficult). The following risks are currently a priority, partly due to increased attention from the public domain (VROM, 2004: 12):

1. Legionella (in drinking water)
2. Soil decontamination
3. Radon (in building materials)
4. High-voltage power lines
5. Transmitting stations for mobile phones
6. Group risk related to external safety
7. Medication in water (including drinking water)

According to the Ministry of Public Health, Well-being and Sport (VWS[30]), there are several larger overarching environmental factors that are related to negative health effects. These are air pollution (emissions and ozone), noise, an unhealthy indoor environment (i.e. in buildings) and UV radiation (VWS, 2005). Air quality generally receives the most attention within VROM due to stringent measures imposed by the

[29] Specifically: Radon in building materials, high-voltage power lines and transmitting stations for mobile phones (GSM, UMTS); see: www.vrom.nl/pagina.html?id=12350
[30] Volksgezondheid, Welzijn en Sport (VWS) – see www.minvws.nl

EU (Van den Berg, 2007). It is therefore clear that international agreements (particularly EU regulations) play an important role in determining the focal points.

iii. Goals and norms

In the mid 1990s, the Dutch House of Commons (*Tweede Kamer*) ruled that negligible levels of risk (the VR level) would only be set for substance-related policy[31] (and would therefore no longer be applicable to external safety and radiation) due to difficulties in the implementation phase. The VR level was subsequently replaced by the ALARA principle for all other risks (Passchier, 2007). As a general rule, decision makers desire scientific proof that no actual or expected health risks are present below the specified norms (Passchier Vermeer et al., 2001). Standards should be as precautionary as feasible if no such data is available. However, the Maximum Tolerable Risk (the MTR level) would no longer be -based only on predictions of the possible effects on health, but would also involve considerations of attainability (with regard to financial and technological aspects). For example: a lot of resources have been used over the years for cleaning contaminated soil, yet the actual gains achieved in most areas were minimal. Future costs will therefore be weighed against the perceived benefits of stricter standards.

Different norms are sometimes also set for sensitive population groups, usually children (Van den Berg, 2007). It is known, for example, that children will react more strongly than adults to certain substances (such as lead), which suggests that stricter norms can be generated around schools, playgrounds, etc. However, there is no specific protocol for such situations and decisions are made on a case-by-case basis (Van den Berg, 2007). The process of generating norms (and their relative strictness) currently varies for different environmental components. Where noise is concerned, for example, an MTR has been set alongside a *preferable* level of nuisance, whereas for air quality, only one norm has been generated (the MTR). If the MTR is exceeded, the choice of whether to intervene remains largely a political one bounded by time and place[32] (Van den Berg, 2007). In recent years, Disability Adjusted Life Years[33] (DALYs) have been used to validate the specified norms (i.e. to indicate that a certain level of protection is necessary to prevent excessive loss of life, or disability).

The Dutch government generally aims to minimise risks according to the ALARA principle[34] and the Best Available Technology – BAT (De Hollander, & Hanemaaijer, 2003). This would suggest that variations can still exist in the levels of risk protection (relating to factors such as geographical location) as norms are formulated on the basis of what is *reasonable* and *available*, which may vary from place to place[35] (VROM, 2004: 19). This means that a *differentiated* risk management approach is

[31] The negligible level of risk was maintained for substance related policy because it is thought that maintaining this level will help with combating the cumulative effects of exposure to various chemical substances simultaneously or over time (Passchier, 2007)
[32] There are hence no predefined 'intervention values'
[33] See *Chapter 1, Section 1.3.1.*
[34] See *Section 2.2.1., Heading iii*
[35] What is considered 'reasonable' may also vary from substance to substance, for example the limits relating to chemicals – if the substance is not naturally occurring, it can be banned completely – if, however, it also occurs in nature, limits then have to be adjusted to compensate for this. 'Reasonable' limits will also be considered in light of other, chemical alternatives and the benefits obtained from the use of those chemicals (Van den Berg, 2007).

generated. In certain situations it is even possible to diverge from the legal norms in order to generate a more area-specific approach (if this would lead to a per capita improvement in environmental quality). The policy space for allowing differentiated norms therefore forms part of the preparatory phase, whereas the actual decisions surrounding compensation, for example, form part of the risk management phase.

2.3.2. Risk management

i. Tools, strategies, and responses

Economic assessments are required when attempting to achieve the most efficient allocation of government funding. Prevention is generally considered cheaper than cure[36]; an attempt will therefore be made to avoid all risk (in line with the *precautionary principle*) where new developments are concerned. However, it has been made clear that precautionary measures should be re-evaluated regularly in light of new scientific and societal developments. A less precautionary stance may be adopted if research proves conclusively that risks surrounding mobile phone transmitting stations, for example, is negligible. In addition, the government will focus on the *polluter pays principle*[37], which places some of the responsibility relating to risks in the spheres of market and civil society.

Although DALYs are primarily used in the risk assessment phase, this measure may also be used (usually at the national or regional scale) to identify which policy decisions will be most beneficial in terms of 'burden of disease' (Van den Berg, 2007). An analysis of the societal costs and benefits may also be conducted. However, although such tools and methodologies are being used, decision-making regarding risks often still tends to be ad hoc as it is influenced by the degree of knowledge available, uncertainty and attainability (Van den Berg, 2007).

In recent years, societal perceptions relating to risks have been monitored in the form of questionnaires, inventories and working groups (Van den Berg, 2007). This does not mean that the results always have a direct impact on policy; public opinion still influences risk policy most significantly through the political sphere (i.e. politicians who wish to be re-elected attempt to tackle those issues that cause public unrest).

Due to increased policy space for differentiated norms, the compensation mechanism may be used in attempting to reduce the negative effects of environmental health strains that are deemed beneficial on – for example – economic grounds. An example here would be the improvement of noise insulation for citizens living in the vicinity of a transport hub – like an airport (the economic benefits of which are substantial). Such mitigation measures may be coupled with further financial compensation. There is, however, no pre-defined protocol that must be followed when one wishes to deviate from the legislative minimums and make use of compensation strategies. Rather,

[36] Besides financial considerations, preventative action also contributes towards minimising uncertainties in the stakeholder domain (VROM, 2004: 20)

[37] The Organisation for Economic Cooperation and Development (OECD) defines the term as 'the principle according to which the polluter should pay the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level (a standard) of pollution'' (Glossary of Environmental Statistics, 1997).

these instances have to date been dealt with in an ad hoc manner (this fact was confirmed by a VROM employee, who also felt that a standardised approach would not be desirable as the situations in which compensation is used differ so greatly from one another). This would suggest that a highly transparent decision-making structure is necessary to generate a socially acceptable output.

Risk reduction, although desirable, comes at a price, and when resources are allocated for this cause, it inevitably implies that fewer will be available for use in other areas. The only risk for which the government currently still attempts to maintain an 'equal protection for all' criterion is external safety (Van den Berg, 2007). From a political standpoint, the cost-effectiveness of implemented measures is of great importance. Risk management was traditionally applied only after certain problems had arisen (i.e. *ex post*); the modern approach, however, is to avoid all risk (in line with the precautionary principle) and implement more *ex-ante* risk management strategies (which require careful financial consideration before implementation to reduce unnecessary government spending). More so than in the past, the Dutch approaches to risk will be considered in light of (VROM, 2004: 18):

1. the extent and severity of danger and risks (*taking into consideration the possibility of uncertain knowledge*) weighed against the societal costs and benefits of that activity (i.e. a more utility-based approach)
    i. Referring here to the impacts over time (i.e. *short-term versus long-term*), as well as the geographical range of effect
2. the possibility and effectiveness of measures
3. the cost efficiency of the proposed measure(s)
4. international policy developments (particularly EU standards/guidelines)
5. new technological, scientific and societal/cultural developments occurring nationally and internationally

As mentioned, well-substantiated deviation from the minimum norms may be allowed (to encourage a search for creative, area-based solutions) and stakeholder perceptions will increasingly be considered in the decision-making process. A positive correlation has been shown between levels of trust and increased transparency in decision-making (which in turn influences people's perceptions of risk). Transparency is therefore seen as a key factor in the 'modern' approach to risk, which can be achieved by ensuring good provision of information and open dialogue with stakeholders (VROM 2004: 24). If done successfully, this can enhance the acceptability of political and other decisions as, for example, choices made by the government are clarified in light of changing technological, economic and cultural developments in society.

2.3.3. Defining responsibility

In the Netherlands, health in general is the responsibility of the Ministry of VWS, whilst environmental health risks are tackled by VROM. Generally, however, the political opinion in the Netherlands appears to be that risk management should not be the task of the government exclusively. One of the main elements in the 'new' approach to risk is a focus on identifying the responsibilities of different parties (i.e. the government, business sector and civil society) when it comes to preventing and dealing with risk.

Conflicting ideals exist within Dutch society relating to the role of the government. On the one hand it is felt that the government should do more to protect its citizens from possible harm, yet at the same time they are sometimes criticised for getting too involved (and interfering too much with the market mechanism). Simply stated, the role of the government is twofold (VROM, 2004: 9):

i. To create an environment within which the business sector and civil society can identify and interpret their own roles/responsibilities relating to risk
ii. To ensure there is still adequate surveillance by enforcing legislation where necessary

Finding an adequate balance between these two responsibilities is a challenge in itself. The Dutch approach has recently been aimed at creating and implementing environmental policy at the level at which the problems occur (Passchier Vermeer et al., 2001). This implies increased decentralisation and a greater role for local and regional governments in environmental health-risk management. Municipalities, for example, are increasingly allowed to formulate environmental goals and standards at local level.

The role of civil society and the market has also changed over the years. Although corporate social responsibility (CSR)[38] was once deemed to be a far-fetched concept, businesses today are expected to be aware of the risks that may be associated with their activities, and to take steps to minimize – or at least compensate for – the harm or potential harm they inflict. Businesses, however, are often allowed to choose their own implementation instruments. No standardised guidelines have been developed to ensure risks are tackled effectively, and a wide range of approaches (with largely unknown levels of effect) have therefore been implemented in practice. In general, the government currently aims to (VROM, 2004: 4-5):

- divide and clarify the responsibility for tackling and preventing risks (i.e. between the government, the market and civil society)
- increase the role of the market in risk prevention and abatement (*such as encouraging the implementation of pollution prevention measures or stimulating innovation*)
- increase the role of citizens (*especially in situations where they have a large degree of control regarding their relative exposure to risk, e.g. participating safely in traffic*), which may be achieved primarily by an increased focus on communication and participation

Taking the elements listed above into account, one can deduce that the Dutch approach to environmental health risk is becoming more integrated, differentiated and decentralised.

[38] Corporate Social Responsibility: a concept suggesting that organisations should consider the interests of customers, employees, stakeholders, communities and the environment in all aspects of their operations (Wikipedia.org, 2007).

2.3.4. Integration and differentiation

After the failed experiences with the *Integrated Environmental Zoning* experiments in the 1980s, a 'back to basics' approach was taken that attempted to achieve integration *within* the environmental components before trying to create linkages *between* them (Van den Berg, 2007). So far this has only truly been achieved for noise, with an accepted methodology for calculating the overall level of hindrance from various frequencies (and thereby generating a single integrated value for noise exposure) having been accepted in January of this year[39]. Nevertheless, despite the difficulties experienced with generating increased integration within environmental components, several attempts have been made to generate area-based approaches that take *overall* environmental quality as a starting point.

In its most simple form, such an approach may involve simultaneously addressing problems caused by the same source but in different environmental components (e.g. tackling both noise and air quality in a traffic management plan). Technically speaking, this creates a more integrated approach *within* the environment domain. However, it could be implemented as a cross-sectoral approach as it might achieve integration between environmental, health and spatial planning objectives. To date, such approaches have had varying levels of success but their existence clearly illustrates that integrated work methods are firmly embedded in Dutch environmental, and other, decision-making processes.

Health risk policy has, over the years, also become increasingly focused on 'broader' issues (such as the societal perception and acceptance of risks or the cost efficiency of measures), which signifies a more integrated content of risk assessments. However, taking a wide range of factors into consideration often complicates the achievement of strict sectoral and environmental norms. The modern approach to risk may therefore generate some policy space to allow increased flexibility.

The 2004 VROM policy document relating to risks illustrates the possibility of generating a more differentiated, area-based risk management approach. The 'Project Stad en Milieu' (*Project City and Environment*) is presented as an example of an initiative whereby diverging from the minimum environmental norms was possible[40] in spatial planning projects, provided three main criteria were adhered to. Firstly, the deviation had to be well substantiated (i.e. there had to be a viable reason), secondly, compensation had to be offered by improving the conditions in another environmental component, and lastly, the overall quality of the living environment was not allowed to deteriorate (IPO & VNG, 2005). However, no concrete guidelines were given to facilitate decision-making aimed at generating such an area-specific approach. The only, and somewhat vague, criterion given was that any digression from the norm

[39] It took over 10 years for this methodology to be tested and accepted – a true indication that such policy changes tend to take a significant amount of time.

[40] Initially, the initiative was supposed to allow a digression from minimum norms for noise, soil standards, air quality and external safety. However, once implementation was underway, EU legislation did not allow air quality norms to be exceeded. Changes in legislation meant that the deviation from soil norms was no longer necessary and accidents in Enschede and Volendam meant that external safety could no longer be compromised from a governmental perspective (Loonen, 2007). In practice therefore, area-based departures only occurred for noise standards.

should be ‘well substantiated’ (VROM, 2004: 21), although no indication was given as to what this would entail.

Having discussed the primary characteristics of the traditional and modern approaches to environmental health risk in the Netherlands, the following section summarises the elements presented in this chapter.

2.3.5. Summarising the traditional and modern Dutch approach to health risk

The table below summarises the primary characteristics of the traditional and modern approaches to health risk reduction in the Dutch context and in light of the phases presented in an analytical framework in the first chapter (shown in the first column).

Table 1: The traditional versus the modern approach to health risk reduction in the Netherlands

	Traditional approach	Modern approach
General characteristics	Clear distinction between risk assessment and risk management phases	More overlap and communication during risk assessment and management activities
	Non-transparent to the public; closed decision-making	Increased transparency
PREPARATORY PHASE	Use of quantified targets in the form of ‘Maximum Tolerable’ risk levels (MTR) and ‘negligible’ risk levels (VR)	No more ‘negligible’ risk levels (VR); increased focus on the ALARA principle to define norms; implementation of BAT
	Norms-based on components of overall health risks (i.e. norms for each of the different frequencies of noise)	More coherent and simplified norms for specific health risks (i.e. one noise indicator for all frequencies)
	Categorisation according to target group (individual & group risk); new & old situations	More detailed categorisation of risk (predictability; target groups; context)
	Norms geared at equal protection (i.e. equal environmental quality for everyone, everywhere)	More differentiation (area-based norms) and provisions to allow compensation (i.e. making up for less quality in one environmental compartment by improving the quality of a different compartment, or by offering financial compensation)
	Research based on scientific analysis	More integrated content of risk assessments (i.e. inclusion of qualitative information, such as perceived levels of risk)
RISK MANAGE	Risk communication to inform on decisions already made (i.e. ‘decide – announce – defend’ principle)	Allowing public comment on risk management decisions
	Use of sector-based permits to regulate environmental issues; sector-based environmental regulation	Increasingly cross-sectoral approaches alongside sector-based regulation (i.e. attempts to integrate environment & health in spatial planning – MILO)
	No deviation from minimum standards allowed	Well-substantiated deviation from the minimum norms allowed (i.e. Stad & Milieu)
		Decision on *types* of compensation measures

M E N T	A focus on 'equal protection for all' in allocation of resources	Consideration of overall societal costs & benefits in light of estimated levels of danger (for resource allocation)
P H A S E	State responsible for risk management and decisions taken in top-down fashion, whilst being supplemented by research from the academic domain	Clarification and division of responsibilities for tackling risks (i.e. between government, market & civil society); decentralisation of tasks to lower levels of government (i.e. local government in charge of setting environmental targets)

Although this table clearly highlights the differences between the traditional and modern approaches to environmental health risk, it is perhaps useful to summarise the situation in the Netherlands graphically in light of the analytical framework presented in the first chapter (*see Section 1.3.4*). Depicting the approaches to risk in this manner makes it possible to illustrate the characteristics of the processes and phases more clearly (facilitating a visualisation of the risk policy process in the traditional and the modern sense), whilst including some important additional information.

It is clear from the diagram on the following page that different sources of knowledge now play a role in the assessment phase (it depicts the inclusion of civil society and the business sector in the modern situation). Furthermore, instead of a strict separation between the risk assessment and risk management phases (depicted by the solid black line in the traditional approach) and one-way 'flows' of knowledge (shown by the single black block arrow), the two-way block arrows in the modern approach depict a more dynamic exchange of information and less distinct separation between the two phases (illustrated by the dotted line). *Ex ante* risk management and the traditional *ex post* approaches are also shown. This illustrates an improved ability to learn from the positive and negative outcomes of policy choices. The oval shaped boxes show that the principles that underpin the setting of norms have also changed.

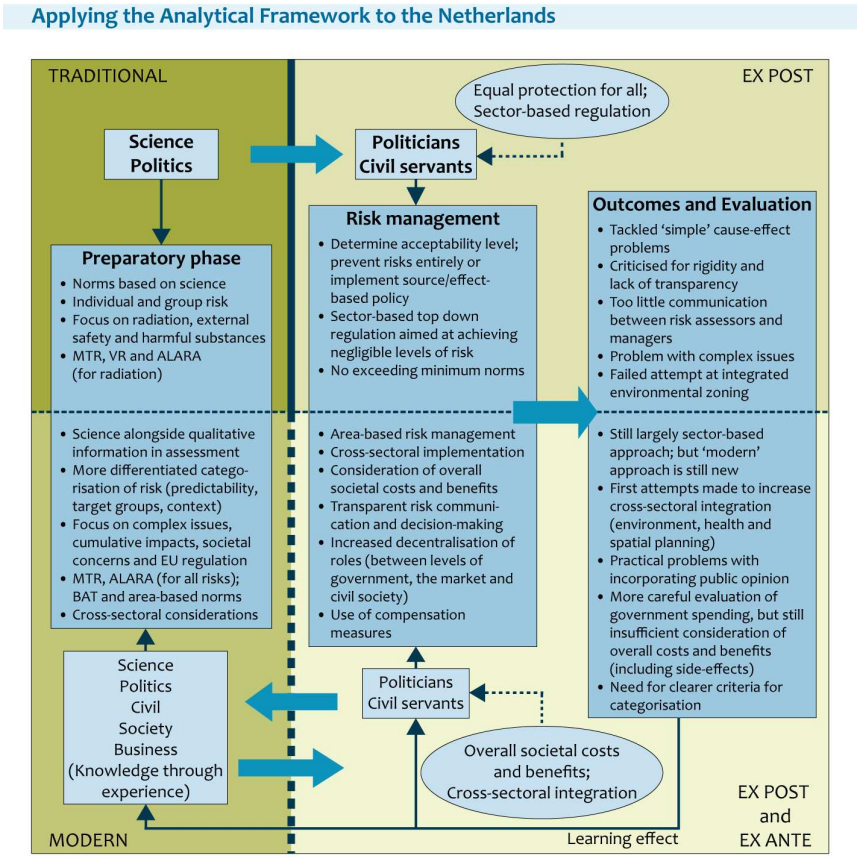

Figure 2: Applying the Analytical Framework to the Dutch situation

2.3.6. Outcomes of the modern approach thus far

i. Successes

The approach to risk in recent years aims to better suit the needs of modern society. The norms are formulated in such a way to be are as attainable as possible for the business sector. Furthermore, according to Van den Berg (2007), the document entitled *Dealing Sensibly with Risk* has influenced the manner in which risk is approached by VROM. More time is now spent evaluating whether certain issues pose a real threat and if investments are indeed necessary to minimize actual and perceived risks.

Measuring success can be difficult as often a situation cannot be considered a 'clean slate' when policies have been implemented, and initiatives do not occur in a 'closed' system (indicating that different factors can influence a measured outcome). Dose-effect relationships play an important role in determining whether a specific policy is attaining the desired effect (although this is more important for civil servants than for the political sphere, as politicians appear to show little interest in such data). In determining the relative success of policy, Van den Berg (2007) suggests that the current structure does not focus sufficiently on assessing the side effects of interventions, so the overall costs and benefits are not adequately estimated.

ii. Problems and shortcomings to be addressed in future

Although RIVM's '*Dealing Sensibly with Risk*' (MNP – RIVM, 2003) was supposed to form the basis of a new governmental approach to environmental risk; this has not yet materialised. Most risks are not dealt with in a standardised manner and environmental policy is still largely based on 'traditional' regulation in the form of norms and minimum norms that must be adhered to. Furthermore, although the categorisation of risks presented in the NMP4 (*see 3.2.1*) could potentially lead to a more structured and standardised approach to risk, an ad hoc approach still prevails in practice. However, the 'modern' approach (as it is outlined above) is still very recent, so it may take some time before the changes have manifested themselves (Passchier, 2007).

Risk management strategies are still largely based on a scientifically valid evaluation of the potentially negative effects of activities (and the likelihood of their occurrence), but the new approach to risk suggests a greater focus on stakeholders' *perceptions* of risk. In practice however, the relative weight of such qualitative factors varies according to the specific risks being tackled (Van den Berg, 2007). This indicates that there is no consistent or coherent approach that ensures the inclusion (and quality) of such data in the decision-making process.

Judging by public discourse on the issue of governmental risk management[41], not everyone is convinced that the national budget is being spent optimally and in some cases large financial allocations are being made to influence public opinion (even

[41] See, for example: www.politiek-digitaal.nl/column/risicobeleid

when there is no evidence to prove that the perceived risks do indeed have a scientific basis). This could, for example, be the case for the millions spent by the government to investigate the potential cancer effects of mobile phone transmitting stations. On the other hand, risks that could potentially be catastrophic at national level (e.g. flooding) or problems that a large percentage of the population is continually exposed to (such as odour) do not always appear to be dominant issues for stakeholders (Van den Berg, 2007). Deciding upon the extent to which risk management must conform to public opinion therefore remains a complex task.

According to Van den Berg (2007), there is no overt tension between traditional top-down regulation and more integrated approaches, but the increased need to consider public opinion can, at times, pose practical problems in achieving traditional norms. Moreover, although the precautionary principle is meant to be implemented in uncertain situations, VROM tends in practice to adopt a position that favours conducting further research (i.e. '*we'll look into it*') before deciding on concrete precautionary measures. This indicates that the current approach is perhaps not really as vigilant as it claims to be. Ultimately, the government needs to become more honest about its capabilities and explicitly communicate that it is not always possible to minimise every risk (either practically or financially).

The concept of compensation tends to be criticised for diverting attention away from finding necessary solutions (Passchier, 2007) and for attempting to create relationshipss between entirely unrelated issues (Van den Berg, 2007). Such practices can lead to inconsistent approaches to tackling risk, as the compensation mechanism is centred on considerations of efficiency versus equity (the balance of which can vary per case). From a civil servant's perspective, it is also unclear when 'compensation' becomes 'mitigation', a clear indication that the concept is not well-defined in practice.

Nevertheless, in some instances the possibility to use compensation is characteristic of the modern approach to tackling environmental health risk in the Netherlands. This factor, in combination with the characteristics of the modern approach presented in *Table 1, Section 2.3.4*, can be used to derive several indicators for a more integrated and differentiated approach to environmental health risk management.

2.3.7. Conclusion & indicators characterising the modern approach

The Dutch government's approach to environmental risk policy used to be based on the principle of equity, suggesting that each person had the right to an equal level of protection from harm. However, it became clear that certain people were exposed to greater degree of risk due, for example, to transport, storage and the use of hazardous chemicals (RIVM, 2003)..Focusing solely on equal protection may therefore lead to excessively expensive measures that are impossible to realise (as well as potentially having negative rebound effects due to monetary resources being withheld from other sectors in order to maintain sufficient funding for risk abatement). On the other hand, focusing only on achieving the most efficient (and cost efficient) scenario would inevitably lead to certain population groups being treated unjustly, which raises moral dilemmas. This is the classic efficiency versus equity debate all governments still face today (de Hollander & Hanemaaijer, 2003: 4). The modern approach in the

Netherlands is therefore partially aimed at achieving a better balance between these two principles.

The traditional approach was also not transparent enough and did not involve stakeholders sufficiently in the assessment or management phases. It is hoped that an increased focus on risk communication, weighing stakeholder opinions and decentralising tasks will contribute towards combating this problem in the modern approach. Furthermore, one of the side-effects of the traditional approach was that cumulative impacts were not addressed sufficiently. Sector-based regulation may have partially tackled individual environmental issues, but it did not take the interaction of various problems into consideration. The more integrated mentality advocated in the modern approach is geared at resolving this issue.

On the basis of the situation in the Netherlands, several indicators show a more integrated and differentiated working method. These indicators were derived directly from the characteristics in the modern Dutch context and have been summarised in the following table.

Table 2: Indicators of integration and differentiation characteristic of the modern Dutch approach to environmental health risk

	Indicators of integration and differentiation
General characteristics	Blurring of phases in approach to risk
	Focus on transparency (i.e. highlighting uncertainties)
Preparatory phase	Other principles underpinning norms besides health-based criteria (i.e. costs)
	Simplified norms for specific health risks
	More differentiated categorisation of risks
	Differentiated (or area-based) norms
	Increased policy space for use of compensation
	Inclusion of stakeholder opinions (*in risk assessment*)
Risk management phase	Inclusion of stakeholder opinions (*in risk management phase*)
	Including health risk considerations in the formation of sector-based norms
	More cross-sectoral integration
	Utilising increased policy space for differentiated risk management
	Allocation of resources based on principles other than equity (more than in the past)
	More decentralised role division (i.e. between levels of government, market & civil society)

A more detailed description of the exact definition of the indicators can be found in *Appendix 3*. A table at the end of the next chapter 'scores' the approaches in the various countries on the basis of these indicators. The following chapter will therefore discuss other international environmental health risk strategies in light of the situation in the Netherlands, the indicators above, and the analytical framework presented in first chapter.

Chapter 3: An international comparative analysis

3.1. Introduction

The approaches in the countries assessed have various similarities (usually still focusing on the health impacts of pollution in the primary ecological components, such as water, air and soil) but also exhibit several differences. The following section will discuss some of those commonalities and divergences, whilst relating to the Dutch context where relevant. The chapter is structured according to the elements presented in the analytical framework in *Section 1.3.4*; which implies it is subdivided into the preparatory and the risk management phase. These phases are discussed for both the traditional, as well as the modern approaches for environmental health risk reduction (for a complete list of the countries included, please refer to *Section 1.3.6*). The countries will then be evaluated in light of the indicators presented at the end of the last chapter (*Section 2.3.7*).

In most of the countries assessed, a centralised environmental (often government) agency appears to be the primary player in charge of enforcing environmental health policy and assisting the government with the formulation of this policy. In the UK, Austria, Germany, Flanders[42] (Belgium) and Slovenia, for example, this role is fulfilled by the Environment Agency[43] (EA), in Malta by the Environment and Planning Authority[44] (MEPA), and in the USA, Scotland, Denmark and Ireland by the Environmental Protection Agency[45] (EPA). These were the primary institutions targeted in this research due to their key positions regarding environmental health policy. The Regional Environmental Centre[46] (REC) in Hungary and the Environment and Food Agency[47] (EFA) in Iceland were also contacted.

Unless specific references are given, the information in this chapter was obtained from e-mail questionnaires and interviews. In some countries, the approach to risk (including health risk) is very well-documented and understood (such as in the USA and the UK). However, there were significant gaps in the knowledge available for several other countries (the descriptions in some cases are therefore more detailed than in others). A generalised statement has been given for areas in which the responses were quite similar, with one or two relevant examples from specific

[42] The arguments for including Flanders as a case study can be read in *Section 1.3.6.*

[43] The UK Environment Agency (www.environment-agency.gov.uk) is a non-departmental public body, but is sponsored by the Department for Environment, Food and Rural Affairs (DEFRA) and the Welsh Assembly Government (WAG) in Wales. For Austria, see: www.umweltbundesamt.at For Germany: http://www.umweltbundesamt.de/index-e.htm, for Flanders: www.vmm.be and for Slovenia: http://www.arso.gov.si/en/

[44] See www.mepa.org.mt; the Malta Environment and Planning Authority (MEPA) is an autonomous body with representatives from various sectors (including health)

[45] See www.epa.gov (US), www.sepa.org.uk (Scotland), http://glwww.mst.dk/homepage/ (Denmark) and www.epa.ie (Ireland) – please note that for Denmark the person responding was specialised in he examples are hence mostly related specifically to this environmental compartment)

[46] The REC Hungary plays a role in solving environmental problems in Central and Eastern Europe by promoting the exchange of information and co-operation between non-governmental organisations, the government, the business sector and civil society (see www.rec.org/magyariroda/e_index.html)

[47] The EFA in Iceland falls under the Ministry of Environment (see http://english.ust.is/)

countries. Only a brief overview of the historical or 'traditional' approaches has been given on the assumption that the modern approach is of most interest at the present moment.

3.2. Traditional approach

In the first half of the last century, most countries had an unstructured environmental management approach, which meant pollution was not dealt with in a coordinated manner. In 1970, the American EPA was formed due to increasing public concern regarding water, air and land management (US EPA, 2007). This indicates that the USA was a front runner in creating a single responsible environmental authority, and that public opinion has played an important role in the US context for many decades.

It was up to this new agency to tackle existing environmental issues, as well as generating new guiding principles to prevent further damage. Their early work is discussed here as the traditional approach for the USA. This also applies for Austria, which has had an environmental agency since 1985. In most countries, however, such agencies were only set up more than a decade later, indicating that in these contexts, the 'traditional' approaches do not feature a single unified environmental agency.

3.2.1. Preparatory phase

i. Risk assessment and categorisation

The US EPA was already conducting risk assessments in the early 1970s, although it was not formally recognised as a process until December 1975, when the first risk assessment document was published[48]. The economic impact of environmental risks was already being considered at this time, along with the health impacts, although it was 'recommended that the health data be analysed independently of the economic impact analysis' (US EPA, 2004: 4). In 1983, the National Academy of Sciences (NAS) published the 'red book[49]', which contains the most common basic definition of risk assessment being used in the USA today, which reads 'risk assessment is a process in which information is analysed to determine if an environmental hazard might cause harm to exposed persons and ecosystems' (US EPA, 2004: 2). This suggests that the roots of risk assessment can be traced back to the scientific domain.

Risk assessments in the USA traditionally focused on individual chemicals or stressors and only looked at one source, pathway or potentially negative effect. Studies using laboratory animals were often conducted in order to assess the potential impact of certain chemicals. Between the 1970s and the 1990s, research focused on testing the responses in the most sensitive species (US EPA, 2004), with risk

[48] *Quantitative Risk Assessment for Community Exposure to Vinyl Chloride* (Kuzmack & McGaughy, 1975 as cited in US EPA, 2004: 4); which was followed by *Interim Procedures and Guidelines for Health Risk and Economic Impact Assessments of Suspected Carcinogens* (Train, 1976 as cited in US EPA, 2004: 4).

[49] *Risk Assessment in the Federal Government: Managing the Process* (National Research Council – NRC, 1983 as cited in US EPA, 2004: 4)

management responses being based on this data. If data was unknown (relating to specific chemicals and/or site-specific information in particular), default assumptions[50] were used to fill in the data gaps. For example: it is assumed that 'toxic responses observed in laboratory animals are indicative of toxic responses that are likely to occur in people' (US EPA, 2004: 56). In the USA, just as in all other countries, there is no evidence of any form of risk categorisation.

In Malta, risk assessments were carried out ad hoc by contracted risk assessors (there were no formal requirements to guide this process). The former Yugoslavia (run primarily from Belgrade) was in charge of environmental and health management in Slovenia before its independence in 1991 (United Nations Economic Commission for Europe – UNECE, 1997). Local environmental monitoring was minimal and risk assessment virtually non-existent. In Hungary, some health and environmental risk assessments were carried out by individual scientists or researchers who were interested in the matter. These did not, however, follow a specific methodology or have any influence on governmental decision-making.

The Austrian EA's early risk assessments were conducted in response to the 1986 Chernobyl accident and therefore looked at the effects of radiation. Furthermore, some assessments of heavy metals and dioxins in soil were conducted in cooperation with German experts (on the basis of existing German threshold values). In the UK, risk 'hardly ever featured, at least not outside the circle of technical specialists' (Health and Safety Executive as cited in Fisher, 2000: 110) and risk assessment was therefore based only on scientific data. In Ireland, the Central Statistics Office (CSO) has played an influential role in providing data on health and environmental issues for many years.

ii. Prioritisation

All countries gave priority to examining the negative effects of human activity on the fundamental ecological systems (i.e. water, the atmosphere and soil) and their subsequent impact on human health. In Scotland, the focus on risk was drawn predominantly from EU stimuli. In the UK context, health risks were prioritised as problems presented themselves throughout history. Clean air has been a main concern for over half a century as a result of the smog in London in the 1950s, whilst water quality became important in the 1980s. Air quality has also been a focal point in Hungary, Germany (specifically SO_2) and Austria for many years, with the latter also traditionally focusing on the conditions of soil and the effects of radiation.

The first 'risk assessments' probably occurred in the USA, but these only analysed the impact of chemicals (vinyl chloride and carcinogens specifically), which can therefore be considered a priority of that time. Malta has historically had minimal access to fresh water resources, so this has always been one of the main concerns locally (Government of Malta, 2002). 'Basic environmental national priorities' were established by the government of former Yugoslavia (UNECE, 1997: 7) and were therefore also applicable in Slovenia (with one of the main priorities also being air

[50] A default assumption is 'the option chosen on the basis of risk assessment policy that appears to be the best choice in the absence of data to the contrary' (NRC, 1983 as cited in US EPA, 2004: 51).

pollution). In Iceland, the constant threat of natural disasters (avalanches in particular) has been important for many decades.

iii. Goals & norms

Regulatory measures were much the same in most of Europe. Standards in all the countries were sector-based (just as in the Netherlands), with environmental health issues being dealt with primarily by regulation in the environmental domain by specifying permissible emissions using science-based calculations. The decisions were taken in a top-down manner, without public consultation and based on the best available scientific knowledge. For example: norms were established for water supplies, sanitation and air-quality in the UK, and in 1980 the US EPA generated water quality criteria for 64 contaminants (US EPA, 2004: 4).

For Denmark, there was a specific reference to the mentality behind the setting of norms, which was that 'no health risk from environmental exposure was acceptable'; showing that all norms were aimed at achieving a negligible level of risk.

3.2.2. Risk management

i. Tools, strategies, and responses

According to Vogel (2003: 25), setting regulatory policy can be considered a form of risk management. Sectoral regulation was the main policy tool used in all the countries to tackle environmental health risk. Some countries, such as Austria, based their strategies on the approaches in neighbouring countries (in this case some of the sector-based approaches generated in Germany). In the UK, the government's response was traditionally ad hoc, generally intervening only when a risk was deemed 'unacceptable' (Fisher, 2000: 113).

In Scotland, risk reduction strategies have, for many decades, been embedded in environmental legislation geared at controlling operational activities and preventing accidents (through COMAH: Control of Major Accident Hazards). Malta used to rely heavily on sectoral legislation to reduce environmental health risk although officials in charge of environmental policy would consult Health Department officials regarding matters that had a significant impact on health (this occurred long before a structured approach to inter-sectoral cooperation was established). In Yugoslavia (and therefore Slovenia), an environment fund was set up as an economic tool for achieving national environmental goals (UNECE, 1997).

The 1972 Clean Water Act and the 1977 Clear Air Amendments made the USA a front runner in the use of the precautionary principle (see *Chapter 1, Section 1.3.2.*). The US EPA has historically been able to issue sanctions to enforce compliance with environmental laws, as well as being able to provide financial aid to the various states for environmental programmes (US EPA, 2007). From the 1970s, US environmental regulatory policies often responded to public opinion and pressure from non-governmental organisations (NGOs), which regularly challenged the powerful political position of the business sector (Vogel, 2003). The roles and responsibilities in tackling environmental health risks were therefore already quite widely dispersed.

3.2.3. Defining responsibility

In most cases, the preparatory phase was based on scientific information, which indicates a great reliance on players in the scientific (research) domain. The Austrian EA was initially part of the former Ministry for Health and Environment (risk assessment and management therefore remained in the hands of the central government). In all the countries, national governments retained decision-making power regarding the final content of legislation and setting of norms. Slovenia traditionally had little influence over their environmental management, as this was controlled by the Yugoslav national government (UNECE, 1997). In Malta, independent risk assessors were contracted by the government when required (no centralised unit for risk assessment and/or management existed). Assessments in the UK and Ireland this phase were also carried out by independent scientists (who advised the government), whereas in the USA, the EPA (which had already been in existence since 1970) has played a key role in this process for three decades. Advisory bodies also played an important role in the USA. In 1975, the FIFRA[51] Scientific Advisory Panel (SAP) was set up to act as a scientific review mechanism of the US EPA on pesticide-related environmental health risks (US EPA, 2007), providing independent advice and guiding EPA action in this domain.

Regulatory politics in the USA has addressed the competing interpretations of risk stemming from NGOs, industry and regulators (and perhaps to a lesser extent the public) for many decades. In Europe on the other hand, NGOs traditionally had far less influence and public participation was limited. Business had a large degree of influence on policy and 'decisions about risk remained the preserve of experienced bureaucrats and their established advisory networks' (Jasanoff, 1993 as cited in Vogel, 2003: 9).

3.2.4. Outcomes of the traditional approach

i. Successes

Problems having direct cause-effect relationships were (at least in part) addressed by sectoral regulation in all the countries. Stricter regulation regarding air, water supplies and sanitation in the second half of the last century led to significant improvements in environmental quality in the UK (UK EA, 2005). For example: industrial emission levels (and access to information regarding these emissions) have improved significantly over the last decades. In Malta, the phasing out of coal combustion also curbed pollution and eliminated the problem of fly and bottom ash (Government of Malta, 2002). In Yugoslavia (and therefore Slovenia), decisions surrounding the use of less polluting fuels led to improved air quality (UNECE, 1997), whilst transport strategies temporarily improved air quality in Hungary. Nevertheless, none of the traditional approaches were capable of tackling more complex environmental problems.

[51] Federal Insecticide, Fungicide and Rodenticide Act (US EPA, 2007): a panel made up of seven people nominated by the National Institutes of Health and the National Science Foundation.

ii. Problems and shortcomings

The Danish mentality surrounding environmental health risk (i.e. no level of risk is acceptable) was not economically or technically feasible in many cases (with some calculations suggesting that the top 50 cm of soil across the whole country would have to be replaced). This is similar to the Dutch experience, in which an 'equal level of protection for all' also proved to be unattainable. In Austria, a lack of knowledge and communication, and limited joint action (between sectors) formed barriers in achieving the desired level of environmental health. Risk assessment in the UK was originally developed for 'closed systems' in the field of engineering (Fisher, 2000). Understandably, when this method was applied to environmental and health risks (which occur in 'open-ended' systems), it did not appear to cope adequately with the increased complexity. Furthermore, unrest rose in the UK after the public was exposed to several 'unacceptable' risks[52]; which led to the need for increased communication with stakeholders[53] (Fisher, 2000). A lack of transparency was blamed for inefficient and inconsistent standards that were not in line with public interest. In 1996, the Environment Agency of England and Wales was officially established on the basis of the Environment Act of 1995 (Wikipedia.org, 2007). The need for a more centralised agency to coordinate environmental activities also led to the formation of the Irish EPA in 1993 and the Scottish EPA (SEPA) in 1996.

In the USA, the data needed to determine appropriate predictions of human responses to toxicity was lacking. This meant that decisions were often based on data collected from sensitive animals, which suggests that policy was sometimes found to be overcautious (i.e. being aimed primarily at 'high-risk' individuals). The traditional approach in the USA also focused primarily on cancer-related measurements (i.e. the probability of death), whereas decision-makers also wanted results from non-cancer assessments. Moreover, people were shown to be influenced by a variety of different chemicals and stressors from multiple sources. This suggested the traditional 'single chemical/stressor' approach was not sufficient and a better understanding of cumulative impacts was needed (US EPA, 2004: 146). In the mid-1980s, the US EPA began emphasising that a more transparent risk assessment process was needed.

The environment gradually deteriorated in Yugoslavia, posing serious threats to human health by the 1980s. NGOs began playing an important role in generating awareness for environmental concerns around 1986–1987 (UNECE, 1997) and Slovenia's independence in 1991 allowed environmental concerns to be tackled on a more regional basis.

Maltese environmental law traditionally dealt with problems as they arose, which led to a 'piecemeal and fragmented approach' (Government of Malta, 2002: 24). The 1991 Environment Protection Act attempted to tackle this issue. The different sector-based approaches had always worked alongside one another, leading to a duplication of work and effort. It was therefore felt that a more inter-sectoral approach was needed. Furthermore, an important element in Malta's accession to the EU was

[52] Examples include: *bovine spongiform encephalopathy* (BSE); *salmonella* in eggs and *E. coli 0157* (Fisher, 2000: 109).

[53] The Department of the Environment (DoE), HSE and Interdepartmental Liaison Group on Risk Assessment (ILGRA) have all published reports on this matter (see Fisher, 2000: 123)

compliance with the EU directives that demanded the use of Risk Assessment and Risk Management techniques. The same applies for Hungary and Slovenia, where many changes occurred in the approaches to environmental and health management following EU accession.

In Flanders, a recent biomonitoring programme (discussed below) has shown that measurable biological effects occur at levels far below the current norms. This indicates that traditional sector-based norms may not have provided sufficient protection, assuming that these effects are early indicators for adverse health effects. The results of this research are being translated into policy to ensure that future environmental health strategies are more precautionary.

3.3. Modern approach

As a matter of interest, the UK EA does not recognise a clear distinction between a 'traditional' approach and a more 'integrated' approach. This is perhaps due to the fact that the EA is still relatively young, which indicates that all activities conducted by that organisation can be characterised as 'modern'.

3.3.1. Preparatory phase

Perhaps it would be useful to first give an overview of the manner in which risk is currently conceptualised in the various contexts[54]. In Ireland, environmental health risks are defined as any environmental factor that might give rise to the damage of human or animal health[55]. In Malta, 'health risks' are any environmental factors (including physical, chemical, biological or socio-economic) that have harmful consequences for human health and the environment. The UK EA says that risk is related to the probability of someone being exposed to a hazard and to the harm this could cause' (UK EA, 2005: 6), whilst the US EPA states that risk is 'a measure of the probability that damage to life, health, property and/or the environment will occur as a result of a given hazard' (US EPA, 2007). The Austrian EA did not provide a specific definition, but relates health risk to issues[56] caused by outdoor air pollution, hazardous substances (in indoor air, household dust and products), the contamination of water and food, and so on. The German EA states that risk can be defined as the probability of an environmental factor having a potentially negative health effect, whereas Iceland does not have an official definition for this concept.

i. Risk assessment and categorisation

In the USA, risk assessment is perceived to be a tool that can be used to characterise possible hazards to human health. It is composed of four steps: hazard identification,

[54] For a more detailed account of international definitions relating to risk, refer to IRGC (2006: 147)

[55] This is seen to include a wide array of risk issues, such as second-hand cigarette smoke, smoke-producing fuel, genetically modified organism field trials, industrial emissions, inadequately treated drinking water, *naturally occurring* radon gas, contaminated land, poorly managed food outlets, etc.

[56] With 'issues' referring to an increase in mortality/morbidity, loss of healthy life years, an increase in certain illnesses and hospital attendances – to mention but a few.

dose-response assessments, exposure assessment and risk characterisation (US EPA, 2007). Austria also considers these steps as being the most important elements of a risk assessment (Hilding-Rydevik et al., 2005; as do the Netherlands and Australia (see *Appendix 4*). However, in Australia a preparatory step termed 'issue identification' is added, which identifies the problems needing to be addressed[57] (enHealth, 2004: 4). The final step 'integrates information from the preceding components of the risk assessment and synthesizes an overall conclusion about risk that is complete, informative and useful for decision-makers', whilst highlighting any relevant uncertainties (US Environmental Protection Agency – EPA, 2000: 10). The characterisation is based on the principles of Transparency, Clarity, Consistency and Reasonableness – TCCR (please refer to *Appendix 5* for the criteria underpinning these principles), and is seen as a potentially powerful tool for risk communication.

The whole assessment process is considered 'highly interdisciplinary' and focuses on generating 'a rational framework for evaluating environmental hazards' (US EPA, 2004: 2). Importantly, the US EPA explicitly states that the risk assessment should only be a source of information, and should **not** recommend specific decisions. In related literature, risk assessments appear to provide the scientific input for risk management decisions, with a primary objective being that risks should neither be underestimated nor grossly overestimated (US EPA, 2004). Interestingly, in Australia the same procedure is meant to 'provide the best possible scientific, social and practical information' (enHealth, 2004: xi), which suggests a broader focus than is adopted in the USA (due to the emphasis on social factors).

The US EPA still uses default assumptions to make up for the lack of knowledge (as is the case in Australia), although some progress has been made. For example, although in the past chemical toxicity data was collected from species with the most sensitive response, more biological knowledge and experience is available nowadays, which implies that better choices can be made regarding human risk prediction. Risk assessments are seen to be 'a mix of science data, science policy, judgments, guidelines, and best professional judgment' (US EPA, 2004: 142), although the EPA will 'favour a selection (of data) that ensures against underestimating risk as a policy choice' (EPA, 2004: 58), and environmental models are being used increasingly to support risk assessments.

Using models to predict the possible impact of risks is fraught with uncertainty, as information on the validity of such models is often lacking. According to the Dutch Health Commission, justification for choosing a particular model should be discussed at length when implemented (1995: 23). Although this does appear to happen in the US, it only occurs sporadically in countries like Slovenia. In general, it seems there are no legislative requirements to ensure the disclosure of such information in any of the countries assessed.

The US EPA states that current risk assessment (referring here to the evaluation of science) and risk management (decision-making and policy-making) are not always two distinct phases, and that decision-makers should be involved early on in the

[57] This also involves – following the Canadian model – evaluating what 'public perceptions of the hazard are' (Health Canada as cited in enHealth, 2004: xiii), although no specific indication is given on how this information should be weighed in light of other data.

assessment phase[58]. Increasing attempts are also being made to assess the cumulative and 'aggregate exposure[59]' levels for various environmental risks. For some pesticides, for example, the potential inhalation, oral (i.e. eating or drinking) and dermal absorption routes of the chemical are all assessed to generate an aggregate exposure estimate[60] (US EPA 2001: 4). Furthermore, tools that allow a distributional data analysis are increasingly favoured as they allow an evaluation of the exposure to risk across the whole population, rather than just high-risk individuals.

In Australia, a clear distinction is made between a Health Impact Assessment (which refers to an evaluation of the health effects of a particular development proposal or policy) and a Health Risk Assessment (HRA), which generates knowledge that can be used as a basis for generating policy (enHealth, 2000). Important elements in the HRA are the hazard (source of danger), level of uncertainty, adverse health effects, target, timeframe[61] and perceptions of stakeholders regarding the relevance of the risk. Risk assessments can be conducted for whole populations or individuals, whereby the latter can refer to the average or the most sensitive person[62]. Levels of risk in Australia may be defined qualitatively into the categories 'high'; 'medium' or 'low', or quantitatively on the basis of numerical estimates. This is similar to the approach taken in the Netherlands – although the categories are different (see *Section 2.3.1., Heading i*).

In both the USA and Australia, it is made clear that 'the cost, feasibility, or how the scientific analysis might influence the regulatory or site-specific decision' should not be considered in the risk assessment phase (US EPA, 1995 as cited in enHealth, 2004: 7). However, in several other countries (such as Hungary), the lack of economic considerations in the assessment phase was said to have caused significant problems in the implementation phase. It therefore seems unclear as to when the incorporation of cost issues would be most desirable, although this generally falls under the risk management phase at present.

The UK EA assesses health risk by using predefined environmental quality standards (based on scientific research) to conduct a comparison of the impact of emissions from various sources on the environment and health. A scientific analysis is considered an important part of the risk assessment phase (implying an important role for researchers, academics and scientists[63]). Communication between government officials and the EA may occur throughout the assessment phase, although the extent

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[58] Please refer to the *EPA Risk Characterisation Handbook* (2000) for a more detailed analysis of the roles of risk assessors and risk managers in the US context.

[59] Aggregate exposure refers to an 'analysis of the exposure to a single chemical by multiple pathways and routes of exposure' (US EPA, 2001: 4)

[60] Although guidelines have been developed to assist aggregate exposure risk assessments for pesticides, it explicitly states that such documents are merely meant to provide guidance and 'EPA will depart from its policy where the facts or circumstances warrant it' (US EPA, 2001: 6). This indicates that for some environmental risks it is possible to take an area-based perspective (as long as adequate explanations are provided for the chosen course of action).

[61] Australia was hereby one of the only countries (apart from the US) to specifically mention that risk assessment occurs 'under a specific set of conditions for a certain time frame' (enHealth, 2004: xi)

[62] For a thorough description of the Australian Risk Assessment process, and a more detailed description of international models, please refer to enHealth (2004) – *see reference list*

[63] 'Advice can come from a number of quarters including other government departments, universities, commissioned research, specific or general advisory committees, international, EC (European Commission) or other organisations' (Fisher, 2000:118).

of this exchange of information varies from risk to risk – as is the case in the Netherlands. Before allowing potentially polluting activities to occur at local level, public and other stakeholders are consulted and their views/perceptions may lead to changes in the permits issued by the EA (the inclusion of qualitative data in the assessment phase can therefore have a direct impact on the risk management approach). The UK EA, however, is still not aware of any classifications used to categorise risks in the UK (this is also the case in most other countries).

In Scotland, SEPA must assess the impact of environmental emissions on human health and in doing so aim to be consistent, transparent and scientifically sound. In the new Strategic Framework for Environment and Health, risks are conceptualised on the basis of the Drivers-Pressures-State-Exposure-Effects-Action (DPSEEA) model (please refer to *Appendix 6*), which suggests they are assessed in terms of causal chains. The health risks perceived by the public can, at times, play an important role. In Hungary, the government is increasingly recognising the value of conducting health and environmental risk assessments. When the country started the process of becoming an EU member state, experts from neighbouring countries (as well as those researchers that had experimented with risk assessment in the traditional context) were brought in to train professionals in the risk assessment process. The methods followed were consistent with those prescribed by the EU.

Many of the European countries make some reference to health-related impacts as part of their Environmental Impact Assessment (EIA) legislation[64]. In Malta, a Health Impact Assessment is generally included as part of an EIA before permits are granted for proposed developments. Several areas of public health in Malta (including bathing water quality and food standards) now require risk assessments by law. These assessments include an evaluation of the societal costs and benefits, economic factors and qualitative forms of data (i.e. societal perceptions of risk, which are measured through public consultation meetings, focus groups and surveys). There is no ranking of the relative weight of these factors and they are considered simultaneously, in an 'integrated' manner (taking multiplicative[65] effects into consideration). Scientific advice can be provided by external bodies, such as the University of Malta, which has an air quality monitoring programme (Government of Malta, 2002).

In Malta, risks are categorised on the basis of their complexity and manageability, with unpredictable risks being treated with extra precaution. Depending on the risk being studied, the primary standard levels are negligible risk, tolerable or acceptable risk[66], and unacceptable risk. This implies that, unlike the Netherlands, Malta still uses the 'negligible risk' concept. Health risks relating to chemical exposures are further classified into six categories[67] related to the actual and potential effects they induce.

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[64] For a comparison between fifteen member states, see Hilding-Rydevik et al. (2005)

[65] *For example:* qualitative forms of data may have direct effects on the actual and perceived societal costs and benefits (therefore having a 'multiplying' effect)

[66] A standard that is often used for an acceptable level of cancer is one additional case of cancer per 10,000 or 1,000,000 people per lifetime; for dose-dependent health effects the most commonly used terms are 'No Observable Effect Levels and Concentrations' (NOEL and NOEC).

[67] Acute toxicity (visible after short-term exposure), carcinogenic, chronic toxicity (develops gradually), developmental toxicity (effects resulting from exposure prior to conception, in the prenatal phase or before sexual maturation), neurotoxic (affecting the nervous system) or reproductive effects.

In Iceland, public and occupational health are two EIA focal points. However, this country also has much experience in estimating risks related to natural disasters. For example, they have developed an advanced quantitative methodology that estimates risk on the basis of the annual probability of death by avalanche[68]. In Denmark categorisations of risks may occur for certain environmental components (e.g. there are various categories for soil depending on the use of the land and estimated levels of risk). Some ranking may also occur on the basis of the ease of conducting economic and other evaluations (i.e. risks that are easy to assess may be prioritised). Public opinion plays a minimal role in the Danish context.

In Slovenia, the EA monitors environmental conditions, but their assessment procedures do not have a specific health component. Reports are generated on the status of the environment and this information is relayed to the Health Department for use in environmental health approaches. Various countries, including Austria, Flanders (Belgium) and Germany, mention the use of human biomonitoring[69] data as a basis for norms, alongside the monitoring of environmental conditions. Germany also pays specific attention to the economic valuation of environmental health risks to children[70], concluding that children-specific values should be considered when designing environmental policies, but that 'it should not be generally assumed that environmental influences have a greater effect on health in children than in adults' (Umweltbundesamt, 2004:16). In Flanders, DALY calculations are also used to determine the impact of risks, with noise and particulate matter scoring the highest. It also states that uncertainty is taken into consideration when these calculations are used to prioritise risks.

ii. Prioritisation

Countries tend to have varying interpretations of the primary environmental focal points important from a health perspective. These range from a distinction between indoor and outdoor environmental quality to specific localised interests (such as a preoccupation with scarce freshwater resources or previous nuclear contamination). Air quality is perceived to be the primary environmental health problem in most countries (although this is presumably related to strict international norms). Concerns over toxic landfills are also a recurring theme on a more local level.

Lifestyle factors are increasingly being considered an environmental health risk, with environmental agencies expressing a desire to tackle such issues. This differs from the Dutch context, as lifestyle factors are not regarded as falling under 'environmental' health risks, and are therefore tackled by the Ministry of Health, Well-being and Sport (VWS). This also applies for pesticides, which are tackled by the environment department in most countries (although the Netherlands does use similar standard-setting procedures relating to the maximum daily intake and 'no adverse level of effect values', etc).

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[68] With an acceptable level of risk being $0.3 * 10^{-4}$ per residential home (Jónasson, Sigurðsson, & Arnalds, 1999: 5)

[69] According to the Flemish EA, this involves monitoring biomarkers in human beings that focus on environmental exposures, diseases (or disorders), genetic susceptibility and the potential combination of these factors

[70] For more detail on the German data, please refer to Umweltbundesamt (2004) – see reference list

The UK EA has identified the following priorities: chemicals[71], air quality[72], flooding and climate change, inequalities, outdoor recreation and research[73] (Environment Agency, 2005). Priorities are established by in-house discussions supported by the Chief Executive. They are chosen on the basis of where the EA feels their efforts are able to obtain the greatest environmental improvement (Smith, 2007). Discussions with stakeholders take place, so public opinion is taken into consideration to some extent, but the input of experts and officials weighs more heavily. Within these components, many of the targets and focal points are derived from European Directives.

Fly-tipping incidents (illegal dumping) are also a significant problem in England and Wales, occurring approximately every 35 seconds (UK EA, 2005: 12). The focus here is on tackling hazardous waste incidents as these have the greatest impact. The local community is concerned about the toxic effect of landfills (even though little scientific evidence exists to support their claims) and the EA is therefore conducting further research regarding this matter[74]. This clearly illustrates the influence that public opinion can have on government funding, which also applies in the Netherlands (with millions now being spent on concerns related to mobile phone transmitting stations). In both cases, precautionary approaches are being used in response to public pressure.

Interestingly, flooding is increasingly perceived as a real threat in the UK and Scotland, whereas in the Netherlands (which is probably one of the most vulnerable nations in the world), surveys show little public concern regarding this issue (Van den Berg, 2007). In Slovenia, the health impact of landfills is also an issue, with concerns relating primarily to contaminated groundwater (UNECE, 1997), although the quality of drinking water in general, and all EU focal points, are also considered priorities.

EU issues are also dominant in Hungary, although research is focused on sensitive population groups (specifically the elderly and children) as they are considered the most vulnerable and there is a limited budget available to collect relevant information. In terms of environmental components, air pollution and water issues (specifically management of the Danube River) are prioritised, but climate change is also perceived to pose a significant threat. In Flanders, problems with regard to waste incinerators, nonferrous industries and dioxin pollutants in food were triggers for environmental health policy. An assessment procedure termed the 'phase plan'[75] ('fasenplan') is used to determine priorities for chemical risks based on biomarker signals.

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[71] The EA's chemicals strategy is aimed at industrial and waste sites. Further priorities have been identified within this strategy, namely flame retardants and pharmaceuticals (UK EA, 2005)

[72] The UK EA focuses on the outdoor environment (and therefore **not** indoor air quality). This implies that they also focus only on naturally occurring radon gas rather than its presence in building materials – as is the case in the Netherlands

[73] Environmental tobacco smoke, persistent organic pollutants and radon were also mentioned as important issues (in this case, the latter is related to environmental concentrations of the gas related to the underlying geology of certain regions of the UK).

[74] Specifically whether there are increased birth defects in babies of women living near landfills

[75] This procedure consists of four successive steps to interpret biomonitoring data: determine an anomaly, evaluate the severity, and determine the cause and identify the local source. They are completed chronologically in cooperation with authorities at various levels, and stakeholders.

In Ireland, the EPA mentions air pollution, waste and noise as having an explicit link to human health. Socio-economic and lifestyle and environmental factors, such as obesity, smoking, poor diet and lack of exercise are considered more problematic than the environmental threats relating to factors such as industrial emissions. In Germany, fine particles, noise, environmental tobacco smoke and chemical substances are prioritised. In Scotland, air quality (indoor and outdoor), contaminated land, the cumulative impacts of exposure to chemicals and radioactive waste, and the impact of climate change pose the greatest threat. Priorities are determined by the best scientific and epidemiological data but may also be driven by public opinion.

The US EPA focuses on seven different environmental areas: air, pesticides, pollution prevention, toxics & chemicals, waste & recycling, and water (US EPA, 2007). The Austrian EA mentions air and water pollution (including drinking water), noise, climate change (heat waves and floods), accidents and lack of exercise related to inadequate environmental quality. Furthermore, since some areas of Austria were exposed to high radioactive contamination following the Chernobyl incident in 1986, protection from radiation ('radioecology') is also particularly relevant (Umweltbundesamt, 2007). In Iceland, protection from avalanches (which fall under natural disasters) is still a primary concern, as is ensuring that outdoor activities occur 'in harmony with nature'. The EFA, however, states that there is no official risk priority list at national level (even though risks associated with hazards are compared with one another).

The Maltese government considers outdoor air pollution[76] and accidental injuries (including road traffic accidents) to be the worst local environmental health problems. Waste management is also a problem as liquid waste discharged untreated into the sea poses health threats to swimmers and divers (Government of Malta, 2002). In Austria, EU Directives are given precedence, but politicians often appear to make choices on the basis of 'low-cost and high popularity'.

iii. Goals and norms

The UK Health and Safety Executive (HSE) defines norms as 'generic control measures that must be applied to eliminate or reduce the risk for a particular hazard' (HSE as cited in Fisher, 2000: 112). These standards do not have to be legally binding but they are expected to exert some kind of influence on activities that have an impact on the environment. Due to the ad hoc nature of risk regulation in the UK, the development of environmental and health norms did not occur in a systematic or rational way but can be considered 'the product of historical and political happenstance over the last two centuries' (Fisher, 2000: 113). In this sense, they have evolved and responded to social and political needs, with the process being inherently flexible. The 'As Low As Reasonably Practical'[77] (ALARP) principle provides a rough guideline for setting norms. So, whereas the UK has shifted from using ALARA to focusing on ALARP, the Netherlands (and Scotland) are still using the former principle.

[76] Within the component 'air quality', Malta has further prioritised sulphur dioxide, nitrogen oxides, carbon monoxide, ozone and fine particles. This indicates that further prioritisations do occur *within* the environmental compartments.

[77] This phrase is used primarily by the Health and Safety Executive (HSE) and has its roots in the ALARA principle (see *Chapter 2, Section 2.2.1, Heading iii*)

The Flemish government sets target values for different environmental compartments and limit-values to reduce pollution. The standards are based on a balanced consideration of the estimated probability and magnitude of the effects, the percentage of the population affected and the social impact of effects. Hungary attempts to adhere to EU standards where possible. However, national objectives are also kept in mind (i.e. economic development), which means it is not possible to maintain the same level of stringency everywhere.

Slovenia still uses sector-based regulation to control environmental and health risks, aimed at achieving an equal level of protection for the population as a whole, with norms primarily taking the form of emission standards based on EU legislation (which is considered to be quite precautionary). For air quality emission, standards are set at 'general'[78] or 'special' limit values; the latter applying to specific equipment or plants (indicating the possibility of a somewhat area-based approach). In Iceland, regulations regarding air, water, soil and chemicals are derived from EU directives. Norms for natural hazards are set on the basis of the probability of being killed, with, for example, avalanche hazards for buildings being calculated on the basis of an individual being inside a certain building 100% of the time[79]. This type of calculation could therefore be considered relatively precautionary. Furthermore, in Iceland, 'a common method of determining the acceptable risk level due to a particular hazard is to compare it with other risks' (Jónasson, Sigurðsson, & Arnalds, 1999: 9).

All the EU member states mention that Directives from the European Commission (EC) currently play an important role in standard setting. The US EPA has different guidelines for setting standards within the various programme offices. This is related to different legislative requirements imposed by the US Congress for the various environmental risks. The Clean Air Act, for example, states that the risk level experienced by the Individual Most Exposed[80] (IME) should form the basis of policy decisions regarding hazardous air pollutants[81].

On the whole, the US EPA still uses 'high-end' hazard or exposure levels, thereby ensuring the protection of the most sensitive population groups (US EPA, 2004: 16). These high-end levels are based on a calculation of risk for an individual that receives an exposure greater than that which 90% of all individuals in their population would be subjected to[82] (US EPA, 2007). The Maximum At Risk Individual[83] (MARI) may be used in Ireland (Lynott, 2006) and can therefore be considered a precautionary

[78] 'The general limit values have been divided into several groups of compounds (organic compounds, inorganic gaseous compounds, dust, metals, etc). Furthermore, they are set according to the hazard potential of the pollutant, the technology that is available, and the type and size of the plant' (UNECE, 1997: 49)

[79] This is the same unit as is used to calculate the risk of plane crashes

[80] For more information on the analytical framework used to estimate the IME, please refer to *Risk Assessments Principles & Practices* (EPA, 2004: pp. 27-29)

[81] Furthermore, the Maximum Individual Risk[81] (MIR) should be no higher than approximately 1 in 10,000, whilst the 'ample margin of safety' (applying to the largest amount of individuals as possible) in relation to cancer risk should be no higher than about one in a million (US EPA, 2004: 27).

[82] The EPA refers to this as 'a dose level received by anyone in a defined population that is greater than the 90th percentile of all individuals in that population' (US EPA, 2007).

[83] MARI is 'a theoretical individual, a subsistence farmer living for 30 years (usually) in, and obtaining all their food from, a 100 m diameter plot upon which the maximum pollutant flux is deposited' (Lynott, 2006: 17). It represents the most sensitive individuals in a population.

measure. However, risk management decisions may be adjusted if available data dictates a lower or higher level of protection.

In the Australian context, Environmental Health Criteria[84] can be identified for toxins. In general these tend to be precautionary, taking multiple exposure pathways into consideration. Uncertainty regarding the use of animal data is compensated by the use of a safety factor (ranging from 10 to 2000). Moreover, Acceptable Daily Intake (ADI) values from the WHO are used for ingested toxins; these are based on the most sensitive animal data[85]. According to Australian experts, estimates in 'ordinary language' (specifically well-defined qualitative categories) may be just as useful as numerical estimates. Furthermore, it is even felt that 'numbers may give a misleading implication of accuracy' (enHealth, 2004: 128). The value of quantitative estimates therefore remains debatable. The Netherlands is just as advanced as other countries when it comes to using quantitative estimates as a basis for policy, but it remains difficult to assess whether this is indeed a positive trend.

3.3.2. Risk management

i. Tools, strategies, and responses

In Australia, risk assessment and management are referred to as two separate phases in which the latter takes economic and political factors into consideration alongside the scientific and social elements of the risk assessment. There is a general consensus between government bodies on the regulation of chemicals stemming from industrial, agricultural and medical spheres. The precautionary principle is considered to be relevant in the risk management phase, stating that this 'must include a cost/benefit assessment', whilst also taking stakeholder acceptability into account (enHealth, 2004: 9). This clearly indicates that public perception is considered important, from the assessment phase through to the management phase.

Environmental statutes may be used to address health risks. US environmental law falls into three categories: risk-averse health-based provisions, technology-based provisions[86] and provisions that involve 'balancing' the costs and benefits of protection from risks (Applegate, 2000 as cited in Vogel, 2003: 12). The risk characterisation generated in the assessment phase is considered in light of other economic, technological, political, regulatory and social factors (including attitudes and values of society) to determine an appropriate risk management approach (US EPA, 2004: 3) with the relative weight of these factors varying per risk. It is explicitly stated that 'there may appear to be a variation from one EPA risk management

[84] Before forming these criteria, it is advised that certain questions are posed such as: why is the criterion necessary? Will it serve as a standard or a guideline? Will it be generic or situation-specific? (For more information see enHealth, 2004: 141)

[85] If no ADI values are available, literature or other scientific evidence is consulted to determine if a substance may cause cancer (enHealth, 2004). For carcinogens, Guideline Doses[85] are identified which are considered to be 'protective of human health' (enHealth, 2004: 147). The lowest guideline dose chosen is the one supported by the most evidence. For other risks, Health Guidance Values may be established.

[86] Requiring 'best conventional', 'best available' or 'maximum achievable' control measures (see Vogel, 2003: 12).

decision to another in the way that public health protection goals have been balanced against other considerations … however, overall, EPA interprets its statutes to be protective of public health and the environment' (US EPA, 2004: 14).

Interestingly, although, in many aspects, the USA used to be a trend-setter in environmental risk management[87]; the EU now has several 'health, safety or environmental policies[88] that are either stricter or more innovative than in the USA' (Vogel, 2003: 13). The EU Integrated Pollution Prevention and Control (IPPC) Directive[89] 'imposes a requirement for industrial and agricultural activities with a high pollution potential to have a permit which can only be issued if certain environmental conditions are met, so that companies themselves bear responsibility for preventing and reducing any pollution they may cause' (European Union – EU, 2007). The UK EA considers this to be closely related to environmental health risk reduction, as it reduces pollution, which has direct health effects. This is in line with IPPC Best Available Techniques (BAT) concept, which includes a cost-benefit element (i.e. a technology--based approach) and is also used in many other countries.

The UK EA uses licensing/permitting systems and emissions standards to control environmental pollution. In terms of monitoring, the EA directs most of their attention towards poor performers and illegal operators. When it comes to specific interventions, choices are based primarily on efficiency, but there are no specific tools that can be used to compare the relative benefits of different options, and choices are therefore based on professional judgment.

In line with community concerns over landfills, a precautionary approach has been taken by not locating composting sites within 250m of residential or office land use (UK EA, 2005: 14). This illustrates the effect of public opinion on risk management responses. There is a legislative requirement to try to include public opinion in the decision-making process, although it is acknowledged that 'public attitudes to risk are difficult to measure' and that 'public concerns may be founded on ignorance, false information, unreliable media reporting, etc' (House of Lords, 2006: 6). It is therefore up to experts in the field to determine the relative weight of such factors. In legislative terms at national level, the precautionary principle was formally adopted in 1990, with the aim of 'supporting sustainable development' (Jordan & O'Riordan, 1995 as cited in Vogel, 2003:19), and more than fifteen years after the USA began using this principle.

A national health plan has been implemented in Iceland which is geared at enhancing people's health throughout 'their entire lifespan', as well as reducing diseases and accidents and alleviating 'the pain and suffering caused by them' (Ministry of Health and Social Security, 2004: 6). This last factor indicates an explicit focus on reducing the social disruption associated with risk. There are also early warning systems and specific protocols that must be adhered to for avalanches, volcanic activity and floods. Compensation can be used when natural disasters occur. The possibility of using compensation is sometimes also used in the Hungarian context. Small towns are

[87] The USA, for example, already required environmental impact assessments in 1969 whereas the EU only adopted this method in 1985 (Vogel, 2003: 13).
[88] *For example*, policies relating to GMOs, climate change and eco-labeling (Vogel, 2003: 13).
[89] In a sense, this is a translation of the 'polluter pays principle',which was discussed in the previous chapter (see *Chapter 2, Section 2.3.2., Heading i*)

sometimes compensated financially for increased traffic flow resulting from highway construction. Decisions to use compensation occur ad hoc, as is the case in the Netherlands. Nevertheless, most countries saw the concept of compensation as being undesirable and stated such measures would rather be avoided. Judging by the fact there is no concrete, national protocol for implementing this mechanism in the Netherlands, it would seem that Dutch civil servants share this sentiment.

In Hungary, there has also been a strong emphasis on educating the public in order to empower them in public consultation processes, with NGOs and the media playing an important role in this process. In general, decisions are made as transparently as possible by highlighting areas of uncertainty and communicating openly with stakeholders.

There is a concrete protocol at national level in Belgium for the response to heat waves and the NEHAP was completed in 2002[90]. In Flanders, specific actions must be taken when standards are exceeded for particulate matter, recreational water and during ozone/smog periods. Moreover, a project aimed at 'sensitising' the public and local governments for pesticides[91] was initiated and a centre of expertise for environment and health[92] (consisting of universities and research organisations) now exchanges environmental health policy-relevant information. Such research has, to date, led to the implementation of a 'cadmium action plan' (to reduce lung cancer). Furthermore, thirteen policy action proposals have been implemented for DDT; these were classified on the basis of costs (financial and manpower), effectiveness in DDT reduction, and benefits of action for different age groups and in relation to other chemicals. The 'polluter pays principle' is used to enforce financial contributions from stakeholders.

An Action Plan for Environment and Health has been set up in Germany aimed at integrating environmental and health issues into various policy fields. Local and regional noise reduction action plans and specific plans for reducing dust have also been implemented (in line with EU regulation), whilst the 'Blue Angel' eco-label promotes the most environmentally friendly goods and services. This last initiative has been used to promote the reduction of indoor environmental health risks (for example, by labelling paints and flooring that are low in pollutants), as well as being used for certain pesticides and low-radiation mobile phones (Dürkop, Moriske & Englert, 2005).

The EPA in Ireland works with licensing systems for industrial and waste management activities, and considers that the most appropriate techniques depend on local factors[93]. The increased focus on research has also led to improved water quality and the development of methods such as the Microbial Risk Assessment model, which identifies water that is at risk for becoming contaminated (Lynott, 2006). The finalisation of the first National Environmental Health Action Plan (NEHAP) this

[90] An evaluation of the Belgian NEHAP can be read at www.nehap.be
[91] See http://www.zonderisgezonder.be/
[92] See http://www.milieu-en-gezondheid.be/
[93] Emission Level Values (ELV) are used to indicate what maximum achievable emission standards can be achieved through the optimal combination of process and abatement techniques (Irish EPA, 2007). Justifications to the EPA are required if the most stringent ELV is not adhered to.

year is regarded as one of the first important steps in identifying the primary environmental health issues in Ireland[94].

The first version of the NEHAP in Malta, which is regarded as part of the foundation of the modern approach to environmental health risk, dates back to the late 1990s. Since then, several concrete protocols have been developed to deal with risk in specific areas. For example, a comprehensive Pesticides Monitoring Programme is used to evaluate risks relating to pesticide consumption through certain products[95]. The most concrete risk-based decision-making in Malta has occurred in relation to the creation and resiting of landfills, the siting of waste recycling plants and other proposed land development (primarily the area in which environmental health management and spatial planning overlap). An interministerial working group has also been set up to ensure the implementation of the 2001 waste management strategy (which was developed with public consultation), and the Malta Environment and Planning Authority (MEPA) was created in 2002.

Austria completed their NEHAP, which included goals for various environmental components[96], around 1998. A modus operandi currently exists which must be followed when signals are obtained from early warning systems. There are, for example, over 336 radiation[97] monitoring stations in Austria which are connected to a centralised national unit (Umweltbundesamt, 2007). If a problem is detected, this body will alert provincial and regional units (who each have their own risk management protocols). Provincial governors are also issued with action requests if limit values are exceeded in other environmental components (like air and water quality). Public opinion is weighed most heavily in decision-making concerning risks relating to radiation, electromagnetic fields, waste incineration and hazardous chemicals.

The protocol for tackling risk in the Scottish context varies according to the legislation that is applicable. Societal opinion is considered most important when there is a high degree of uncertainty surrounding the risk (and the government needs to justify action or inaction). In this case, an explicit evaluation of the overall societal costs and benefits will be carried out. Addressing inequality and implementing environmental justice are important drivers in Scottish governmental decision-making. Furthermore, in addition to BAT, Scotland also utilizes the Best Practicable Means[98] (BPM) concept and interventions based on the precautionary principle[99] are

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[94] Ireland took a long time to develop their NEHAP strategy, with many European countries having completed comparable plans over a decade ago. The UK was a front runner in this field (publishing their strategy in 1996). However, in 2000 'it was realised that the original aim of the NEHAP to provide an overview of the provision for environmental health in the UK had been subsumed within the wider drive for sustainable development' (Kleinjans et al., 2003) and the NEHAP was invalidated.

[95] This tool identifies guideline levels of pesticides in food: Maximum Residue Limit – MRL (theoretical maximum residue consumers could ingest), Acceptable Daily Intake (amount that can be ingested daily over a lifetime without appreciable health risk) and the Theoretical Maximum Daily Intake (calculated by multiplying the MRL by the estimated average daily consumption per capita). Similar approaches are used in other countries for food-related risks.

[96] Specifically air, water, historic pollution, food quality & safety, radiation, chemicals safety, noise, traffic, accidents, occupational safety and the urban environment (Kleinjans et al., 2003[2]).

[97] Specifically measuring the 'ambient gamma dose rate'

[98] '*Practicable* means reasonably practicable with regard to local conditions and circumstances, the current state of technical knowledge and to the financial implications. *Means* includes the design, installation, maintenance and manner and periods of operation of plant and machinery, and the design,

used in cases of high uncertainty. The possibilities for compensation are tied to the polluter pays principle, which is laid down in the Environmental Liabilities Directive.

When Slovenia became independent, it began its environmental reform by ratifying the London Amendment on Ozone-depleting Substances, which the former Yugoslavia had refused to sign (UNECE, 1997). Environmental conditions are now monitored across the country but there are no specific protocols for dealing with risk. Furthermore, there is limited use of cost-benefit analyses and economic factors are generally not taken into consideration until strategies reach the implementation phase. Environmental regulation is made up of regulatory and economic instruments (UNECE, 1997), with the 1993 Environmental Protection Act allowing economic sanctions for pollution to water, soil and air. There is also a National Environmental Protection Development Fund (the Eco-Fund) which is a state-owned stock holding company that provides loans for environment-related infrastructure (UNECE, 1997).

The EU is becoming increasingly influential in terms of risk management (and specifically the implementation of environmental health policy). Not only are actions within member states shaped by EU standards, they are even 'helping to define the American regulatory agenda' (Vogel, 2003:14). Although all European respondents made some reference to the EU (specifically for environmental standards relating to air, soil and water), it appears that to improve the chances of accession into the union, countries readily adopt the prescribed EU standards and methodologies including those for risk assessment. This would suggest that Eastern European countries are gradually enforcing more consistent risk assessment and management strategies than in the past. The lack of funding, however, is repeatedly mentioned as a significant problem. Western European countries like the Netherlands, the UK, Germany and Austria, as well as Australia and the USA are therefore at an advantage as they have stronger economies (and thus more available resources for the risk policy process).

There is a focus n most countries on assessing the costs and benefits of risks and risk management options; these trends are therefore not unique to the Netherlands (although the processes are better developed than in countries like Slovenia and Hungary where the implementation of such principles is still relatively new).

3.3.3. Defining responsibility

The EU formally separates risk assessment and risk management, stating that scientists and technical experts should be responsible for the former, whilst politicians should handle the latter (Vogel, 2003). The USA highlights the exact opposite, emphasising that there is not necessarily a distinction between the two phases.

Legislation plays an important role in US environmental management, with laws specifying necessary levels of protection being proposed by Congress, and bodies such as the EPA being authorised to create regulations that will allow the law to be

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construction and maintenance of buildings and other structures' (Scottish executive publications, 2007). This is therefore similar to BAT, but both principles are used in Scotland.

[99] The SEPA has written guidelines on the application of the precautionary principle, in cooperation with Northern Ireland through the Scotland and Northern Ireland Forum for Environmental research (see: SNIFFER, 2005 *Applying the precautionary principle – an overview*, SNIFFER: Edinburgh)

enforced at local level[100] (such as emission standards, coupled with possible sanctions). The EPA is subdivided into various programme offices that interact with different government bodies and stakeholders. Furthermore, two types of risk assessors are identified: those that develop chemical-specific or stressor-specific assessments, and those who develop site-specific or medium-specific assessments (US EPA, 2000: 20).

In Australia, it was suggested that one person would not have the knowledge and skills to conduct an entire health risk assessment independently, but that there must nevertheless be one individual coordinating the process (enHealth, 2004). Any proposed Environmental Health Criteria produced have to be endorsed by a national health body, and a separate unit has been set up to tackle the issue of radiation. The overall responsibility regarding environmental health risks, however, is 'fragmented'; as it is spread between national, state and local-level federal agencies (enHealth, 2000: 32).

Although the scientific domain plays an important role in risk assessment in the UK, the central government remains the primary player dealing with risk problems (Fisher, 2000) in order to prevent 'undemocratic' decision-making (by placing the decisions regarding risks in the hands of unelected 'experts'). Agencies like the EA have recently been called into being solely for risk regulation, but their powers are still relatively minimal[101], although the EA does 'seek to influence policy as a champion of the environment and as a body at arm's length from Government' (Smith, 2007). During both the assessment and the risk management phases, the EA obtains advice from the Department of Health and other expert scientific committees (UK EA, 2005: 15). The EA is required by law to implement national policy, but they do have some freedom in choosing how resources are spent across the various policy areas.

In Iceland, the EFA helps to draft legislation on hazardous substances, food and external safety, as well as coordinating the local health inspectorates, which are in charge of the implementation phase. The EPA in Ireland is in charge of environmental protection, including the prevention and control of environmental pollution[102]. There are separate offices within the EPA for environmental assessment, enforcement, licensing & guidance and communications (Lynott, 2006).

The Maltese Ministry for Health, Elderly and Community Care has had an Environmental Health Unit (EHU) since the early 1990s, which works closely with the Environmental Health Policy Coordination Unit of the Health Director General's Office to monitor, assess and control environmental issues posing a threat to health. There are also individual boards relating specifically to environmental health in relation to transport, pesticides and radiation. However, the MEPA takes most of the decisions regarding environmental health risks.

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[100] For more information regarding US laws and regulations see: www.epa.gov/epahome/lawintro.htm

[101] Furthermore, although these risk regulators should technically be accountable to various parties (i.e. politically to Parliament, financially to the Treasury and legally accountable to the courts), there are 'few stringent accountability mechanisms in this area' (Fisher, 2000: 120), which suggests that they have a relatively high degree of freedom in their actions.

[102] Although the Health Service Executive, local authorities, the Food Safety Authority and the Health & Safety Authority all play a role in environmental health matters.

The Slovenian state is responsible for monitoring natural emissions and phenomena, whereas the polluting parties are required to monitor their own emissions. The Ministry of Health is responsible for environmental aspects that affect human health (such as air pollution). The government sets the standards and the EA provides scientific advice and implements legislation. More localised issues, such as noise, are transferred to municipal level (which is also in charge of setting standards). The public is allowed to comment on the proposed risk management strategies, but they are generally not involved in the risk assessment phase. Communication with the public occurs primarily through the media (with NGOs having played a pivotal role in promoting public participation). The Slovenian public is largely of the opinion that the government should be in charge of risk assessment and abatement.

In Hungary, the Environment and Health Research Institute conducts health risk assessments, whilst the Ministry for the Environment handles environmental risk assessment (although the latter focuses implicitly on health impacts). External agencies like the REC or academic institutions may provide input for these processes. The government is ultimately responsible for setting and implementing standards, although tasks may be delegated to municipalities. There is a willingness to let stakeholders (the public and the business sector) play a larger role in the risk management process, but this has proven to be a difficult task and the government is currently open to any suggestions (international or otherwise).

Environmental matters in Austria are monitored by the national government, but, provincial bodies are asked to respond[103] if standards are exceeded. NGOs play an important role in raising awareness and encouraging the abatement of risks in civil society. Austria, the USA and Australia, as in the Netherlands, place specific emphasis on the division of roles between the government, market (business sector) and civil society when it comes to risk management. Trends towards increased decentralisation are therefore also present in other countries (although such processes have already been around for many years in the USA).

In Belgium, competences are divided across Communities, Regions and the Federal government agencies, which cooperate regularly. The Flemish EA monitors air and water quality, and produces an annual report. The Air, Nuisance, Risk Management, Environment and Health Division of the Environment, Nature & Energy Department in Flanders develops environmental and health policy (this body also communicates with the Belgian federal government through the Environment-Health unit). The federal government, however, remains solely responsible for tackling radiation issues. In Denmark, the federal government is in charge of decision-making and implementation occurs at regional level. In Scotland, the tasks surrounding decision-making and enforcement vary per health risk and are divided between the various levels of government, public agencies (such as SEPA) and health boards.

3.3.4. Integration and differentiation

[103] The decisions to intervene are based on hard data and can therefore, according to the Austrian EA, be considered transparent.

In order to encourage integration, most countries have formed one centralised environmental agency that is in charge of providing advice for policy and often for its implementation too. The creation of such bodies generally appears to be a response to previous regulatory failures and therefore signify a shift towards integrated practices as a result of historical shortcomings. The Maltese MEPA is the 'youngest' environmental agency (created in 2002) and the American EPA the oldest (having been in existence since 1970). This, in a sense, indicates the USA was a front runner in recognising the need for more integrated practices.

Currently, the US EPA explicitly mentions the value of achieving greater harmonisation with certain partners (i.e. other national governments, such as Canada, state governments and the OECD) to achieve more consistent practices and scientific consensus on methodologies (US EPA, 2004). It is also felt that internal integration needs to improve by creating better 'cross-programme interaction' (US EPA, 2004: 146). Specific methods have been developed to encourage a more integrated risk assessment content. For example, the Integrated Risk Information System (IRIS) has been developed[104] for chemical assessments, as well as a model and checklist for performing integrated cumulative risk impact assessments (see *Appendix 7.1 & 7.2*). Moreover, there is a desire to build an uncertainty analysis into the risk assessment phase (rather than dealing with uncertainty in a piecemeal fashion).

The UK EA is attempting to work with other government departments to better coordinate their activities (UK EA, 2005). Furthermore, in their annual reports they regularly refer to EU-level legislation, which indicates that UK policy is clearly embedded in international policy frameworks, as appears to be the case for all European nations. As mentioned, the UK EA does not recognise a clear distinction between 'traditional' national approaches to risk and the current more 'integrated' mentality. This is a clear indication that such changes may occur gradually, making it difficult to distinguish when a new trend really commences. Communication with stakeholders throughout the entire risk policy process (from assessment to risk management) is seen in the UK, just as it is in the Netherlands. The UK does, however, have the most extensive legislative basis for ensuring this occurs, even having formulated 'the Concern Assessment Tool' (House of Lords, 2006: 6) for this purpose. Nevertheless, despite this legislative basis, communication still does not occur in a consistent or coherent manner in either context, with the frequency and extent of interactions varying per risk (often focusing on those topics that generate the greatest public unrest) and according to the specific preferences of the individuals involved in the process.

In the Netherlands, health-based considerations are increasingly influencing sectoral norms, as is the case in other countries. Australia and Germany, for example, have linked several spatial planning policies with environmental health concerns (ranging from improved access to green space to ensuring facilities are within walking distance of residential areas in order to encourage more active lifestyles). The Netherlands is therefore not alone in this line of thinking, which indicates a global trend towards increased cross-sectoral integration. However, Germany specifically mentioned that education on how to design public spaces sufficiently in line with health concerns needs to be improved (it was suggested that planners and architects should be legally

[104] For more information see: www.epa.gov/iris/intro.htm

obliged to calculate the costs and benefits of settlement structures, taking into consideration aspects such as accessibility, infrastructure costs, decreases in property value due to noise overload, and the costs for cooling & heating).

In Malta, integration between sectors has been encouraged through the formation of an inter-ministerial committee on environment and health, which has representatives from the health, environment, planning and transport sectors, as well as local councils. One of the first tasks of this committee was to revise the NEHAP in line with commitments made at the Ministerial Conference on Environment and Health in Budapest (which indicates a drive towards integration with international policy frameworks). These developments were fuelled by European initiatives surrounding environment and health, the EU accession process, increased public interest and pressure from the media.

In Iceland, Ireland[105], Austria and Scotland, Strategic Environmental Assessments[106] (SEA) include an explicit focus on health impacts. Icelandic transport planning also requires an assessment of possible pollution, noise and accident reduction measures. There have been discussions about spatial planning playing a more prominent role in pollution reduction. In Ireland, working relationships between the Irish EPA and other health authorities (such as the HSE[107]) have recently improved considerably. However, it is felt that increased efficiency can be achieved and more collaborative working arrangements realised (as the responsibilities regarding health protection are spread across various actors). This statement also applies strongly to Slovenia, which still has a strong sector-based working ethic.

Since the former Yugoslavian days, environment and spatial (physical) planning departments in Slovenia have been located in the same Ministry at national government level (although there is little evidence of cross-sectoral policy approaches). In some instances, the idea of 'integration' seems to be appearing in other sectors, as 'co-operation between the energy sector, local authorities and the Hydrometeorological Institute is excellent' when it comes to exchanging information on air quality (UNECE, 1997), and 'sustainable development' is repeatedly mentioned as an important national objective. However, as there is little visible proof of increased integration, a lot remains to be done in terms of working together in the implementation and formation of integrated policy initiatives.

In an UN report about Hungary, integration is referred to as 'an interdisciplinary and holistic approach which produces more expensive solutions in the short run rather than solving problems in a partial way' (Nemes, 1995: 7). SEA is perceived to contribute towards integration of environmental and health issues in the assessment phase, and interdisciplinary working groups are sometimes set up for specific topics (like energy efficiency). The national Sustainable Development Strategy encourages cross-sectoral integration with the strategy as a whole focused on the achieving a high

[105] See www.epa.ie/whatwedo/advice/sea

[106] 'SEA is a process to ensure that significant environmental effects arising from policies, plans and programmes are identified, assessed, mitigated, communicated to decision-makers and monitored, and that opportunities for public involvement are provided … SEA is a generic tool which can be used in a variety of situations.' (Sea-info.net, 2007)

[107] The Irish Health Service Executive (HSE) was established in 2005 and provides health and personal social services for the Irish population (www.hse.ie)

quality of life, which is defined as good health and a high environmental quality. The link between a more healthy, active lifestyle and a person's economic status is also recognised, which indicates a clear understanding of the integrated character of environmental and other health risks.

In order to achieve differentiation, the US EPA is able to take area-specific information into consideration when assessing certain risks (such as exposure risk to pesticides). In Scotland, it is possible to generate area-based environmental standards through legislation. The use of BAT in Ireland also depends on local factors (as the 'best available' technology or technique may vary from place to place), as does the ALARP principle in the UK (i.e. 'reasonableness' may depend on context-specific factors). This indicates that, as in the Netherlands, some policy space has been made to encourage a more differentiated risk management approach.

Although it is possible to generate situation-specific risk assessments in Australia (indicating the possibility of generating an area-based approach), these 'should not lead to significant variations in the estimated risk of similar situations' (Langley & El Saadi, 1991 as cited in en Health, 2004: xiv), which highlights a desire for consistency. In Hungary, it was stated that area-based approaches might result from a lack of sufficient funding (i.e. certain areas might be prioritised for tackling environmental health risk, suggesting that lesser quality is – at least temporarily – accepted for other locations). However, this is not coupled with compensation arrangements and one can therefore assume such area-based disparities occur worldwide and are not a result of conscious policy choices but rather the result of (limited) resource availability (which can therefore not be considered a 'modern' trend).

3.3.5. Outcomes of the modern approach to date

The characteristics of the current approach to environmental health risks can be summarised briefly as follows: a greater focus on transparency and cross-sectoral considerations, better risk communication, significant financing for research (sometimes with a specific emphasis on identifying cumulative impacts) and more regular inclusion of calculations for cost and efficiency. All countries still use the maximum permissible levels of risk (e.g. in the form environmental standards). However, in several contexts, the possibility of taking area-based factors into consideration, along with the reduction of norms beyond maximum levels (through ALARA/ALARP), can be considered important characteristics of the current approach. The approaches in different countries have had varying levels of success to date, as well as having encountered various obstacles.

i. Successes

By and large, the success of policy in most of the assessed countries is measured on the basis of whether the predefined norms have been attained or maintained. When asked to comment on the successes attained in relation to environmental health risks, most countries mentioned specific regulations (e.g. relating to water and air quality), improved dialogue with stakeholders and more regular cooperation between sectors as

their main achievements. Inter-sectoral cooperation has led to a more efficient distribution of financial and human resources, and more coordinated action.

The presence of a centralised environmental agency is perceived to contribute to transparency and increased public trust (although the latter is also greatly influenced by the media). Area-based approaches allow local chances to be used optimally, which also contribute to greater efficiency. Most countries now have access to far more environmental and other information due to a strong focus on collecting viable data and generating research networks, and the body of knowledge is constantly expanding. The US EPA states that this has, at times, allowed them to implement fewer precautionary measures (thereby taking a more 'rational' approach to risk and reducing unnecessary government spending).

In Germany, cross-sectoral successes have been booked by, for example, encouraging the use of construction products that are not damaging to health. The prohibition of indoor cigarette smoking in Ireland is considered one of the most significant environmental health achievements of the last decade (which indicates a 'broader' focus in addressing environmental health risks, since the focus is on lifestyle factors). There is currently a comprehensive Irish risk-based regulatory system in place thanks to collaboration between the EPA and various other parties. In Austria, risk regulation exists for chemicals, food, air and water quality, with sustainability indicators being used to monitor the success[108].

Flanders publishes a biannual policy evaluation[109] report, and more than 100 indicators[110] are used to monitor the environment (Van Steertegem, 2005). The three indicators falling under the category 'environment, humankind & health' are Biomonitoring among adolescents (reference values for the exposure biomarkers), biomonitoring among adolescents and newborns (area comparison for DDT), DALYs, and death by accidental intoxication (Vlaamse Milieumaatschappij, 2006: 6). Environmental indicators are also employed in Slovenia to assess the progress of environmental policy.

The quality and availability of environmental data in Slovenia has notably improved over the past decades, with comprehensive monitoring networks providing up-to-date emission data from point sources, as well as monitoring ambient air quality in various locations across the country. Several localised environmental issues (such as asbestos) have been tackled adequately and the situation regarding air pollution has also shown positive improvement in recent years (UNECE, 1997). This is primarily due to the need to adhere to EU standards (which indicates increased integration of national regulation with international policy frameworks).

The data collected to support policy decisions in Hungary has improved significantly and much work has been done regarding education and capacity-building within civil society (indicating a shift towards more decentralised risk management practices).

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[108] See (*in German*): http://www.nachhaltigkeit.at/strategie/pdf/indikatorenbericht/IndikatorenBericht_2006_080606.pdf

[109] Policy evaluation: 'the scientific analysis of a specific policy theme which is evaluated on the basis of criteria and serves as a starting point for the formulation of recommendations' (Van Steertegem, 2005: 9).

[110] See www.environmentflanders.be for the full list

Citizens are motivated to take part in decision-making processes and to take some responsibility regarding environmental risks (although this is perceived to be a very slow process). Cooperative arrangements between NGOs, municipalities and research institutes have also improved.

The creation of expert groups with members from different sectors has led to improved integration of environmental and health concerns in various Maltese government departments. A clearer process in tackling environmental health risks also contributed towards Malta's accession to the EU, which is perceived to have brought many benefits. The successes of health risk reduction strategies are measured by studies showing improved environmental conditions (i.e. reduction of lead levels in the air) coupled with enhanced health conditions (i.e. reduced levels of lead in blood). Changes in people's lifestyles that lead to less risk exposure (such as the use of sunscreen or avoiding UV radiation at certain times of day) are also seen as a measure of success. However, research initiatives regarding the effectiveness of Maltese environmental health risk policies are generally one-off studies (this indicates the absence of a concrete system for measuring policy success).

ii. Problems and shortcomings

Several countries stress the value of creating more coherent and standardised frameworks that may be used for generating norms (standard-setting) and deciding on appropriate management responses. This would ensure greater consistency in tackling risks (which should indirectly affect the trust of the public in the regulatory institutions). The risk assessment process in Australia was largely adapted from approaches in other countries – the USA and Canada primarily – without clearly focusing on the underlying assumptions of these methods (enHealth, 2004). This has created some inconsistencies at national level, although there has been a focused effort on generating a more coherent method since 2000. In Australia, just as in most countries, it is also felt that more research is needed regarding certain environmental risks. The monitoring of indoor air pollution was referred to as a specific problem.

In Malta, scientific evidence of the effectiveness of policies would be useful, especially regarding the actual reduction of exposure to risk that they have achieved (coupled with evidence of improved health conditions) and their cost effectiveness (or an estimated cost-benefit ratio). They also feel that a more centralised unit dealing specifically with risk assessment and management is necessary. In Germany, although transparency is considered pivotal, some decision-making processes (i.e. decisions concerning Bisphenol A, a potentially hormone disrupting chemical) were not at all transparent. Some improvements could therefore be made in this area. Furthermore, increased integration of environmental concerns and spatial policy is said to be necessary, as there is unused potential in this regard (e.g. noise overload could, in many cases, be reduced if it was taken into consideration during the positioning of buildings – current architectural practices in Germany are very vulnerable to noise impact). it is thought that building properties more compactly would provide many health benefits and should be encouraged more.

Although environmental monitoring in Slovenia has improved, data on the true health impact of environmental factors is still limited (with the lack of data relating to low-level exposures poseing a significant problem, just as in most other countries). The

success of environmental policy is not monitored sufficiently in Hungary, but it is hoped that this will improve in the coming years. In Eastern Europe, the main problem in terms of addressing environmental health concerns is a lack of financial means (this is not a direct criticism on the modern approach but it does indicate that economic factors can be a significant hurdle at national level).

Since Slovenia's independence, economic development has been the national government's primary goal (UNECE, 1997). This has left limited resources available for other objectives and reaching EU levels of environmental protection has been a struggle. The fact that cost-benefit analyses are hardly ever included – in establishing environmental norms or choosing risk management approaches – poses significant difficulties for the EA. A lack of human resources is also still a significant barrier. A standardised approach to environmental health risks is deemed desirable although no funding is available to generate such methods (or conduct research on this topic). Finally, Slovenia was said to be struggling to determine 'adequate' environmental standards (i.e. the dilemma of being too precautionary versus being too careless).

A lack of funding is also an issue in Hungary, where resources have been prioritised to protect the most sensitive population groups. The lack of information available on speculative issues such as climate change (especially in terms of accurate future scenario predictions) is said to be one of the main obstacles to environmental health risk management. Although there has been much support from the EU, it is felt that too much legislation must sometimes be complied with simultaneously (which is often not financially feasible). Furthermore, although stakeholders (especially in the business sector) could play a more pivotal role regarding public health, although complications regarding financial arrangements make this difficult to realise.

The US EPA (2004: 33) has been criticised for not dealing transparently with uncertainty and variability (i.e. fluctuations across space, time and individuals) in their risk characterisations, as well as being inconsistent due to variations in their approaches to risk management. This can be related to differences in the statutes applying to the separate EPA programme offices. For example, it may be required for them to establish a margin of safety, protect sensitive resources, reduce overall risk, prevent unreasonable risk, protect public welfare or function without adverse effects (US EPA, 2004: 14). Inconsistent Congressional mandates are therefore applicable to different areas of the EPA, leading to diverging risk management approaches. This factor was confirmed by staff at the EPA when they were asked to fill out a questionnaire regarding the 'overall' approach to risk in the USA context and found this to be an impossible task (as the USA has such a complex and diverse approach to risk management). This is a strong argument for more coherent decision-making at national level.

Public opinion in the USA believes that some parties consider 'that EPA has so overemphasised conservatism that most risk estimates are alarmingly false, meaningless and unscientific' (US EPA, 2004: 17). This is primarily due to the use of default assumptions (although the EPA does not acknowledge this is being unscientific) and 'high-end' risk estimates as a basis for policy. The USA has had many more years experience with the precautionary approach and therefore developments there (i.e. steering away from overly careful measures) are perhaps

indicative of future trends in Europe[111] (but it is impossible to make any predictions in this regard).

In most contexts, it remains unclear how public opinion should be weighed and how it should influence the setting of norms and so on. Professionals sometimes also experience difficulties in demonstrating (quantitatively) the health benefits of certain environmental and planning policies, the lack of scientific and economic evidence being one of the greatest barriers. However, a concrete answer could often not be given[112] when asked what specific information would be useful for achieving more integrated approaches at policy level.

According to an Austrian research project, barriers to increased consideration of health factors in environmental assessments (which indirectly illustrates the problem of integration between health and environmental management in general) include insufficient knowledge, inadequate definitions of human health (often too narrow or restrictive), no legislative requirements for integration, the absence of health impact indicators and a lack of communication between professionals from the sectors involved (Hilding-Rydevik et al., 2005). Furthermore, implementation of the precautionary principle often generates resistance from the business sector.

Austria also explicitly states that a good noise indicator would be desirable (perhaps they could consult Dutch practice for this matter), which indicates there is a trend, just as in the Netherlands, towards wanting to generate more coherent, simplified norms for specific environmental health risks, but that this is clearly a difficult task. It is important to note that it took over ten years to develop a single noise indicator in the Netherlands, and this is the only environmental component for which one coherent indicator has been developed to date. Further research is needed to develop more simplified indicators for other environmental components (such as air quality).

The Austrian EA expresses a desire for a method that would produce various scenarios based on cost-benefit considerations (i.e. effectively translating environmental and health impacts into 'costs'). Moreover, Austria has been experiencing problems with the allocation of tasks and the division of power (and rights to power) between the federal and provincial governments in relation to health risk management. In many countries, the skills and competences regarding environmental and health management are still spread across federal, provincial and regional levels of government, whilst also being strictly separated in different departments (the creation of one responsible environmental agency does therefore not appear to tackle this problem). Greater integration (or at least effective and regular communication) would be beneficial. Strategies that would encourage civil society to adopt a healthier lifestyle would also be welcome.

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[111] This being said, the levels of precaution in some countries are perhaps currently not as high as policy documents would portray them to be. In practice, in the Netherlands for example, precautionary measures are usually delayed until further research has been conducted. What happens in reality is therefore different from what one sees 'on paper', which implies the situation may already be more in line with the US line of thinking. This claim is also supported by Hammit et al. (2005) in their quantitative comparison of European and US risk strategies.

[112] The 2005 UK EA report does explicitly mention that 'the health effects of chemicals like asbestos, lead and dioxins are well known, but that the effects on health of most chemicals … are poorly understood' (UK EA, 2005: 9), which is a direct indication of one relevant gap in knowledge.

Malta states that although interventions can attempt tackling health risks produced by human activity, these must ultimately be paired with 'a focused strategy to raise awareness in favour of consumption control and to usher in fiscal measurements to promote and encourage investment in energy-efficient modifications, equipment and processes' (Government of Malta, 2002:33). This issue was also mentioned by Hungary and is particularly relevant for health risks associated with environmental pollution (and factors such as energy efficiency). Furthermore, although Health Impact Assessments (HIA) are sometimes included as part of an EIA, it is felt that more emphasis should be given to the former as an individual process, and that an individual risk assessment and management unit needs to be set up. Formal legislative requirements for HIA were also considered a necessity in Scotland (particularly in relation to environmental and spatial policy) whereas in Denmark, greater flexibility and cross-sectoral involvement was deemed desirable.

Many of these problems should, in theory, be addressed through the elements described in the modern approach; it simply appears that these have not been implemented sufficiently or consistently to date (it is therefore possible that some of these problems may be addressed in the near future as the approaches outlined in this paper are still relatively new). The following section evaluates the case studies on the basis of the indicators for integration and differentiation.

3.4. Evaluating countries through of indicators signifying integration and differentiation

The following sections summarise the situation in the various countries assessed according to the indicators presented in the previous chapter (*Section 2.3.7*). In the table, the full name has not been included for each indicator. These are:

1) *Blurring of phases in risk approach*
2) *Focus on transparency*
3) *Other principles underpinning norms besides health--based criteria*
4) *Simplified norms for specific health risks*
5) *More differentiated categorisation of risk*
6) *Differentiated (or area-based) norms*
7) *Increased policy space for use of compensation*
8) *Inclusion of stakeholder opinions (in risk assessment & management)*
9) *Including health-risk considerations in the formulation of sector--based norms*
10) *More cross-sectoral integration*
11) *Utilising increased policy space for differentiated risk management*
12) *Allocation of resources -based on principles other than equity (more than in the past)*
13) *More decentralised role division (i.e. between levels of government, the market and civil society)*

Please refer to *Appendix 3* for a more detailed description of the definition of the indicators.

The countries listed in the table below have been loosely 'scored' on the basis of these indicators. They may receive one of three scores:

✗ = not at all
½ = partially
✓ = completely or frequently

The table was left blank where not enough information was available. The countries that have been shaded in grey were approached for the research but did not respond.

The table is meant to give an indication of the current situation as it occurs *in practice*, rather than providing an overview of governmental *ambitions* (as they might be presented in policy documents).

The table below has been filled in partly by people working in the environmental health risk reduction field in the various countries approached, and partly using information derived from available literature or an interpretation of this. A table was chosen to summarise this information as it gives a good overview of the relative position of countries regarding certain integration and differentiation indicators. However, it must be noted that this table is meant to depict the *overall* situation at national level and does therefore not adequately illustrate the situation within specific sectors (as certain government departments may be more or less advanced, although future research could address this matter). *[*If any countries would like to provide further information on their situation, please do not hesitate to contact PBL*

Table 2: Table indicating the trends in various countries in terms of implementing integrated and differentiated environmental health risk policy

	General		Preparatory phase					Both phases		Risk Management				
	1) Blurring of phases in approach to risk	2) Focus on trans-parency	3) Principles under-pinning norms	4) Simplified norms for specific health risks	5) More diff. cat. of risks	6) Diff. (area--based) norms	7) Policy space for use of compen-sation	8) Inclusion of stakeholder opinions in approach to risk: Ass.	8) Inclusion of stakeholder opinions in approach to risk: Man.	9) Including health considerations in formulation of sector-based norms	10) More cross-sectoral integra-tion	11) Use of increased policy space for diff. risk man.	12) Allocation of resources based on principles other than equity	13) More decentral-ised role division
Netherlands	✓	½	ALARA* BAT**	✓	Predictable Unpredict. Combination	✓	✓	½	✓	½	✓	✓	✓	✓
UK	½	✓	ALARP*** BAT		✗			✓	✓		✓		✓	✓
Ireland	✓	✓	IME**** MARI***** BAT		✗				✓		✓			
Scotland	½	✓	BPM****** ALARA BAT			✓	✓	✓	½	½	✓	✓	✓	½
Germany	✓	½			✗				✓		✓		✓	½
Austria	½	½	ALARA BAT	½	✗	½	✗	½	✓	✓	½	½	½	½
Belgium (Flanders)		✓				✓		✓	✓		✓	✓		✓
Denmark	½	½				✓	✗	✗	✓	½	½	✓	✗	

Iceland	½	½	Focus on EU norms		✗		✓	½		½	✓		✗	
Malta	✗	✓	Focus on EU & WHO norms; BAT		Negligible Tolerable Acceptable Unaccept.	✓		✓	✓	½	✓		✓	✓
Hungary	✗	½	Focus on EU norms		✗	½	✓	½	✓		✓	½	✗	½
Slovenia	✗	½	Focus on EU norms & equal protection		✗	✗			½		✓		✗	½
France														
Sweden														
Norway														
Finland														
Italy														
Cyprus														
Poland														
Bulgaria														
Estonia														
Croatia														
USA	✓	✓	High-end exposure levels ; different principles per EPA office; BAT	½	✗			½	✓		✓		½	✓
Australia	½	✓	BAT	½					½		✓		✓	✓
N. Zealand														
Canada														

* ALARA = As Low As Reasonably Achievable;
** BAT = Best Available Technology (or Best Available Technique)
*** ALARP = As Low As Reasonably Practicable
****IME = Individual Most Exposed
*****MARI = Maximum At Risk Individual
****** BPM = Best Practicable Means

Many countries in Europe are showing similar shifts to those visible in the Netherlands, as can be derived from the table above. The assessment and management phases are becoming increasingly blurred in countries that have had several years of experience with risk policy, which implies that increased communication occurs between the parties involved in these processes. All the countries focus, at least partly, on improving the transparency of the environmental health risk policy process. Furthermore, most countries are implementing principles such as BAT, signifying that technological and cost-related elements are being considered. Although not explicitly mentioned in the table, maximum tolerable levels of risk (in the form of quantified norms) are used in all the countries to control pollution in the environmental domain. Only about half of the European countries attempt to reduce risks further than this maximum level by implementing principles such as ALARA and ALARP.

The focus on generating more simplified norms (e.g. by generating a single indicator for overall noise hinder or air quality) was only explicitly mentioned in a few contexts; the Netherlands could therefore perhaps be considered a front runner in this field. Furthermore, the development of a more differentiated categorisation of risk (i.e. focusing on more detailed categories than '*individual* versus *group* risk', or '*existing* versus *new* developments') was only seen in the Netherlands and Malta (although the value of using 'negligible' risk as a category, as is the case in the latter context, is widely debated). It must be noted that Australia did explicitly mention the value of using qualitative categories, although no national examples could be found (which indicates that such strategies are perhaps used on a lower scale).

Although several countries mentioned the possibility of generating area-based norms, no specific examples similar to the Dutch *City and Environment Project*[113] could be found, which indicates that such decisions probably occur ad hoc. The use of compensation is not very widespread, often even being perceived in a negative light. There is some evidence in almost all the countries showing that stakeholders are able to influence the risk management process (although the extent of this influence varies from risks to risk). The inclusion of stakeholder perceptions of risk in the assessment phase is still in the initial stages, and although some countries are more advanced than the Netherlands, it is difficult to judge how much influence this data truly has on decision-making. On a global scale, the inclusion of health considerations in sector-based norms is not yet a widespread trend, although there was an increased focus on cross-sectoral integration in all contexts (the link between environment, health and spatial planning was often put forward).

The use of differentiated risk management approaches (in terms of generating well-substantiated deviations from minimum norms, or making concrete decisions on compensation measures) does occur in several European countries, although structured approaches (again, like the *City & Environment Project* in the Netherlands) were not given as examples. This indicates that either these decisions are made on an ad hoc basis (except for in Scotland, where compensation is tied to the polluter pays principle), or they operate on a lower scale (such as the Dutch MILO method). Several countries still focus primarily on equal protection for all citizens although approximately half of the European countries assessed are beginning to consider the overall societal costs and benefits of interventions, as is the case in the Netherlands.

[113] See *Section 2.3.4*

Lastly, it appears there is also an international trend towards greater decentralisation of federal tasks in relation to environmental health risk prevention and abatement. Such shifts can reduce the financial strain on central government, whilst encouraging the market and civil society to take more responsibility for their actions.

3.5. Conclusion

The current approaches to environmental health risk have been shaped by the shortcomings of traditional approaches. Briefly summarised, these were: an unattainable focus on 'equal protection for all' (leading to excessively expensive measures), a lack of coordination within the environment domain and between activities in different sectors, a lack of transparency (from a stakeholder perspective), insufficient attention for societal perceptions of risk and cumulative impacts (indicating a lack of knowledge), and piecemeal, unstructured and ad hoc decision-making (leading to inconsistent approaches to risk). The elements depicted in the table above describe the modern approach to health risk in the United States, Australia and parts of Europe. These characteristics (along with an increased focus on research) should, theoretically, work towards combating some of the problems experienced in the past.

Some of the approaches outlined in this chapter are still relatively new, which means the true effects thereof are not yet evident. The value of working in the area-based manner in order to combat the problems experienced with attempting to achieve an equal level of protection for everyone has not yet been recognised. Most countries, however, have achieved greater coordination and integration within the environment domain and between different sectors (although there is still some unused potential in this regard). Working more transparently is a key focal point in all national contexts (with all countries having made steps to improve risk communication). Nevertheless, from a stakeholder perspective, processes are still not sufficiently transparent and important decisions can often still occur within circles of experts.

Steps have been made to include societal perceptions of risk in decision-making processes, but to date no country has suggested a concrete, coherent method that may be used to weigh such qualitative information in light of other scientific data. Furthermore, an overall lack of knowledge regarding uncertain issues such as climate change, cumulative impacts and the effect of low levels of exposure are repeatedly mentioned as significant barriers. Therefore, although data collection has improved, scientific uncertainty still poses a problem.

In many countries, examining health impacts in EIAs or conducting an HIA as part of an EIA or SEA were described as some of the primary methods for including an analysis of health impacts in the risk assessment phase (and thereby achieving a greater integration of environment and health considerations). However, the inclusion of health factors tends to occur ad hoc and is inconsistent (as there are often no formal requirements to ensure they are taken into account). The overall sentiment was therefore that it would be more beneficial to have official (legislative) requirement for performing a HIA (before the implementation of any developments that may have an impact on health and to evaluate the impacts of proposed policies), as this would ensure the inclusion of health as an important factor in decision-making.

Although the creation of a single environmental agency has improved the piecemeal nature of traditional decision-making practices, this is evidently not always sufficient to reduce the ad hoc nature of risk management. More coherent approaches *within* the federal government (particularly relating to the principles underpinning decision-making) are necessary to generate greater consistency. This indicates that although some of the problems experienced in the traditional contexts have been partially solved, professionals are still faced with many obstacles.

The situation in the Netherlands is by and large comparable to that of other nations in Europe that are at a comparable level of economic development. The use of a more differentiated categorisation of risks, and experimentation with a more structured manner of generating area-based risk management approaches, are the only two factors in which the Netherlands can perhaps be considered somewhat ahead. On the other hand, the legislative basis for public participation in the UK is admirable, and Scotland seems very knowledgeable on environmental health risk management in general. The Flemish 'phase plan' that is used in conjunction with biomonitoring has received some attention at EU level, which indicates that this is considered an innovative methodology. Malta, on the other hand, appears to have the most integrated approach at national level, with permanent interministerial working groups being in place to encourage cross-sectoral cooperation (although this could be tied to the fact that it is comparatively smaller than most of the other nations assessed).

The following chapter gives an overview of the most important trends seen at international level, provides answers to the research questions presented in the first chapter and concludes by presenting the most important elements for future research.

Chapter 4: Discussion and concluding remarks

4.1. Introduction

The following section is aimed at shedding more light on the following research questions presented in the first chapter:

Can similar shifts towards more integrated and differentiated approaches for tackling environmental health risk be identified in other countries in light of the experiences in the Dutch context?

To what extent have these shifts occurred and what have the experiences been? (i.e. what successes have been achieved and what are the primary barriers?)

Is there a general desire to make further changes in risk policies? What is the reason for the desired changes and how is their implementation envisaged?

The discussion has therefore been structured according to these questions, and it is followed by a clarification of the limitations of this research and some advice for future research on this topic.

4.2. Discussion

4.2.1. International shifts towards integration and differentiation of environmental health risk policies

A detailed description of the shifts towards integration and differentiation was given in the previous chapter (see *Section 3.4* and the conclusion to *Chapter 3*). Many countries attempted to achieve greater integration through the formation of one central environment agency. Such bodies often tend to be in charge of risk assessment (gathering relevant data, conducting research) and providing advice for setting standards. The creation such an agency is meant to enhance transparency and facilitate the process of integration (e.g. by creating a single contact point for other sectors to communicate with, as well as combining knowledge and skills). In theory, this also creates an entity that may be held accountable for environmental risk management.

The government still retains control over the actual protective level of the norms, but the implementation of legislation is often conducted, albeit partially, by the same environment agency (although this is sometimes carried out by a different office within the organisation). Occasionally, these agencies officially fall under the jurisdiction of the federal government's environment department (although they will generally still not be in charge of setting standards), but this is not always the case. It remains to be seen whether governmental environmental bodies or external environmental agencies produce better results in the coming years. Municipalities are

sometimes instructed to handle the implementation phase, but only a small number of countries specifically highlighted the roles of the market and civil society in risk reduction and prevention.

In order to further promote integration, some countries advocate the benefits of setting up cross-sectoral working groups to promote cooperation and the simultaneous consideration of sectoral ambitions, which can sometimes be diverging and conflicting. Such groups either ensure permanent interaction between various sectors or may be set up temporarily to tackle a specific issue. Moreover, Strategic Environmental Assessments (SEA) are often used to encourage a more integrated approach to tackling environmental health risks.

Countries having had more experience with tackling risks mentioned that the risk assessment and management phases are becoming increasingly interwoven, whereas countries that have only recently begun experimenting with such practices state that these processes are still distinctly separate. This indicates that there appears to be a trend towards a greater blurring of the two phases over time. Nevertheless, environmental health risks are by and large still tackled through environmental policy (as was the case in the traditional sense), whereby the achievement and maintenance of a high standard of public health is one of the primary goals of environmental management.

A thorough literature review conducted in 1999 by the Heidelberg Appeal Nederland Foundation (HAN) showed that most definitions of the term 'risk' in policy documents stem from the idea that risk-taking is synonymous with estimation with regard to decision-making. According to Hanekamp (1999: 24), a definition of risk that is primarily related to moral standards and perception will not lead to a well-balanced and substantiated environmental management regime. The degree of uncontrollability, involuntariness and other such largely subjective factors only translate the degree of societal 'interest' in environmental issues, which means that policy is actually based on a particular *vision* of what is deemed to be important in the environmental domain. An accurate evaluation of the true effectiveness of environmental and health protection achieved in this way is difficult if not impossible to achieve due to the subjective basis of such policy. Although there may be a theoretical element of truth in this statement, most countries find the inclusion of public opinion increasingly important (despite the lack of structured processes to achieve this). Public opinion has, in various cases, had an ad hoc influence on the spending of government funds (as was illustrated in various EU cases – see *Section 3.3.1, Heading ii*).

Some experts state that quantitative risk analyses that express risk in simple numerical form are easily communicated to stakeholder groups and the public (Dutch Health Council, 1995). However, characterising risks on the basis of one quantifiable characteristic may be considered an oversimplified way of setting health-goal priorities. The value of creating more qualitative categories was only recognised in a few contexts, but the shift towards using more detailed and qualitative categorisations of risks will perhaps occur in the coming years.

All the countries still use maximum allowable standards (such as emission levels) to reduce environmental health risks. Concepts such as ALARA and ALARP encourage

the reduction of health risks below the maximum tolerable level, which is a positive trend. These principles form an important part of environmental policy in some European countries, which indicates these countries may also have a more consistent approach to standard-setting at national level than in the USA, where the principles underpinning norms vary per environmental component (see *Section 3.3.4., Heading ii*). Principles such as BAT were mentioned in most policy contexts, which indicate there is an international trend towards taking costs and attainability factors into consideration in certain areas of policy (usually related to industrial emissions). In general, due to the implementation of such concepts in standard-setting, steps are being made towards allocating resources on principles other than equity, such as efficiency and cost-effectiveness. Interestingly, however, only a few countries explicitly mentioned considering the overall societal costs and benefits of risks and risk management strategies.

It appears that the ideal scenario would, in theory, still involve an equitable protection of all citizens, but it is widely recognised that this is often unrealistic due to budgetary constraints. The possibility of generating a more differentiated risk management approach (through deviation from the minimum norms or setting area-based standards) seems possible in most countries (although specific policy documents outlining the procedure and requirements for this process were difficult to trace). Perhaps such decisions are still largely made in an ad hoc manner, based on professional judgment and tailored to the specific characteristics of the situation. The concept of compensation, however, does not seem to be widely promoted.

The precautionary principle seems to generate some international debate at times. European countries are arguing for a more careful approach when it comes to environmental health risks, whereas the USA is gradually becoming less risk averse (Vogel, 2003). According to Vogel (2003), the increase in the risk-averse stance adopted by the EU is partly due to visible regulatory failures (e.g. the occurrence of incidents at chemical plants, BSE, etc) coupled with increased political support for precautionary measures[114]. Nevertheless, being highly risk averse does come at a price and, perhaps partly in line with this mentality, most countries therefore stressed the importance of setting up reliable research networks, with significant funding being spent for this purpose. This has had positive effects; all countries are now actively monitoring environmental conditions considered important at national and international level and at times it is possible to implement less precautionary approaches on the basis of viable data.

In short, it seems that there is indeed an international trend towards integration and differentiation, although the extent to which these shifts have occurred varies from place to place (related to the relative economic strength of the country, the local historical development of environmental and health management, political priorities and cultural values, to mention but a few factors).

[114] This does not mean to imply that such developments were uniform across the member states. In the 1980s, the Netherlands (as well as Germany and Denmark) were beginning to favour stricter regulation, whereas the UK (in alliance with France and Italy) opposed such reforms (Vogel, 2003).

4.2.2. The successes and barriers encountered

An Austrian study showed that in Europe 'environmental considerations have, so far, outweighed health and wider social considerations' (Hilding-Rydevik, et al., 2005: 33). This indicates the need for a more explicit focus on health from an environmental perspective. Although some progress has been made regarding data collection, the lack of accurate knowledge on low-level exposures to environmental hazards appears to pose an obstacle in all the countries assessed, along with the weighing of qualitative data alongside more quantitative, scientific information. Taking public opinion into account is generally translated into good risk communication (empowering the public to take part in discussions) followed by allowing the public to comment on specific environmental proposals or permits. Public opinion regarding environmental health risks is monitored very occasionally, but there are no requirements for using the collected data, which implies that the true effects of this are unclear.

According to a UN report, achieving the integration of public opinion 'is a troublesome task … worldwide due to the fact that the majority of the active population everywhere has been trained to think analytically and to solve problems in a piecemeal way' (Nemes, 1995: 7). People are often discipline-oriented (as the various sectors of government have traditionally been), which makes their participation in integrated decision-making a complex task. Internationally, it is felt that the varying positions held by societal groups regarding the acceptability or relative importance of a particular risk complicates the choice of an appropriate response (Dutch Health Council, 1995).

The value of establishing better communication between risk assessors and managers, as well as between professionals from different sectors, seems to be well recognised in all contexts. However, the degree of such communication varies from risk to risk, often depending on the parties involved. A better legislative basis for communication (both between managers and assessors, as well as with stakeholders) seems necessary in all national contexts. Furthermore, although the creation of one environment agency should, technically, allow for the possibility of holding one entity responsible for environmental health risk reduction, the extent of this accountability still needs to be more firmly clarified in legislation.

Forming cross-sectoral working groups to promote integration seems to be a favoured method at national level. There is, however, no specific indication of a method that is used to weigh different sectoral goals and ambitions, which suggests that these decisions often occur in a non-transparent manner (based on expert opinion and negotiation). There appears to be little published data on comparing, ranking and prioritising health risk strategies, or the other sectoral goals they may compete with. These choices appear to occur ad hoc and are influenced by the current political situation and international agreements (such as EU directives in Europe). Moreover, most countries are attempting to assess the costs and benefits of risk management strategies, although it seems no consistent and reliable methods have been developed to achieve this.

A meaningful and structured manner for evaluating the success of environmental health policy is also lacking in the current international context. Determining the

relative success of interventions is largely founded on the basis of whether the specified environmental norms have been reached. This is not, however, a true indication of whether health is being maximally protected, and some changes should therefore be implemented. Furthermore, some countries repeatedly mentioned that lack of financial means was a significant barrier in combating environmental health risks.

Overall, although the first steps towards integration and differentiation have been made, it appears certain changes are still necessary if the desired results are to be attained (i.e. the highest level of environmental health risk reduction through the most efficient allocation of resources).

4.2.3. Why, how and in what form are changes desired?

The modern risk management approach has still not adequately tackled several key issues, as was clearly presented in detail in the conclusion to the previous chapter and the section above. This would suggest that most countries still desire further progress in this regard. Broadly speaking, as the UN states (UNECE, 1997: 100):

> 'The integration of environmental concerns into socio-economic decision-making requires an appropriate legislative basis, proper implementing mechanisms, adequate institutional arrangements, cooperation from a large number of actors in the public and private sectors, and the dedication of sufficient financial means'.

To implement most of these factors, however, is more easily said than done. From the outset, several nations had an economic advantage with more funding available for experimenting with environmental risk strategies. However, no matter how standardised, integrated or well-functioning a method may be, risk reduction strategies ultimately require significant investment from the federal government in any context. A more consistent way of understanding and tackling risks is required at national level so that money is spent as effectively as possible, and so that spending can be justified to stakeholders.

i. Clearer conceptualisation of risk

According to Passchier (2007), the best way to approach health risks is by focusing on human actions (and the effects these might have) rather than the risks themselves. This provides a clear identification of the parties involved and of the benefits associated with a certain activity in the light of potential losses. To assess and manage risks, their boundaries must be clearly defined. This becomes easier if one conceptualises the problem in terms of human activities. Passchier also states that complex problems are more than the sum of different parts and it is therefore not possible (or desirable) to generate a single structured approach that can be applied to all risk scenarios. Nevertheless, some kind of a checklist (as shown in *Appendix 2.2*) can be useful to ensure that qualitative information is included in the decision-making process. The American checklist for conducting an integrated cumulative risk assessment (as included in *Appendix 7.2*) is also a useful reference in this regard.

On the other hand, most countries state that a more standardised methodology could be potentially useful, but that there should be enough room to take local factors into consideration. It seems that countries without a longstanding history in their approaches to risk would most readily adopt a new methodology as they have little 'existing practice' to stand in the way of such a new approach. The following section puts forward several factors that could form the basis of a 'new' approach to risk.

ii. Towards a 'new' approach to risk

Although general principles of best practice can be identified for any particular environmental management problem, one must remember that 'what is good practice will be related to what is currently in place in a specific context' (Hilding-Rydevik et al., 2005: 93), which indicates the necessity of taking local factors into consideration when implementing predefined and generalised national and international guidelines. Most countries agree that the risk assessment phase should be made up of a sequence of steps culminating in a risk characterisation that may be used to guide the risk management phase. These characterisations should be in a generalised consistent format with some freedom to take situation-specific factors into account. In terms of levels of precaution, a good point was made in Australia: the level of conservativeness employed by assessors in the risk characterisation should be clearly communicated in order to ensure that risk managers do not add increased precautionary measures unnecessarily (enHealth, 2004).

As previously mentioned, SEA[115] are being used to integrate environmental and health concerns globally. Perhaps the usefulness of this tool in achieving cross-sectoral and area-based approaches should be explored in more detail by actively exchanging experiences with this method at international level. The use of biomonitoring and the Flemish 'phase-plan' could potentially also be consulted for inspiration (see *Section 3.3.1, Heading ii*). A focus on lifestyle factors within the environmental health domain appears to be a trend, suggesting that any methodology used for environmental health risk assessment should provide the option for including such factors in the analysis.

The Netherlands appears to be a front runner when it comes to taking the factor of uncertainty into consideration through the creation a risk categorisation system (more specifically, the categorisation of risks according to their predictability). Such a system has the potential of creating greater consistency in the approach to risk as well as increasing the transparency of decision-making. In a sense, such a categorisation can be held synonymous with a 'risk ladder', a concept coined by PBL and RIVM (2003: 5) that links the type of risk to a particular risk management strategy. However, the use of such methodologies is still in the early stages and a clearer definition of the different levels (or types) of risk is needed (as now assigning a risk to one of the 'rungs' in the ladder is still largely based on the subjective opinions of experts).

As the UK House of Lords put forward, 'the use of ill-defined and ambiguous terms in risk management and regulatory documents is generally unhelpful' (House of Lords, 2006: 8). This implies that as a baseline criterion all concepts need to be well

[115] For more information on best practice surrounding SEA, please refer to: www.sea-info.net/

defined to enhance transparency (which includes a clear definition of the criteria underpinning the categorisation of risks, but also the principles underpinning norms such as ALARA, ALARP and BAT, and even concepts such as 'public participation'). All parties need to clearly understand what these terms are referring to and what is expected of them (i.e. clarity in the division of responsibility).

Additionally, although seemingly unbiased, it must be noted that 'in everyday practice there is often a lack of hard criteria to evaluate the reasonableness or best available technology' (de Hollander and Hanemaaijer as cited in de Hollander, 2004: 77). An international focus on developing, and continually updating, a collection of such criteria would be beneficial. Moreover, such concepts should be paired with policies that encourage further innovation (since focusing on the best *available* technology does not stimulate the development of new or *better* technologies).

The UK EA mentions that 'the best way to reduce the risks from waste is for society to generate less of it – to reduce, reuse and recycle' (UK EA, 2005: 12). This mentality is also seen in several other countries and is applicable to most man-induced risk factors related to present levels of consumption (e.g. air quality related to energy use, or more frequent traffic accidents from increased car sales). Risk-reduction strategies should therefore be paralleled with concrete informative strategies aimed at instigating permanent change in societal behaviour.

Nevertheless, an explicit focus on the quantification of health risks, and a method for comparing the costs and benefits of various risk management interventions, is greatly desired in all national contexts. A method that would produce several different risk management options, together with the associated costs, appears to be the ideal scenario. Such a method would also be particularly useful in countries with a more limited budget for environmental and health initiatives.

It appears that determining the relative weight of qualitative and quantitative information is often left up to the expertise of professionals in the field. This, however, could indicate that explicit training in making such decisions should be included in university level curricular activities of relevant studies. Weighing goals from different sectors and reaching adequate cross-sectoral compromises also generates much difficulty. In general, the creation of a cross-sectoral working group, or in some instances a specific risk assessment and management body, appears to offer some solutions. However, the use of such strategies still quite new in most countries and the true benefits (and potential pitfalls) of these will therefore only become clear in the coming years. Furthermore, besides generating a more standardised approach to tackling risk, better evaluation of implemented and integrated policy is also necessary.

iii. Improving evaluative practices

Monitoring environmental conditions to see if norms are being adhered to does not ensure a high standard of public health, and the true meaning of *exceeding* standards with regard to public health is also uncertain. Nevertheless, to date, all countries have suggested this is the primary manner in which the effects of environmental health policy are evaluated (along with monitoring hospitalisations and illness), which suggests they could all improve their practices in this regard.

The use of DALYs to measure the success of policy (and to determine if stricter standards are necessary) could be a step in the right direction. This should, however, occur only at national level as, according to Van den Berg (2007), the effects of policies cannot be measured in terms of DALYs at local level since the calculations would not be sufficiently accurate. Moreover, this still does not take the perceived level of protection from health risks (as held by members of the public) into consideration (living in constant fear of a terrorist attack or the effects of global warming could lead to a lower experienced level of health), which also remains an important factor.

Side-effects are not usually considered in current evaluations of the impact of environmental health-risk policy (indicating these evaluations do not take an integrated approach), which means that the true costs and benefits of risk management interventions are not being fully explored. This implies that on the one hand a more concrete methodology for tackling risk is desired, and on the other that a more coherent approach for evaluating the success of policy is required. Furthermore, it seems that in most contexts it would also be possible to achieve a greater degree of transparency.

iv. Improving transparency

Stakeholders sometimes feel the government is not protective enough, whereas other parties feel the increased focus on environmental health risks is a tactic used by certain environmental and other groups, and sometimes the government. 'Apocalyptic predictions' are suggested to be inevitable unless more stringent regulation is enforced (Hanekamp, 1999). This highlights the need for transparent risk communication (and – in as far as this is possible – more accurate media reporting). De Vries (2002) states that good risk communication implies providing information on the various alternatives (as occurs 'behind closed doors' in the risk management phase) rather than focusing on only one possible outcome[116].

If achieved successfully, transparency can enhance the acceptability of political decisions as, for example, choices made by the government are clarified in light of changing technological, economic and cultural developments in society. Although most countries attempt to achieve greater transparency, decisions are still sometimes made in expert circles, so countries could always improve their practices in this regard. An in-depth assessment of the overall levels of transparency, as perceived by members of the public in each national context, was beyond the scope of this research. However, one could assume that stakeholders always wish to be better informed and have more insight into the decisions governing them.

4.3. Limitations of this study and advice for future research

The primary drawback of this research was the limited amount of time available to collect data. This meant that it was not possible to cross-reference all information

[116] *Please note*: this advice was given specifically in relation to medical risks, but it is nevertheless broadly applicable to risk communication in general

(most of the data included is therefore based on the responses from one or two individuals from the environment agencies contacted and the literature available on the Internet). For several countries, only limited data was available in English. A larger amount of literature could have been consulted given more time, and follow-up telephone interviews with the respondents could perhaps have been held to clarify the collected information. It would also have been possible to contact knowledge sources at other agencies (or government departments) in the countries assessed.

Certain countries that were not included in this research have potentially interesting national risk management approaches (specifically Norway, Sweden and France). Furthermore, the research was focused largely on developed nations, whereas the inclusion of a case study from a rapidly developing economy in Asia would perhaps have been interesting (particularly to assess what prominence risk management has at national level, and how funding decisions are made). Furthermore, rather than formulating open-ended questions (as was the strategy in this research), creating a questionnaire made up at least partly of 'yes and no' answers would have generated a more coherent and comparable data set.

With regard to content, a clearer distinction between the approaches taken for different types of risk would have been interesting alongside the more generalised description given in this paper. Nevertheless, this study provides a rapid quick-scan of current national approaches and is therefore an excellent basis for future research as well as having stimulated various environmental agencies (hopefully) to think critically about the practices they employ for environmental health risk assessment and management.

Choosing to focus on a limited selection of risks (such as chemicals, indoor and outdoor air quality, noise, climate change, natural disasters and lifestyle factors) could perhaps provide a more focused comparison between various countries. It would also be interesting to see if there are side effects associated with working in a more integrated manner. It is possible, for example, that placing an increased emphasis on 'health' from an environmental perspective will not lead to the maximum level of environmental protection (from an ecological perspective). Furthermore, there is always the danger that ambitions in other sectors will take precedence over environmental and health ambitions if one chooses to work in a more cross-sectoral manner. A more focused evaluation of the spin-offs of integrated strategies (and suggestions on how one could curb the negative effects) would therefore be beneficial.

4.4. Concluding statement

In most countries, it appears that the creation of a single coherent environmental agency has improved the transparency and integration of environmental health risk policy. Creating one body that is specialised in environmental health risk assessment and management has many benefits as it generates a platform for improved transparency, accountability and opportunities for cross-sectoral integration (as one centralised contact point is set up). Such organisations have therefore effectively tackled some of the problems experienced with more traditional, strictly sector-based approaches. However, the creation of these agencies has occurred quite recently in most countries, and the potential problems will therefore only become apparent in the future. Furthermore, the presence of such an agency is not sufficient to achieve a coherent national environmental health management approach; uniform decision-making is also necessary at national level to ensure a certain level of consistency. Moreover, the degree of accountability of the environment agencies and the required extent or frequency of cross-sectoral negotiations needs to be more firmly embedded in legislation.

Although the analysis of risks is predominantly the task of scientists, the problem of defining and assessing risks is often largely influenced by civil society, the business sector and the political sphere, which explains some of the variations in countries' approaches to risk. National governments have to deal increasingly with pressing global issues that are likely to have both predicatable and unpredictable adverse effects on health. Examples of these are climate change and the possible spread of associated infectious diseases. This is coupled with increasingly empowered stakeholders that want an augmented focus on their interests, and transparent decision-making processes. Modern approaches to risk are therefore attempting to adapt to the changes occurring in society.

The developments in the Netherlands parallel the situation in other countries when it comes to working in a more integrated way. The Dutch formula for allowing area-based differentiation and their form of risk categorisation are the only unique elements (although the value of qualitative categories is also mentioned in other countries, so this mentality does exist elsewhere). The consideration of costs and benefits surrounding risk management is gaining ground at international level, although the quantification of health risks is often perceived to be a complex task. A more rational approach to risk (tied to making the best choices regarding government funding) was mentioned as desirable in all contexts.

It appears that no country to date has generated a structured approach for incorporating qualitative, subjective information (specifically stakeholder perceptions) in the decision-making process (although the UK has the most solid legislative basis for public involvement). Instead, this occurs in ad hoc manner that does not necessarily ensure that high-quality data is collected, or that enough weight is given to this information.

A lack of accurate data, including information on the true effectiveness of current policy and methods for properly quantifying health risks, appears to be the greatest barrier in achieving integrated health risk reduction strategies. It is also felt that there

should be a strong legislative basis that encourages the incorporation of health related aspects in environmental assessment and management, and that professionals need to begin adapting to this more integrated mentality by acquiring knowledge relevant to both environmental and health management, rather than focusing specifically on one or the other.

It was often mentioned that opportunities for greater cross-sectoral integration are not being used optimally (and that significant gains are envisaged from the increased integration of spatial planning, environmental and health concerns). In addition, it appears a more standardised approach to risk – one that takes into consideration qualitative information, costs and local factors – would be readily accepted in most national contexts. This would ensure greater consistency in tackling environmental health risks, which is desirable from both governmental and stakeholder perspectives (as it justifies the response chosen in a particular situation).

This paper has presented several elements that should form part of the basis of this 'new' approach to environmental health risk. However, it must be remembered that, to date, environmental health risk policy appears to come at a significant price, and a budget to implement extensive predefined methodologies may not always be available at national level. Regular communication between agencies involved in these practices internationally should nevertheless speed up the process of forming an approach to risks which is suitable in a variety of economic and other contexts. Through active cooperation and exchange of knowledge, it may still be possible to formulate the standardised approach to risk that seems so sought after, yet at the same time elusive.

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Appendices

Towards integration and differentiation in environmental health risk governance

An international comparative quick-scan of policies

February 2009

Universiteit Utrecht

Appendix 1.1

The table below illustrates some of the levels of the maximum tolerable and negligible risk as proposed in the 1989 Dutch Dealing with Risk strategy. As previously mentioned, separate levels were identified for individual and group risks in relation to external safety.

Type of risk	Level	Individual risk	Group risk
Large accidents (external safety)	MTR (maximum tolerable)	10^{-6}/year	10^{-5}/year
	VR (negligible level)	10^{-8}/year	10^{-7}/year
Exposure to harmful substances	MTR	10^{-6}/year	
	VR	10^{-8}/year	
Radiation	MTR	10^{-5}/year	
	VR	-	

Table 1: Maximum tolerable and negligible levels of risk in the traditional Dutch approach

The group risks depicted in the table are calculated on the basis of 10 people dying; for 100 people dying from large accidents, the MTR level is 10^{-7}/year, for 1000 it would be 10^{-9}/year and so on. In other words, 'the maximally tolerable probability of an accident with 10 times the number of victims should be 100-fold smaller' (Dutch Health Council, 1995: 22). These figures are an indication of the number of people that would be 'allowed' to die over a certain period of time as a result of aforementioned factors (the larger the value, the greater the risk per individual).

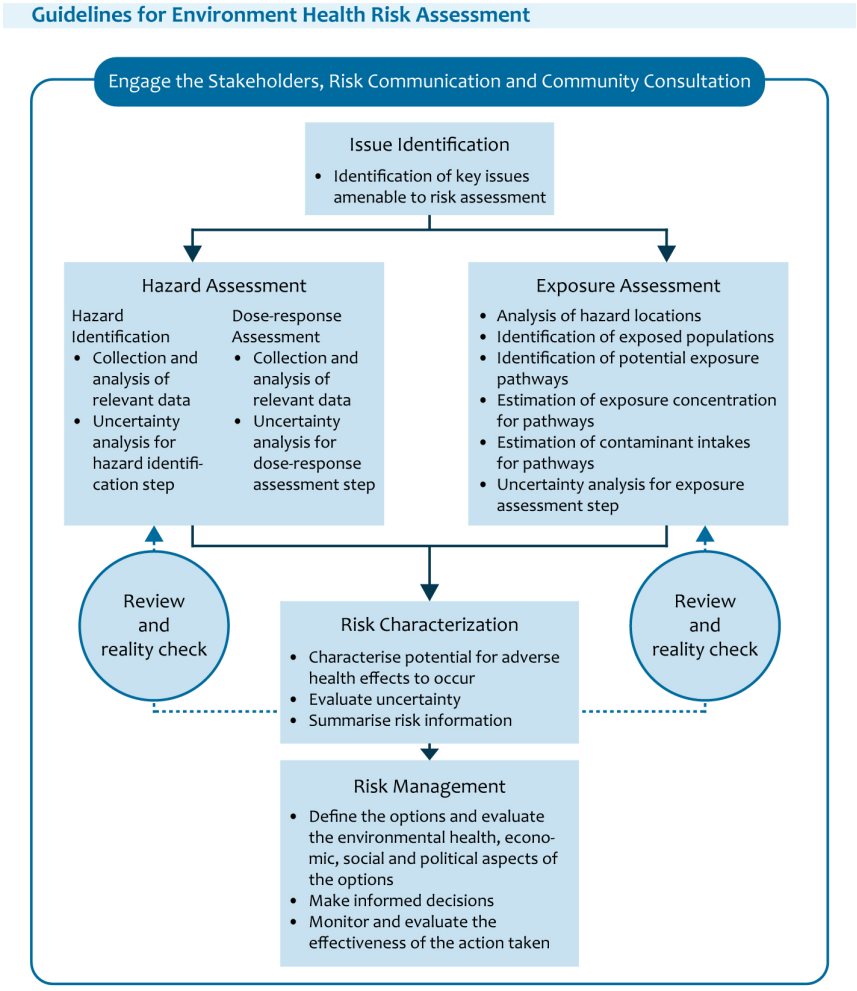
The document also highlights that there are norms for noise (with 50 dB being the preferred level and 55-65 dB the MTR) and odour, but that these are also laid down in other laws.

Appendix 1.2

In the context of the scheme below, a *risk* has been defined as 'the probability of a certain degree of damage to human health, the environment or goods' (Dutch Health Council, 2004: 12). The table below depicts a standardised manner of interpreting risks (aimed at generating acceptance for the chosen course of action), as put forward by VROM and VWS in 2004 in the "*Beoordelingskader Gezondheid en Milieu"*), and illustrates some of the points considered to be important within the Dutch approach to (health) risk.

Extent of damage to health	Severity of effects on health	Perception of the effects of the risks	Intervention: possibilities or necessity	Costs and benefits
How many people are exposed?	What types of illness or complaints arise? What is known about the effects of this type of exposure? *(i.e. estimation of Disability Adjusted Life Years – DALYs?)*	Does the risk threaten the perceived level of safety?	Do European norms prescribe necessary intervention?	What are the predicted costs if no action is taken?
How many people became ill or are affected?	What health effects do citizens associate with the exposure?	Is the risk voluntarily and/ or controllable?	Is intervention possible? ➢ at the source ➢ at European, national, regional or local level ➢ economically, technically, spatially, judicially, informatively?	Is it known how much society would be "willing to pay" for intervention?
Can the number of people affected change in the future?	Who experiences the health effects? *(i.e. vulnerable groups, such as children, women, the elderly?)*	Are there other reasons why the risk would be perceived as 'unacceptable' by some? *(i.e. catastrophic potential?)*	Who was responsible for interventional measures? Who is being asked to intervene?	What costs would be associated with avoiding or minimizing the risk?
Is the level of risk above the maximum permissible level?	When do the health effects occur (periodically, incidentally or permanently)?		How effective are interventions in theory (in terms of reducing exposure or preventing illness)?	How does this relate to other ways of achieving health benefits?
How certain is the link between exposure and the impacts on health?	Is treatment possible?		How effective are they in practice; how long does it take to achieve results; is it possible to monitor the implementation?	Have the measures been successfully implemented in other sectors?
How much does the exposure to this risk contribute to the total incidence of illness?			Is there societal or political pressure, or is this expected to develop?	Have the measures had undesirable effects in other sectors?

Appendix 2



enHealth (2004: pg 5) *Environmental Health Risk Assessment: Guidelines for assessing human health risks from environmental hazards*, Department of Health and Ageing and enHealth Council, ISBN 0 642 820910, Commonwealth of Australia: Canberra

Appendix 3

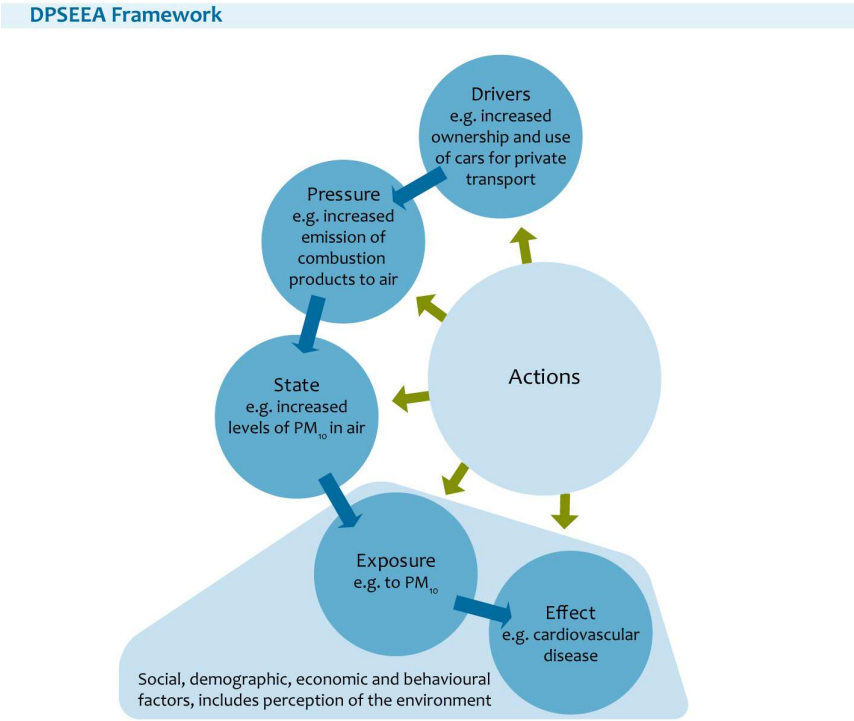
The following has been taken directly from the US EPA Risk Characterization Handbook (2000: 13).

Principle	Definition	Criteria for good risk characterization
Transparency	Explicitness in the risk assessment process	- Describe assessment approach, and assumptions, extrapolations and use of models - Describe plausible alternative assumptions - Identify data gaps - Distinguish science from policy - Describe uncertainty - Describe relative strength of assessment
Clarity	The assessment itself is free from obscure language and is easy to understand	- Employ brevity - Use plain English - Avoid technical terms - Use simple tables, graphics and equations
Consistency	The conclusions of the risk assessment are characterized in harmony with other EPA actions	- Follows statutes - Follow Agency guidance - Use Agency information systems - Place assessment in context with similar risks - Define level of effort - Use review by peers
Reasonableness	The risk assessment is based on sound judgement	- Use review by peers - Use best available scientific information - Use good judgement - Use plausible alternatives

US Environmental Protection Agency – US EPA (2000) *Science Policy Council Handbook: Risk Characterization*, December 2000, EPA 100-B-00-002, United States Environmental Protection Agency: Washington

Appendix 4

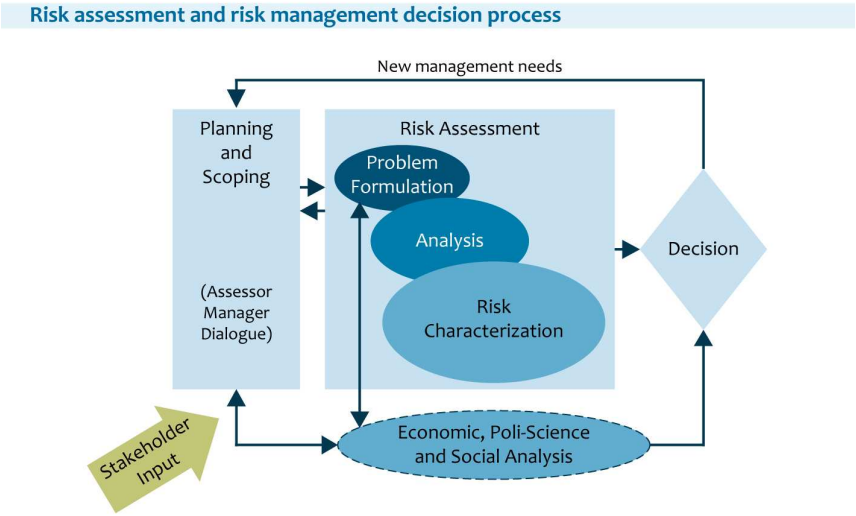
Below is a graphic depiction of the Scottish DPSEEA framework:



Healthy Environment Network (2005) *4th Healthy Environment Network Meeting*, Thursday 3rd of February, 2005: Stirling (page 7)
[available online at: http://www.healthscotland.com/uploads/documents/4091-henmtng0502hlthimp.pdf]

Appendix 5.1

The integrated risk assessment model generated by the US EPA appears as follows:



US EPA (1997) *Guidance on Cumulative Risk Assessment: Part one*, **Accessed on:** 10/08/2007 http://www.epa.gov/brownfields/html-doc/cumrisk2.htm

A guideline or checklist for risk managers, assessors and other experts is shown as follows (only the aspects that are relevant to human health are shown below):

Appendix 5.2

Outline of risk dimensions and elements in integrated cumulative impact assessments

Dimension A. Population

("Who /What/Where is at Risk?")

1. Humans
    a. Individual
    b. General population distribution or estimation of central tendency and high and low end exposures
    c. Population subgroups
        1. Highly exposed subgroup (for example, due to geographic area, age group, gender, racial or ethnic group, or economic status)
        2. Highly sensitive subgroups (e.g. asthmatics, cardiovascular patients, children, elderly people, or genetically susceptible persons)

Dimension B. Sources

1. Single source
    a. Point sources (e.g. industrial or commercial discharge, and superfund sites)
    b. Non-point sources (e.g. automobiles, agriculture, and consumer use releases)
    c. Natural sources (e.g. flooding, hurricanes, earthquakes and forest fires)

2. Multi-sources (Combinations of those above)

Dimension C. Stressors

1. Chemicals
    a. Single chemical
    b. Structurally related class of substances
        1. Individual substances (i.e. only one is present at a time)
        2. Existing in a mixture
    c. Structurally unrelated substances with similar mechanisms of impact and/or same target organ

        1. Individual substances
        2. Existing in a mixture
    d. Mixtures (i.e. dissimilar structures or dissimilar mechanisms)
2. Radiation
3. Microbiological or biological (these range from morbidity to ecosystem disruption)
4. Nutritional (e.g. diet, fitness, or metabolic state)
5. Economic (e.g. access to health care)
6. Psychological (e.g. knowledge of living near uncertain risks)
7. Habitat Alteration (e.g. urbanization, hydrologic modification and timber harvest)
8. Land-use changes (e.g. agriculture to residential, and public to private recreational uses)
9. Global climate change
10. Natural Disasters (e.g. floods, hurricanes, earthquakes, disease, and pest invasions)

Dimension D. Pathways

1. Pathways (recognizing that one or more may be involved)
    a. Air
    b. Surface Water
    c. Groundwater
    d. Soil
    e. Solid Waste
    f. Food
    g. Non-food consumer products, pharmaceuticals

2. Routes of Human and single species exposures
    a. Ingestion (both food and water)
    b. Dermal (includes absorption and uptake by plants)
    c. Inhalation (includes gaseous exchange)
    d. Non-dietary ingestion (for example, "hand-to-mouth" behavior)

Dimension E. Endpoints

1. Human Health Effects (e.g. as based on animal studies, morbidity and disease registries, laboratory and clinical studies, or epidemiological studies or data)
    a. Carcinogenic
    b. Neurotoxic
    c. Reproductive dysfunction
    d. Developmental
    e. Cardiovascular
    f. Immunological
    g. Renal
    h. Hepatic

i. Others

Dimension F. Time frames

(What are the Relevant Time Frames: Frequency, Duration, Intensity and Overlap of Exposure Intervals for a Stressor or Mixtures of Stressors)?

1. Acute
2. Subchronic
3. Chronic or effects with a long latency period
4. Intermittent

Appendix 6:

Explanation of Indicators

14) *Blurring of phases in approach to risk* = there is no longer a clear distinction between the risk assessment and management phases (the process is now more iterative, with increased communication between risk assessors and managers)

15) *Focus on transparency* = uncertainties are made clear (for stakeholders); a clear and transparent decision-making process is implemented (there is increased and open communication with relevant parties)

16) *Principles underpinning norms* = principles that are used to form norms OTHER than health-based considerations (such as taking costs or attainability into consideration)

17) *Simplified norms for specific health risks* = generating a more coherent, simplified indicator for the 'whole' risk instead of only looking at certain elements of a health risk (*e.g.* one indicator is created for the total 'risk' caused by all frequencies of noise)

18) *More differentiated categorization of risk* = Instead of focusing on the risk categories used traditionally (e.g. in the Netherlands this was individual versus group risk), more differentiated risk categories are now in place (in the Netherlands, the degree of a risks predictability if used to 'rank' or typify risks)

19) *Differentiated (or area-based) norms* = It is possible to set standards according to the local characteristics of a certain area (indicating that the environmental quality strived for may vary from place to place), or on the basis of the characteristics of a particular risk (i.e. a risk may mainly affect a particular segment of the population)

20) *Increased policy space to use compensation* = it is possible to compensate for lesser quality in one environmental component (e.g. experiencing some noise overload) as long as financial compensation occurs (e.g. to pay for insulation); or improvement occurs in another environmental compartment (e.g. if more green areas are constructed so people have access to more open space, to compensate for the noise overload)

21) *Inclusion of stakeholder opinions* = this indicator has been split into the inclusion of stakeholder opinions during the assessment phase (in which perceptions of risk have an influence on the risk characterisation), or a focus on such qualitative data during the management phase (i.e. when the public is allowed to comment on risk management decisions, such as permits)

22) *Including health considerations in the formulation of sector-based norms* = including health-related considerations in the setting of standards in other sectors (e.g. specifying a certain amount of green space needs to be included in spatial plans)

23) *More cross-sectoral integration* = increased information exchange and weighing of ambitions stemming from different sectors simultaneously (e.g. looking at the health effects, environmental impacts and economic effects of a transport-related development)

24) *Using increased policy space for differentiated risk management* = generating well-substantiated deviations from the maximum standards set at the national level within a certain environmental component, as long as the per capita quality of the living environment improves (i.e. *MILO* method and *Project City & Environment* in the Netherlands), making decisions on the form and extent of compensation

25) *Allocation of resources based on principles other than equity (more than in the past)* = there are considerations regarding the overall societal costs and benefits of interventions or other important reflections in the allocation of resources to a specific risk management strategy

26) *More decentralized role division* = the responsibilities surrounding risk reduction are increasingly transferred (partly) from the national government to the market (business sector), civil society and lower levels of government