

# Tackling environmental risks with environmental planning: international experiences

## 通过环境规划解决环境风险：国际经验

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## Foreword

This report is developed as an activity under the Sino-Norwegian cooperation project “Planning for cost-effective environmental risk reduction”. Through several examples it reviews relevant policies to reduce acute, accumulated and regional environmental risks in the EU and the US, and potential lessons for China are proposed.

The target audience for the report is our colleagues at provincial and city environmental protection bureaus (EPBs) and their associated research institutes for prevention of, and emergency response to environmental risk. In particular, the project cooperates with the EPBs of Jiangsu Province, Guizhou Province and the cities of Anshun (Guizhou) and Tongling (Anhui). Colleagues at Ministry of Environmental Protection (MEP) may also find the report useful for their work. Being a long text the report is meant for reference purposes and for readers interested in particular topic. The executive summary points to similarities and draw general inferences.

Vista Analysis has been main responsible for the report, and our partners at the Chinese Academy of Environmental Planning, led by Ms. Yu Fang and Mr. Cao Guozhi, have contributed with valuable inputs to previous drafts.

We sincerely thank all who has contributed to the report.

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## Executive Summary

### Abstract

*We review relevant policies to reduce acute, accumulated and regional environmental risks in the EU and the US. Potential lessons for China are proposed. We note that Western countries over the years have reduced a number of environmental risks considerably, initially by applying various command and control policy instruments, and then gradually by applying more flexible regulations. We find that many policy initiatives are directed towards curbing environmental risks in general, and do not distinguish clearly between the various kinds of risks.*

### Background

The Baseline Study of Environment Planning and Risk Management in China (Vista Analysis report 2013/37) reveals that the environmental policy in China is currently in a phase where basic legislation and principles are in place, but where necessary institutional development, baseline data collection, policy and cross-sector mainstreaming as well practical application of environmental policy are still at a youthful stage. Many practical problems remain for integrated application of high-quality environmental planning and risk management.

In the 12<sup>th</sup> 5-Year Plan (2011-2015), the Chinese government made it a priority to “strengthen the environmental risk prevention and control in key fields”, and lists risk prevention as one of the main tasks of environmental protection.

Current overall challenges regarding environmental planning and risks management, include according to the Baseline Study lack of dissemination and standardization of experience and tools for environmental risk planning, lack of overview and risk handling capacity on the ground, lack of experience and methods for regional planning to manage environmental risk, lack of standardization of practices across different departments and regions, and lack of integration of environmental risk principles in relevant laws and regulations.

Current environmental risk management mostly relies on the investigation, troubleshooting and regulation of government departments, while enterprises generally do not carry out risk management assessments and they often lack competence and awareness about the importance of risk management. The situation for enterprises can be challenging, as the official targets of environmental risk prevention and control as well as the means, are often not clear.

In this report we intend to show how the EU and the US through practical policies have approached the environmental risks caused by various pollutants. China may be inspired of and learn from this when improving its policies to reduce environmental risk.

The target audience for the report is our colleagues at provincial and city environmental protection bureaus (EPBs) and their associated research institutes for prevention of, and emergency response to environmental risk. Being a long text the report is meant for reference purposes and for readers interested in particular topics. In this executive

summary we point to common themes across the EU and US policies, and give an overview over these policies. Chapter 1 gives direction for further reading.

We divide the environmental risks into three categories, in line with the challenges China faces when tackling its environmental problems:

1. **Acute** environmental risks and emergency response, i.e. damage and response related to emissions/releases caused by sudden and large emissions, sometimes caused by accidents
2. **Accumulated** environmental risks, i.e. damages resulting from long-term emissions/exposures to a pollutant, also referred to as chronic risk, and
3. **Regional** (spatially concentrated) environmental risks, which could be of both acute and accumulative type. In areas with several emission sources, multiple habitats, substances and endpoints, and generally high concentrations of pollutants, the aggregate level of environmental risk may be higher than can be deemed from inspection of each source in isolation.

### Principles and approaches

The environmental problems addressed in the 1970s and 1980s in Western countries were mostly caused by high concentrations accumulated over several years. Some acute emissions caused by accidents in some plants also contributed to raising awareness. A main driver for the development of the environmental policy in the 1970s and 80s was public awareness. Some of the main principles behind the policies and approaches in Western countries have been:

- **The precautionary principle**, focusing on reducing the risk for potential damages from new releases, e.g. of toxic substances, even if their potential damages are not fully understood.
- **The substitution principle**, stating that a harmful production input or consumer product should be substituted with a less harmful one if such exist.
- **Right to information**, most information on emissions, local air and water quality, contaminated sites etc. is today publicly available.
- **The subsidiarity principle** is today a key principle for all policies in the EU, ensuring that decisions are taken as near as possible to the citizens affected.
- **Fairness and equity** are important in order to ensure broad acceptance for the environmental regulations.
- **The polluter-pays principle (PPP)**, defined as the polluter being responsible for paying for the emissions reductions from their own activities. But government funding has often been provided for the cleaning up of old, abandoned industry sites.
- **Cost benefit considerations**, although formal cost benefit analysis has not always been explicitly used.

Policy approaches are generally based in law, to ensure a solid and lasting foundation of the policy. This enables those affected to **take the regulator or polluter to court** to ensure an impartial judgment of the case, and that a polluter which has violated laws will have to pay compensation. The legislation generally does not make any distinction between for instance acute and accumulated risks. However, there are in all countries special rules on how to control damages from acute accidents if they occur.

Designated institutions have been established, staffed with personnel with the necessary skills. The one and same institution is usually responsible for handling all three kinds of environmental risks. However, there might be special institutions handling the rescue and cleaning up from acute emissions to water and soil.

Most of the policy instruments have been based on **command and control**. Generally, the same policy instruments have been used for all three kinds of environmental risks, but there are some examples of how policy instruments could be particularly targeted towards one or two types of risk. Over the years more **flexible regulations**, giving plants some more choice on how to reduce emissions, have been introduced. Gradually some economic instruments like taxes on emissions and harmful production inputs, emissions trading etc. have also been introduced.

### Lessons from the examples in EU and US

In the following we present best practice examples of how acute, accumulated and regional environmental risks have been handled by policies in the EU and the US, see table A for an at-the-glance summary. The examples indicate how the principles and approaches just outlined have been put to use in the contexts of the individual issue areas. Each example also includes a paragraph on lessons that may be of value for China.

**Table A. Overview of policy examples and the types of environmental risk they address**

Policy Examples	Acute Risk	Accumulated Risk	Regional Risk
EU Industrial Emissions Directive	x	x	(x)
EU Water Framework Directive	(x)	(x)	x
The OSPAR Convention	(x)	x	x
EU Reach Directive		x	x
EU Seveso Directives	x		(x)
EU Habitats Directive		(x)	x
EU Soil Thematic Strategy		x	(x)
US Superfund		x	
Climate-friendly air quality control		x	x
APELL	x		(x)
Chemical industrial parks	x		(x)
IRBM in the Rhine River	(x)	(x)	x

#### *Regulating industry pollution: the EU Industrial Emissions Directive (IED)*

The Industrial Emissions Directive (IED) shows how EU applies an integrated approach to control emissions into air, water and soil, waste management, energy efficiency and accident prevention. It shows the basic approach to regulations of environmental risks caused by industrial sources, based on Best Available Techniques (BAT). The requirements of the IED Directive represent current “best practice” in the EU on how to grant emission permits, what they should contain and how the regulations should be monitored and enforced. It should therefore be a lot to learn from the IED for Chinese environmental authorities.

An approach for China could be to start out with the Best Available Techniques Reference Documents (BREFs) that the EU has developed for the various industries

when deciding what level of emission reductions to impose on industries. The BAT specified in the BREFs could be adjusted to local Chinese conditions, taking into account issues like what technologies could be available and most suitable, what it would cost to replace existing technologies with BAT etc. In this respect it should also be considered if some simpler, perhaps cheaper “end-of pipe” solutions (i.e. installing cleaning devices) could be more cost-effective and yield environmental improvements quicker, compared with changing (larger parts of) the production processes.

#### *EU's Water Framework Directive*

The EU Water Framework Directive (WFD) provides the legal framework for all water management in the EU. It contributes to reducing regional environmental risk related to water by imposing and monitoring environmental standards and integrated management at river basin level. It commits EU member states to achieve the goal of good qualitative and quantitative status for all water bodies by 2015. The goal of the directive is to prevent further deterioration of aquatic ecology, as well as terrestrial ecosystems and wetlands that depend on aquatic ecology, to restore their status as close to natural conditions as possible, and to promote long term sustainable water use. It is a framework in the sense that it prescribes steps to reach the common goal.

The EU WFD is an example on how aquatic ecology and water resources are protected from environmental and ecological risk, within a framework of regional environmental risk assessment and management.

Since the beginning of the 11<sup>th</sup> Five-Year Plan (2006-2010) the Chinese Government has greatly increased its efforts to improve water management and reduce water pollution, but the situation is still very serious in much of the country. The approaches and tools of the WFD would need to be used and applied by China in accordance with local circumstances, institutional capacities and other factors. While the WFD generally speaking is a success by reducing environmental risks related to water significantly in the EU, it has also been criticized for being unnecessarily complicated and for setting in motion administrative and scientific coordination processes that are time-consuming and where the outcome is uncertain. A general advice would be to learn from the best practices exemplified by the WFD, but at the same time try to keep things as simple and practical as possible in order to reduce bureaucracy and costs.

In the WFD, the river basin management plan provides the opportunity to assess the extent to which measures triggered by other legislation are in fact sufficient to preserve aquatic ecology and drinking water sources from accumulated and acute risk. If that is not the case, the directive requires the country and river basin authority to close this gap with additional measures. By such an approach it is checked whether the accumulated effect of environmental legislation related to water actually delivers the desired environmental state in the water bodies. Such an assessment of the combined effects of environmental and sector legislation related to water in China, would likely also reveal gaps and be helpful in order to improve water quality.

In China responsibilities for dealing with water is split between several agencies within government. The framework of integrated river basin management plans provides a platform for coordination of efforts between different agencies at central and provincial levels, as well as between provinces sharing river basins. The strategy of Integrated



River Basin Management (IRBM) was incorporated into China's 2002 Water Law and subsequently in different development cooperation programs. However, there is still substantial room for learning from EU experiences with regards to assessment and management of regional environmental risks related to water.

### *The OSPAR Convention*

The North Sea is an area of intense human activity putting great pressure on the marine environment. Land-based discharges (river input and direct discharge), ocean-based discharges (dumping and incineration at sea) and atmospheric deposition have been among the major sources of contaminant inputs to the North Sea. Therefore, a set of international regulations directed at waste dumping at sea and from land based sources have been put in place, most notably being the Convention for the Protection of the marine Environment of the North-East Atlantic (the 'OSPAR Convention'). The convention aims to combat marine pollution risk (long-term accumulative pollution as well as acute incidences, including both types in specific Marine Protected Areas (MPAs)) in the North Sea and the wider North-East Atlantic.

The OSPAR Convention shows how regional risk (mostly accumulated, but also acute) caused by release to water from several countries is handled through a legally binding agreement between the countries.

The Chinese government has made a significant effort in developing legislation for the coastal zone, including establishment of jurisdictional and zoning boundaries, and allocating use rights for coastal and marine resources. A main priority for China could be to enhance enforcement of current regulations, particularly for land-based activities. Findings indicating that three-quarters of discharges failed to meet regulatory standards during 2004-2012, clearly show a need for a massive upgrade of control and enforcement mechanisms.

Implementation of Marine Protected Areas has been an effective tool in the protection of marine waters in the North Sea region with a coverage of 22% within territorial waters, and could be further developed in China as the current coverage seems to be fairly low (1.3% in 2009). A broader coverage of Marine Protected Areas with appropriate monitoring and management systems, along with nationally coordinated actions against land-based polluters, may contribute to reversing the negative trend with respect to pollution of the Chinese marine waters.

### *EU REACH Directive*

REACH (Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals) entered into force on 1. June 2007. It is considered by the EU itself as the most groundbreaking piece of legislation on safer chemicals in the world, and the most complex legislation in EU's history.

REACH places the responsibility for safe management of the risks of chemical substances on the industry, and ensures that appropriate safety information is provided to their users. This should encourage enterprises to apply risk reduction measures from an early point in the life cycle of the substance concerned. It also permits EU Member State competent authorities to re-orient their resources towards evaluating the quality

of the information submitted by industry rather than doing risk assessments themselves. Furthermore, the EU can target additional measures at highly dangerous substances, where there is a need for complementing action at the EU level.

REACH is an example of how accumulated and regional risk from the production, use and disposal of chemicals and of products containing hazardous substances are handled by imposing common rules for this in all countries.

China is perhaps the world's largest producer and user of chemical substances. There are several regulations in place in China to handle this problem. In 2010 MEP released the revised version (the Order No. 7) of the Provisions on Environmental Administration of New Chemical Substances, replacing old regulations. This regulation is similar to EU REACH and is also known as "China REACH". Under this regulation, companies shall submit notification for the new chemicals used as ingredients or intermediates for pharmaceuticals, pesticides, veterinary drugs, cosmetics, food additives and feed additives etc. There are also other regulation for the production, storage, import, use, sales and transport of hazardous chemicals.

The REACH framework is very comprehensive and requires a lot of knowledge, analytical capacity etc. from the industry. We see from Europe that implementing REACH requires a lot of time and effort, and it will take many years before it is fully implemented. Thus, it would be demanding for Chinese authorities and companies to fully implement a scheme similar to REACH. However, Chinese companies exporting goods into the EU are already affected by REACH requirements, and have to follow the procedures and comply with the requirements if they have products that contain potentially harmful substances that have previously not been assessed or authorized by the REACH bodies. Thus, many Chinese companies will over time gain experience with the REACH framework, which could eventually make it easier for China to implement a similar scheme. An option for China could be, at least in an interim period, to adopt the outcome from the REACH processes in the EU, allowing the use of all substances that are authorized through the REACH process.

#### *EU: The Seveso Directives*

The 1976 Seveso accident in Italy spurred EU legislation aimed at prevention and control of the risks of major accidents in the chemical industry. The resulting "Seveso" directives now apply to around 10 000 industrial establishments using or storing dangerous substances in large quantities. The Seveso directives aim to minimize consequences for the environment and at the same time regulate the protection of employees of a company as well as people in close proximity to a chemical plant if an accident happens.

The directives oblige member states to facilitate that industry operators have systems in place to prevent major accidents. Operators that handle dangerous substances above certain thresholds are obliged to regularly inform the public likely to be affected by an accident. The operators should provide safety reports, a safety management system and an internal emergency plan. Member States must ensure that emergency plans are established for the surrounding areas and that mitigation actions are planned. These objectives should also be taken into account in land-use planning. The legislation

constitutes a tiered approach to the level of controls. The larger the quantities of dangerous substances present within an establishment, the stricter the rules.

The Seveso directives are examples on how acute risks (and to some extent regional risks) from accidents in industry plants are reduced by requiring them to have safety management systems and internal emergency plans etc.

A lesson from the EU experience is the importance of providing guidelines to local planners with respect to risk assessment in land-use planning. Such guidelines should include methods for assessing the requirements for safety distances, which usually need to be adjusted to local conditions. The guidelines could be applied when new industry plants are considered, but could also be useful in cases when existing industries are (too) close to residential areas and the relocation of either the industry plant or the residents is considered. This is particularly important in many Chinese settings where urbanization is rapid and residential areas are expanding into new territories.

Central authorities (for instance MEP) should establish the overall guidelines for this land-use safety planning and emergency preparedness. The implementation of the guidelines should most likely be the responsibility of local authorities, which is the case under the Seveso directives. Also, the evaluation and revisions of the Seveso directives have in particular revealed the need for: i) Focusing on safety management systems for whole establishments instead of technical units within an establishment, ii) Fixed time limits for most of the actions required by the legislation as well as penalties in the event of noncompliance, and iii) Exchange of information across member state borders (i.e. provinces) to avoid and minimize domino effects in the event of a major accident.

#### *The EU Habitats Directive*

The Habitats Directive is a key policy tool for reducing and managing regional risk to ecology in the EU, and constitutes the union's main tool for preserving biodiversity and following up the Convention on Biological Diversity. The goal of the directive is to protect and ensure long-term viability for threatened species and nature types in Europe, which are defined as approximately 1,000 species and some 220 habitats that are listed in the directive's annexes. The directive sets a common minimum standard for protection of the most important European species and habitats, and it includes a legal obligation for all EU Member States to ensure their survival through a network of protected areas (called Natura 2000) and relevant measures throughout EU territory.

The EU Habitats Directive shows how imposing an ecological red line for preserving biodiversity in the EU contributes to reducing the ecological risk related to a decline in biodiversity and loss of species, based on regional risk assessment and management.

China is among the 12 mega-biodiverse countries in the world, and clearly one of the most important countries globally for conservation of biodiversity. China is a signatory to the international Convention on Biological Diversity. Despite some positive trends such as growth in forest cover, many natural areas, habitats and species in China are threatened. To ensure basic ecological protection the need for an "ecological red line" has recently been stressed.

The Habitats Directive would seem to contain a number of features that are relevant for China: i) The Habitats Directive provides an example of how an ecological red line can be established and implemented through a strictly scientific approach and a process of international or regional cooperation, ii) It provides a methodology for assessing the necessary scale of protection of species and habitats at a geographical level relevant for biodiversity, and iii) it ensures a system for monitoring and for regular reporting on the status of the most threatened species and habitats. In the EU it has been important to have the EU Commission as a watchdog ensuring that Member States fulfill their obligations, and a similar role is likely needed from the central level in China versus the provinces.

#### *EU Soil Thematic Strategy*

Different EU policies for water, waste, chemicals, industrial pollution prevention, nature protection, pesticides and agriculture are contributing to soil protection. However, as these policies have other aims as well, they are not sufficient to ensure an adequate level of protection for all soil in Europe. Therefore, the European Commission in 2006 adopted a Soil Thematic Strategy and a proposal for a Soil Framework Directive (still not formally adopted). This recognizes eight major threats: soil erosion, decline of soil organic matter, soil contamination, loss of soil biodiversity, salinization, compaction, soil sealing and landslides. The EU Commission has in recent years supported initiatives raising awareness of the importance of soil as a limited resource, as well as research and monitoring projects. The objective of soil protection is also increasingly integrated into other EU policies, including agriculture and rural development. Around €3.1 billion has been allocated to the rehabilitation of industrial sites and contaminated land as part of the Cohesion Policy for the period 2007-2013.

EU Soils Thematic Strategy shows how the EU attempts to reduce accumulated risks caused by release of harmful substances.

A report issued jointly by the Chinese MEP and the Ministry of Land and Resources found that nearly one-fifth of the farming land in China is polluted. The main pollution source is industrial and agricultural activity, particularly irrigation by polluted water, the improper use of fertilizers and pesticides and the development of livestock breeding. Given the severe situation for soil pollution in China, especially regarding agricultural soil, there is a strong need to strengthen mitigation policies. In the EU one so far has relied on the policies for other sectors when it comes to protecting soils. These policies are, however, not effective in cases where there is a need to remediate already contaminated land. Substantive resources have therefore been allocated to rehabilitation of polluted soil. Due to the potentially very large cost of cleaning up heavily polluted sites, China may look into the 'fitness for use'-approach applied in the EU, as a first step to protect human health and environment from the effects of soil pollution. This would imply, inter alia, that food production should not take place on polluted soils.

#### *US Superfund*

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) was enacted in 1980 in the US (with amendments in 1984 and 1986) to assist in the cleanup of abandoned hazardous waste disposal sites. **Superfund is an**

**environmental program established to address cleaning of abandoned sites** contaminated with hazardous substances, as well as "pollutants or contaminants" which are defined more broadly. **It allows the Environmental Protection Agency (EPA) to** identify parties responsible for the hazardous substances releases and compel those parties to clean up the sites, or EPA may clean up itself using the Superfund (a trust fund) and eventually claim cost recover from responsible parties.

The Superfund example shows how accumulated risk has been handled when caused wholly or partly by releases from abandoned industry sites.

China's rapid urbanization has resulted in the need to redevelop land once occupied by industries that sat on the cities' perimeters decades ago. Such sites are often heavily contaminated because pollutants leaked into the soil during previous production processes and because hazardous wastes weren't handled properly. Experts estimate that contaminated industrial sites in the country number 300,000 to 600,000. MEP in 2014 released five official guidance documents on contaminated sites remediation, including the investigation phase, monitoring, risk assessment and remediation technologies. These are built on experiences learnt from the US Superfund and Chinese practices. We still see several potential lessons for China from the US Superfund scheme, including: i) Apply a stepwise approach when assessing the sites. It could be cost-effective to start with a screening process to see if the contamination is "large enough" to warrant further action, ii) Assess ways of financing the clean-up actions; financing has been a major challenge in most countries, iii) Keep it simple. Superfund has over the years developed rather comprehensive schemes for analyzing and prioritizing between sites. This requires a lot of skills and analyzing capacity. In China, where problems are large and priorities are obvious elaborate analysis is not always necessary. iv) Keep an eye on lessons learned from US and EU experiences. This could, for example, be related to mega-site management strategies, complex groundwater contamination control etc. Finally, in light of both Superfund and the EU Soil Thematic Strategy v) There is a need for a national law or regulation to control soil pollution in China.

#### *Preparations for climate-friendly air quality management in the EU and US*

Policies to mitigate climate change and air pollution are often considered in isolation. Recent studies have shown that significant benefits can be achieved through integrating climate change mitigation and air quality improvement efforts (co-control). According to one study, the benefits may amount to additional CO<sub>2</sub> reductions of 15% in Western Europe. Much of this is related to decreased coal combustion. Together with selected state and local environmental management agencies, the US-EPA is exploring the development of so-called comprehensive Air Quality Management Plans (AQMPs). These plans will address the control of multiple pollutants and air related considerations such as land-use, transportation, energy and climate change. US-EPA is currently working with three pilot areas in order to develop a template for co-control for US states.

The co-control example shows how accumulated and regional risks related to air pollution and climate change may be handled more cost-effectively by targeting the emission sources in an integrated way.

Current studies show that in a country like China, where the economy and industries are developing rapidly and large investments are geared towards curbing air pollution, it may prove costly to disregard the opportunity for co-control of air pollutants and greenhouse gases (GHG). Because China is at a relatively early stage of building its environmental regulatory systems, it may in some ways be easier to establish co-control mechanisms compared to countries where different governmental institutions have long-term regulatory systems and practices.

Based on international experience, the most important lessons for China include: i) The most effective policies are those that affect the root causes of emissions rather than deal with them solely through control efforts at the smokestack. This pushes the point of regulation further upstream, to where energy is made and consumed. ii) Equally important, the price of coal and coal based electricity should increase to reflect its pollution and to let the polluter pay. iii) Recently, the US and Europe have adopted integrated multi-pollutant approaches that address pollutants like particulate matter (PM), NO<sub>x</sub>, SO<sub>2</sub>, mercury, and, increasingly, CO<sub>2</sub>. These approaches encourage industry to develop long-term financial and environmental plans to optimize investment in pollution control equipment. Such an approach offers better planning, greater certainty, lower cost, and more environmental benefit per yuan invested.

#### *APELL – Awareness and Preparedness for Emergencies at Local Level*

APELL is part of a broad cleaner and safer production programme that UNEP has launched with the objective of promoting worldwide sustainable production and consumption patterns. The strategy of the APELL approach is to identify and create awareness of risks in an industrialized community, to initiate measures for risk reduction and mitigation, and to develop coordinated preparedness between the industry, the local authorities and the local population. Because the risks, capabilities, stakeholders and regulatory situation of a community will vary from place to place, the process is designed to be adaptable to local conditions. While most industrial accidents can be contained within the boundaries of the industrial plant, there will be cases where impacts extend beyond and affect the plant neighborhood. In the worst case, cascade (domino) effects, where an accident in one facility damages an adjacent facility, causing a loss of containment and additional accidents, can have devastating impacts in a broader area. Often, the actions of the first responders to the emergency are of crucial importance for the final extent and severity of the emergency.

APELL is an example of a tool for bringing people together to allow effective communication about risks and emergency response, and to prepare measures to respond and control emergencies to reduce primarily acute but also to some extent regional risk.

In China, the frequency of sudden environmental pollution accidents has increased with development, regional industrialization and urbanization. Recognizing the need for improvement, the Chinese government is introducing new environmental management tools, and Chinese industrial estates are exploring various tools as a means to mitigate environmental factors. Policy directives in China now encourage companies to individually tackle environmental management by implementing systems such as ISO 14001 Environmental Management Systems and procedures for cleaner production. A pilot project under the APELL programme was implemented in Yangtze River

International Chemical Industry Park in 2010 in Zhangjiagang City, Jiangsu province, containing more than 80 companies. This project and similar projects in other countries may provide useful experiences for a potential scale-up of the programme in China.

### *Chemical industrial parks*

A chemical park could be defined as a site accommodating several chemical companies which are legally separate entities. The infrastructure and a variable range of services are provided by the largest chemical company on the site (the major user) or by one (or more) independent infrastructure companies. A chemical park is similar to an industry park, but an industry park also consists of companies from other industry sectors. Chemical industry parks are common in many European countries, and are examples of how Seveso directive requirements are translated into internal systems and guidelines in parks to reduce acute and to some extent regional risks.

China has for many years been embracing the idea of industrial parks in general and chemical parks in particular, and a growing number of new chemical parks are being set up. As the evidence from such parks in Europe proves, the parks may be able to balance both economic development and environmental protection.

However, there might be some challenges in organizing these parks when it comes to taking care of environment, health and safety issues. A particular challenge in Europe has been that the regulations are focusing on traditional industry sites, and are generally not targeted at regulating industry parks. Even if the regulatory approach in China may be different, there should be some lessons to learn from the European experiences, including: i) Ensure that comprehensive risk assessments are carried out, ii) Ensure clear rules and responsibilities for safety and emergency management, iii) Ensure sufficient internal emergency preparedness to mitigate damages from accidents, iv) Ensure safety distances to residential areas.

### *Integrated River Basin Management (IRBM) in the transnational Rhine River Basin*

The Rhine is one of the most important rivers in Europe, and is a vital waterway carrying trade and goods from the North Sea and deep into the centre of the European continent. For many years the Rhine was known as the sewer of Europe, due to heavy industrial pollution. A fire and chemical spill near Basel in Switzerland in 1986 practically killed all life and threatened drinking water sources along the Rhine right downstream to the Netherlands. The incident triggered the Rhine Action Programme for cleaning up the river and one of the first priorities was the handling of dangerous substances which might get into water bodies, as well as the security of industrial plants.

The example of IRBM in the Rhine River Basin shows how a management plan among several countries contribute to managing and reducing regional risk from release of harmful substances into a river. Environmental risk management at a regional level, in the form of integrated river basin management, involves a shift in mindset, from focusing on *using* water locally to *managing* water resources at a river basin level to balance environmental, social and economic priorities.

As an effect of the intense industrialization process in China, the environmental status of Chinese rivers does not currently meet the requirements for sustainable development

and the situation resembles the situation in European rivers in the 1970s and 1980s. Since 2002, the principle of integrated water management has been recognized in China's water law, but to realize such management on the ground takes time. Since the 10<sup>th</sup> five year period 2001-2005, MEP also began to formulate and implement pollution control plans for key basins.

Based on the experience from the Rhine river basin, a generic set of recommendations can be provided for regional environmental risk assessments related to water, including: i) Make an inventory of the baseline situation for environmental risk, including emission pathways and current water use, at a sub-regional/provincial level and river basin level, ii) Make a register of priority areas, such as environmental protection areas and drinking water sources, at sub-basin/provincial level and river basin level, iii) Set environmental targets for water bodies based on the typologies of water bodies, iv) Assess the effect of current legislation and measures, and identify gaps between current measures and environmental targets, v) Identify measures that need to be carried out at river basin and sub-river basin levels to tackle accumulated as well as acute risk, design a cost-effective program of measures in dialogue with major stakeholders, and set up coordination mechanisms, and vi) Keep the process open and transparent, with all data made available to the public, and carry out a program of soft measures at all levels to develop common understanding and awareness.

*Decreased exposure to hazardous pollutants in the EU: how did it happen?*

The early warnings of the environmental impacts of production and use of industrial and man-made chemicals, including persistent organic pollutants (POPs), came from observations from aquatic ecosystems in the 1950s and 1960s. One of the first major responses to this was the Helsinki Convention signed in 1974, which focused on the prevention and elimination of hazardous chemicals in the Baltic Sea. Since then, legislation and policies have been put in place to address the use of hazardous substances, their release to Europe's environment, their levels within aquatic and terrestrial environments, and their adverse impacts.

EU legislation has led to documented reductions in the emissions of and exposure to many well-known hazardous substances to air and water in Europe. The policies and measures used encompass product substitution, restrictions on marketing and use, the setting of emissions and environmental quality standards and monitoring according to these standards, requirements to demonstrate the implementation of clean production processes and best available techniques in applications for industrial permits, fiscal instruments and actions to raise public awareness. Part of the legislation targets the risk management of chemicals as such (production, handling, disposal etc.), whereas other legislation focuses on the environmental quality in order to ensure that pollution does not lead to adverse effects on humans and environment.

The policies and legislation, of which we have provided examples, shows how EU has managed to reduce the exposure to hazardous pollutants to reduce environmental risk.

A core lesson for China from the EU experience is the usefulness of long-term programs to monitor the burden of hazardous pollutants in the various environmental compartments and in biota. Reliable data on emissions enables design of science-based policies and realistic targets. Interplay with the public is also crucial: In many cases, EU



citizens, e.g. through NGOs, have pushed governments to implement stricter rules. Media, often made aware of critical issues by NGOs, may also play an important role to alert the public and thereby push policy makers.

EU legislation within the field of hazardous pollutants is in many ways a patchwork of legislative and other instruments, which over the years has been gradually integrated and streamlined. As China is building up its own tools and mechanisms for abating hazardous and often trans-boundary long-range pollution, it should strive to avoid geographical overlap and duplication of responsibility, while allowing for input and suggestions from all relevant stakeholders. While the primary focus in the near-term in China is likely to be the well-known environmental threats, emerging issues should be prevented from becoming future traditional environmental threats. Endocrine disruption is a challenge that must be addressed in ways that take into account the rapid advances in knowledge about this type of environmental risk. Overuse and misuse of pesticides have become a major problem globally, especially in developing countries like China, which increase environmental and health risks.

## 1 Introduction 引言

In this chapter we present an introduction to how the EU countries and the US have approached environmental risks in order to reduce the potential damage on human health and ecology. The chapter contains definitions of environmental risk, and presents an introduction to the principles behind the policy frameworks in the EU and the US. The chapter is meant to be both an introduction to the examples (case studies) in the following chapters and a summary of the main issues in the examples.

本章我们介绍欧盟国家及美国是如何应对环境风险以减少对人类健康和生态的潜在损害的。本章包含环境风险的定义，介绍了欧盟和美国政策框架背后的原则。本章同时简要介绍后面几章中的范例（案例研究），对范例中的相关问题进行总结。

### 1.1 Three categories of environmental risks 环境风险的三个类别

In this report we divide the environmental risks into the following three categories, in line with the primary challenges China faces when tackling its environmental problems:

在本报告中，我们按照中国在应对环境问题时所面临的主要挑战把环境风险分为以下三个类别：

4. **Acute** environmental risks and emergency response, i.e. damages and response related to emissions/releases caused by sudden, large emissions sometimes caused by accidents  
突发性环境风险和应急响应，是由突发环境事故所导致的大量排放引起的排放与泄漏有关的损害和响应。
5. **Accumulated** environmental risks, i.e. damages resulting from long-term emissions/exposures to a pollutant, also referred to as chronic risk, and  
累积性环境风险，是因长期排放/接触某种污染物而造成的损害，又称为慢性风险，以及
6. **Spatially concentrated** (regional) environmental risks in specific areas (small or large), which could be of both acute and accumulative type.  
特定区域（小区域或大区域）内的**空间布局**（区域）环境风险，空间布局性环境风险既可能是突发环境事件的突发性风险，也可能是累积性风险。

Whereas the two first categories refer to the temporal distribution of the risks, the third refers to the spatial distribution.

前两种是指风险的时间分布，第三种则是指空间分布。

The differences between acute and accumulated environmental risks are not always distinct. For instance, if the accumulated concentration of a pollutant in an area is very high on a more permanent basis, rather small increases in the emissions could cause acute risk. Also, if an acute emission or release continues over a longer period, it may become an accumulated risk. Often, the three types of risk of an emission or release are correlated. Still, it is useful to distinguish between them. Below these risks are further described.

突发性环境风险与累积性环境风险的区别并不总是很明显。例如，如果某一地区某种污染物的累积浓度长期高居不下，那么即使排放量非常小幅地增大也会导致突发性风险。同时，如果突发性排放或泄漏持续时间较长，则可能会演变成累积性风险。这三类排放或泄漏风险常常是相互关联的。尽管如此，对它们进行分类仍然是有用的。下面进一步描述这三类风险。

### 1.1.1 Acute environmental risks 突发性环境风险

Acute environmental risks are risks to human health and/or ecology (i.e. plants, wildlife etc.) from sudden and often unexpected increases in emissions to air or release to water or soil of harmful substances. These could for instance be emissions to air of PM and other traditional pollutants, and releases of various toxic substances to air and water. There are numerous examples of acute emission episodes to air, both in China and elsewhere, where sudden and large increases in traditional pollutions and/or toxic substances cause high and immediate harm to human health, and premature death. Similarly, releases of toxic substances to water may poison the water, which cannot be used as a drinking water source for months and years, and which cause great damage to aquatic life and/or other marine life.

突发性环境风险就是因排放到空气或泄漏到水或土壤中的有害物质突然意外增加而对人类健康和/或生态（即植物、野生生物等）造成的风险。例如，这些排放可能是颗粒物（PM）和其他传统污染物向空气的排放，以及各种有毒物质向空气和水中的释放。中国和其他地方都有很多突发性排放的突发环境事件案例。在这些案例中，传统污染物和/或有毒物质突然大量增加，对人类健康造成巨大的直接危害，并导致过早死亡。同理，有毒物质释放到水中也会污染水体，以致被污染水体几个月甚或几年都不能被用作饮用水源，并且对水生生物和/或海洋生物造成巨大损害。

Normally, to cause significant harm these emissions or releases will have to be of a certain magnitude. Relatively small acute emissions or releases, how unexpected they might be, are not necessarily damaging to health and ecology. The damage caused by an acute emission/release will sometimes depend on the background concentration of the pollutant in the recipient (i.e. the local area). For instance, the damage done by outbreaks of extreme air pollution depends on the background concentration level and the long-term, accumulated exposure it entails. For many highly toxic substances the background concentrations are not that important for the damage, since the release could anyway cause great damage.

通常情况下，污染物排放或泄漏量达到一定的数量才会造成巨大危害。较小量的突发性排放或释放无论有多么意外也不一定会损害健康和生态。突发性排放/泄漏所造成的损害有时会取决于受体（即局部区域）中污染物的背景浓度。例如，极端空气污染爆发所造成的损害取决于背景浓度水平及其所导致的长期累积暴露量。对于很多剧毒物质来说，背景浓度对于损害并不重要，因为这种物质的微量泄漏也会造成巨大损害。

### 1.1.2 Accumulated environmental risk 累积性环境风险

Accumulated environmental risk is a risk to human health and/or ecology from long term exposure to enhanced levels of pollutants in air, water or soil. Exposure to accumulated pollution is not an accumulated risk by definition. It is the long-term nature

of exposure that defines the risk. Generally, pollutants that cause acute risk at a high emission/release level will cause accumulated risk at a low emission/release level. However, some pollutants which are not very damaging in low concentrations (e.g. SO<sub>2</sub>) may need very high acute emissions to cause significant damages. For such substances accumulated risks are usually most important. By contrast, toxic substances are often both acutely risky when emitted over short term and chronically risky when emitted over long term.

累积性环境风险是因长期暴露于空气、水或土壤中不断提高的污染物水平而对人类健康和/或生态造成的风险。按照定义，暴露于累积性污染并不构成累积性风险。风险是按暴露的长期性而定义的。一般而言，带来高排放/泄漏水平突发性风险的污染物会带来低排放/泄漏水平的累积性风险。然而，有些污染物在低浓度时危害并不很大（例如二氧化硫），只有很高的突发性排放才会造成巨大损害。对于这种物质，累积性风险通常是最重要的。相比之下，有毒物质常常是短期排放造成突发性风险，长期排放造成慢性风险。

### 1.1.3 Environmental risks in particular regions (areas)

#### 特殊区域（地区）的环境风险

In areas with several emission sources (i.e. different industries), multiple habitats, substances and endpoints present and generally high concentrations of pollutants, the aggregate level of environmental risk may be higher than can be deemed from inspection of each source in isolation. The different sources could reinforce each other and the whole risk could be larger than the sum of the parts. In this case the concept of regional environmental risk is useful.

在有多个排放源（即不同产业），多种栖息地、物质和端点，以及污染物浓度通常比较高的地区，环境风险总水平可能比孤立地审视每一个排放源而得出的风险水平高。不同的排放源可能彼此互相强化，总体风险可能大于各个排放源的总和。这种情况下，区域环境风险的概念就很有用。

Regional environmental risk is also a useful concept for addressing policies and concrete measures towards outbreaks of pollution, and emergency response where many pollution sources are spatially concentrated, implying a higher risk that pollutants exceed threshold levels for effects on human health and the environment. Regional environmental risk assessment can be defined as risk assessment which deal with a spatial scale that contains multiple habitats with multiple sources of stressors affecting multiple endpoints (Xu & Liu 2009).

In this report examples of handling of regional environmental risk are presented in chapter 2.2 EU's Water Framework Directive, chapter 2.3.1 Ospar Convention and chapter 3.3 Integrated River Basin Management in the Transnational Rhine River Basin, see boxes focusing on this in each chapter.

区域环境风险对于以下情况也是一个很有用的概念：很多污染源在空间上呈集聚状态，这表明污染物很可能会超过阈值水平而对人类健康和环境造成影响，这时需要针对突发污染和应急响应制定相应的政策和具体措施。区域环境风险评估可被定义为对包含多种栖息地的空间规模进行的风险评估，在这些栖息地中压力源影响多个端点（(Xu & Liu 2009)）。

本报告 2.2《欧盟水框架指令》、2.3.1《OSPAR 公约》（奥斯陆-巴黎公约）和 3.3《跨国莱茵河流域综合流域管理》介绍了应对区域环境风险的范例，详见各章关于此内容的文本框。

## 1.2 Fundamental principles and approaches in environmental risk policy development 制定环境风险政策时的基本原则和方法

In this part we give a brief overview of what principles lie behind the framework towards the environmental risk reduction, such as environmental policies and environmental regulation, developed in Western countries since the 1970s.

这部分我们简要介绍环境风险防治框架背后的基本原则，比如 20 世纪 70 年代以来西方国家制定的环境政策和环境法规。

### 1.2.1 How do you know that something is a problem for health and/or ecology 如何知道某种物质对于健康和/或生态来说是个问题

The environmental problems addressed the 1970s and 1980s were mostly caused by high concentrations **accumulated** over several years. Some **acute** emissions caused by accidents in some plants also contributed to raising awareness. The problems of the time were visible and there was little need for (advanced) monitoring and analyses to verify the challenges. Besides, tools for monitoring and analyses were not as advanced as today, and they were costly and not generally available. Later on, it has become more common to monitor and analyze potential environmental challenges, both because of more advanced and available tools, but also because it is sometimes not immediately clear to what extent a challenge or an emission really poses a threat to human health and/or ecology.

Several risk assessment tools and standards have been developed, to assess both accumulate and regional risks. See for instance Li et.al. (2014), Hunsaker et. al. (2008) and WB (1996). These tools would be helpful in the identification of priority environmental contaminants, as well as priority areas, to be further assessed.

20 世纪 70 年代和 80 年代面对的环境问题主要是由多年来**累积**的高污染物浓度引起的，一些企业发生的突发环境事故造成的**突发性**排放，也促进了公众意识的提高。当时的问题是显而易见的，很少需要通过（先进的）监测和分析来验证挑战。另外，监测和分析工具也不像现在这样先进，而且价格昂贵，也并非随处可得。后来，监测和分析潜在的环境挑战变得比较普遍了，因为监测和分析工具更加先进，更易获得，而且还因为有时人们对于环境挑战或污染物排放达到何种程度会对人类健康和/或生态真正造成的威胁并不十分清楚。

为评估累积性和区域风险，一些风险评估工具和标准被制定出来。详见 Li 等人（2014）、汉萨克（Hunsaker）等人（2008）及 WB（1996）的范例。这些工具在鉴定需进一步评估的重点环境污染物和重点地区方面十分有用。

A main driver for the development of the environmental policy in the 1970s and 80s was **public awareness**. People both saw and felt the impacts from bad air and water quality, and urged politicians to take actions to improve these. This was followed up by the EU through the Public Access to Environmental Information Directive (2003/4/EC), which

follows up on the Aarhus Convention (1998) on public access to information. Public awareness is still an important driver today, even if the challenges are not so visible. Scientific approaches and analysis are now much more important for the development of new policies, and play a key role in cost benefit considerations behind new policy initiatives.

20 世纪 70 年代和 80 年代促成制定环境政策的一个主要因素是公众意识。人们看到并感受到了不良空气质量和水质带来的影响，并敦促政治家采取行动来改善空气质量和水质。欧盟通过《关于公众获取环境信息的指令》（2003/4/EC）跟进这项工作，该指令是继关于向公众开放信息的《奥胡斯公约》（1998）之后发布的。如今，公众意识仍然是一个非常重要的驱动因素，即使挑战不是那么明显。如今科学方法和分析对于制定新政策更加重要，而且在新政策方案背后的成本效益考虑中起着关键作用。

### 1.2.2 How do you approach an environmental risk problem?

#### 如何处理环境风险问题？

**The polluter is usually responsible** for the collection and submission of data to the environmental control authorities. If emissions or conditions in a recipient that could indicate that there is an environmental problem are discovered, the authorities would normally require that the plant which may have caused the damage make the necessary investigation to see if actions are needed. The authorities would often design a monitoring and/or investigation program for the plant to carry out. This could contain how frequent and what kind of monitoring to carry out, what and how data samples from the local recipient should be taken, how they should be analyzed etc. The plant would have to carry out and pay for all this (in accordance with the polluter pays principle, see below), and eventually hire consultants to help them fulfill the task. If no responsible emitter/company can be found, for instance because the plant that initially caused the damages is no longer in operation, the authorities will normally ensure that these tasks are carried out and eventually also pay for them (e.g. US Superfund).

污染者通常负责收集数据，并提交环境主管部门。如果发现污染排放或受体的污染状况可以说明有环境问题，环境主管部门通常会要求可能造成损害的企业进行必要的调查，查看企业是否需要采取行动。环境主管部门通常会制定一项监测和/或调查计划由企业执行。计划内容可能包括监测频率、监测内容、样品采集对象、样品采集方法，以及样品检测分析方法等。这些工作应该由企业完成，费用由企业承担（根据污染者付费原则，见下文）。最后，企业要聘请顾问或咨询公司帮助其完成任务。如果找不到责任排放者/企业，例如最初造成损害的企业不再营业，就由环境主管部门负责实施，并且最终还得付费（例如美国超级基金）。

When the results are ready they are submitted to the authorities for consideration and eventually follow up through actions to improve the situation.

当结果准备就绪之后，提交给环境主管部门考虑，并采取行动来具体落实，以改善局面。

In chapter 2.1 an overview of how the process of granting emission permits should be carried out in the EU countries is presented.

## 2.1 节概述了欧盟国家如何执行排放许可证颁发程序。

### 1.2.3 Underlying principles 基本原则

The first policy attempts were a reaction to existing damage to health and ecology, and focus was on cleaning up these by reducing emissions and releases. In recent years the **precautionary principle** has played an increasingly important role in environmental policy. Much resources are now directed towards reducing the risk for potential damages from new releases, e.g. of toxic substances. The resources are directed both at accumulated/chronic damage from long term release, and on acute damage from short term release. The damage potential from these may be unknown, but should be assessed scientifically *before* for instance a product that could cause serious damage is placed on the market. When there is uncertainty about the impacts of a new product, the uncertainty should benefit nature. This means that actions are taken to limit (eventually ban) the use of the new product, even if the potential damage is not fully assessed or known, to be sure that no damage occur. The REACH regulation (see chapter 2) is an example of the implementation of the precautionary principle.

最初的政策尝试是对现有的健康和生态损害做出的反应，重点是通过减少排放和泄漏来清除损害。近年来，**风险预防原则**在环境政策中起着日益重要的作用。目前更多的资源被用于减少有毒物质等的新排放所致潜在损害的风险。这些资源既被用于治理长期释放带来的累积/慢性损害，也用于治理短期释放带来的突发性损害。污染排放或泄漏带来的潜在损害可能是未知的，但应当**提前**进行科学评估，比如在某个可能造成严重损害的产品投放市场之前。如果某个新产品的影响不可确定，这种不确定性应是对自然有好处的。尽管该新产品的潜在损害还未完全评估确定，为了确保它不会带来任何损害，需要采取行动限制（最终禁止）该新产品的使用。REACH 法规（见第 2 章）是一个实施风险预防原则的范例。

**Whether directed at acute, accumulated (chronic) or regional risk cost benefit considerations** lie behind most of the policy implementation, although formal cost benefit analysis has not always been explicitly used. Costs for plants and industries have almost always been considered, and generally it seems to us that one has not wanted to destroy industries' competitiveness or cause unemployment when emission limits or standards have been set. Cost benefit analysis has developed considerably over the years, and is today routinely used in many countries when new policies and tools are designed.

不论是针对突发性风险、累积（慢性）风险还是区域风险，**成本效益考虑**是多数政策实施的依据，虽然并不一定总是使用正式的成本效益分析。工厂和企业的成本几乎总是会被纳入考虑，而且一般在我们看来，在设定了排放限值或标准后，人们不希望破坏企业的竞争力或者造成失业。多年以来，成本效益分析取得了长足发展。如今，很多国家在进行新政策和工具的设计时通常都会进行成本效益分析。

The **substitution principle** lies behind much of environmental policy, even though this may not always be explicitly stated. The idea behind the principle is that a harmful production input or consumer product should be substituted with a less harmful one if such exist. "Harmful" in this case refers both to acute, accumulated and regional risk. For instance, by taxing the use of a harmful substance one gives the user an incentive to use a less harmful substance instead. The REACH regulation is an example of the explicit use

of the substitution principle, where the regulations state that a harmful product or substance should be replaced with a less harmful one if such exist, and the costs are not too high. The substitution principle is mostly applied towards hazardous (toxic) or unknown chemical substances, rather than to more traditional pollutants.

**替代原则**是很多环境政策制定的依据，虽然这一原则可能并不总能得到明确表述。替代原则背后的理念是，有害的生产原料或消费品应当用危害较小的产品取代，如果有这样的产品的话。这种情况下，“有害”包括突发性风险、累积性风险和区域风险，三者兼有。例如，对使用有害物质征税就是鼓励使用者改为使用危害较小的物质。REACH 法规是明确采用替代原则的范例。该法规规定，有害产品或物质应当用危害较小的产品或物质取代，如果存在这类物质，而且成本不太高。替代原则主要适用于危险（有毒）或未知的化学物质，而不适用于较传统的污染物。

**Right to information** is a key to public participation in shaping environmental policy. Today most information on emissions, local air quality (including current concentration levels of main pollutants), local water quality, contaminated sites etc. is publicly available. Previously there has been some reluctance from industry to publish emission data from individual plants. But for instance in EU today key emission data for each plant can be found on the E-PRTR website, together with other information.

**知情权**对于公众参与制定环境政策是一个关键因素。目前，关于污染物排放、地方空气质量（包括主要污染物当前的浓度水平）、地方水质、污染场地等方面的信息是公开提供的。以前企业不愿公布个别工厂的排放数据。但目前，例如在欧盟，每个工厂的主要排放数据及其他信息均可在 E-PRTR 网站上找到。

The **subsidiarity principle** has become a key principle for all policies in the EU. It ensures that decisions are taken as closely as possible to the citizens and that constant checks are made to verify that action is justified in light of the possibilities available at national, regional or local level. It is defined in Article 5 of the Treaty on the European Union, and has become very important when defining whether actions at EU level are justified or not. Specifically, it is the principle whereby the EU does not take action (except in the areas that fall within its exclusive competence), unless an action at the EU level is more effective than action taken at national, regional or local level. It is closely bound up with the **principle of proportionality**, which requires that any EU-level action must be limited to what is necessary to achieve the stated objectives. In other words, the content and form of the action must be in keeping with the aim pursued.

**基层化原则**已成为欧盟所有政策中的一项关键原则。该原则确保做出的决定尽可能贴近市民，并且经常进行检查，以验证哪种行动在国家、区域或地方层面的可操作性方面是合理的。《欧洲联盟条约》第 5 条有基层化原则的定义。基层化原则在确定欧盟层面的行动是否合理时已变得非常重要。具体而言，如果欧盟层面的行动不比国家、区域或地方层面的行动更有效，欧盟即根据该原则不采取行动（除了在属于其专属权力之内的地区之外）。该原则与**比例原则**密切相关，该原则要求欧盟层面的行动必须限于为实现规定的目标所必需采取的行动。换言之，行动的内容和形式必须与所追求的目的一致。

**Fairness and equity** are important to ensure broad acceptance for the environmental regulations of acute, accumulated (chronic) and regional environmental risks. This



comprises both emission sources and areas, i.e. all sources should be treated equally when regulations are implemented. This is often difficult in practice, and it is not always agreed on what fairness and equity means. In the early days of environmental policy it was common to treat old, existing emission sources more lax than new ones (“grandfathering”). Grandfathering is not a cost effective approach, and the use of grandfathering has been reduced over the years so that today existing and new sources are treated more equally than before. A cost effective approach also implies that more lax emission standards could be applied for instance in rural areas where relatively few people are affected compared with more populous urban areas. This difference in standards is not considered fair by all, and has sometimes been disputed.

公平公正对于确保防范突发性、累积性（慢性）和区域环境风险的环境法规得到广泛接受是很重要的。这既包括排放源也包括排放区域，也就是在执行法规时，对所有的排放源应一视同仁。但在实践中这通常很难，而且人们对于公平公正的含义并不总能达成一致。在早期的环境政策中，通常采用“老源老办法、新源新办法”的原则，即对既有排放源更为宽松（“溯往原则”）。溯往原则不是一项成本有效的原则，近年来该原则已较少使用了，使得如今现有的新的排放源得到比以前平等的对待。成本有效的原则还意味着在农村地区可执行比较宽松的排放标准，因为与人口众多的城市地区相比，农村地区受影响的人数较少。这种标准上的差别被大家认为是不公平的，而受到诟病。

What is an **acceptable risk level** could in principle be decided on the basis of cost benefit considerations, based on current knowledge about expected short and long term damages from long term exposure (**accumulated risk**) and probabilities for unexpected incidents to happen (**acute risk**) and short term damages. But some people are risk averse, and want to apply the precautionary principle to a large degree to avoid potential, unknown damages from happening. Others may be more risk neutral, accepting some risk for instance if the cost of risk reduction is high. Generally, there is a tendency that the richer the people/country gets, the higher the valuation of (i.e. desire for) environmental risk reduction.

什么是可接受的风险水平，原则上可以依据成本效益分析、根据当前对长期暴露（**累积性风险**）造成的预计长期和短期损害以及突发环境事件的可能性（**突发性风险**）及其短期损害的了解来确定。但有的人厌恶风险，希望大量运用风险预防原则，以免发生潜在、未知的损害；还有人可能对风险持比较中立的态度，可以接受一些风险，例如在降低风险的成本很高的情况下。一般的趋势是：人民/国家越富裕，降低环境风险的价值（即欲望）就越高。

#### 1.2.4 What kind of institutional arrangements are needed? 需要什么样的制度安排？

Environmental policy in Western countries (and in China), whether it is economic instruments like taxes and emissions trading, direct regulations of emissions or other instruments, is **based in law**, to ensure a solid and lasting foundation of the policy. This is the case for **all the three kinds of environmental risks**, and **the legislation generally does not make any distinction between for instance acute and accumulated risks**. However, there are in all countries special rules on how to **control damages from acute accidents** if they occur. Since policy instruments are based in law, it is possible for those affected to take the regulator or polluter to court to solve disputes, and thus ensure an independent, impartial judgment of the case.

西方国家（以及中国）的环境政策是以法律为基础的，包括税收和排放交易这样的环境经济措施、直接的排放法规以及其他措施，以便确保政策基础稳固且持久。所有这三种类型的环境风险管控措施也都是这种情况，但立法通常并不区分突发性风险与累积性风险。然而，各个国家都有关于如何控制突发性事故造成损害的特别规定。由于政策工具是以法律为基础的，因此受影响的人可以把监管部门或污染者告上法庭来解决纠纷，从而确保案件得到独立公平的判决。

**Efficient institutions** to handle the environmental policy are needed. They need personnel with some skills on (technical) issues like damages on health and ecology from various releases to air and water, abatement options, cost benefit analysis, legal issues etc. Over the years environmental protection ministries and agencies in the EU and the US have built considerable competence in various fields necessary to ensure the implementation and administration of environmental policy based on sound and fair principles. **The one and same institution is usually responsible for handling all the three kinds of environmental risks.** However, **there might be special institutions handling the rescue and cleaning up from acute emissions to water and soil.**

需要**高效的机构**来处理环境政策。这些机构需要具有以下技能的人才：由于空气与水污染排放造成的健康和生态损害等（技术）问题、减排方案、成本效益分析、法律问题等。近年来，欧盟和美国环境保护部门和机构积累了各种领域相当强大的能力，这些能力对于确保根据公平合理原则实施和监管环境政策是必要的。**通常由同一个或类似的机构负责处理所有这三种类型的环境风险。**然而，应该有专门的机构负责开展向水和土壤突发性排放引起的援救和清理行动。

### 1.2.5 How have the abatement actions been funded? 如何筹集减排行动的资金？

Most policies are based on **the polluter-pays principle (PPP)**, defined as the polluter is responsible to pay for the emissions reductions from their own activities. The extended definition of the PPP, which also gives the polluter a responsibility to pay for the damages of the remaining emissions, has to a very little or no extent been applied. The Environmental Liability Directive (“Directive on environmental liability with regard to the prevention and remedying of environmental damage”, 2004/35/EC), aims at giving effect to the PPP by imposing liability on businesses for the prevention and remediation of environmental damage. This applies particularly to damages and risk from **acute** emissions. Over the years a lot of research has been carried out to assess and value in economic terms the damages caused by various pollutants, which to some extent is used as a basis for taxation of remaining emissions causing **accumulated risks**.

很多政策是基于**污染者付费原则**（PPP）制定的，其定义是：由污染者负责支付其自身活动产生的减排费用。根据 PPP 的延伸定义，污染者还要负责为残留排放物造成的损害支付费用。但这种延伸定义应用得很少或者未得到应用。《环境责任指令》（“关于预防和修复环境损害的环境责任指令”，2004/35/EC）旨在通过让企业承担预防和修复环境损害的责任来执行 PPP。该指令特别适用于**突发性**排放引起的损害和风险。近年来开展了大量研究，以从经济角度对各种污染造成的损害进行评估，在一定程度上可以作为对引起**累积性风险**的残留排放物征税的依据。

**Government funding** has been applied for the cleaning up of old, abandoned industry sites in several countries, e.g. the US Superfund (see chapter 2).

些国家通过**政府资助**的方式清理旧的废弃工业场地，例如美国的超级基金（见第 2 章。

### 1.2.6 What kind of policy instruments has been used?采用了何种政策工具？

At the start of the modern environmental policy era most of the policy instruments applied in Western countries were based on **command and control**. Generally, **the same policy instruments have been used for all the three kinds of environmental risks**, but as we will see from the examples in the following chapters there are some examples of how policy instruments could be particularly targeted towards one or two types of risk. In the early days the idea of using other instruments was less developed, and it was perceived that direct regulations could ensure swift and efficient reductions of emissions. When more experience with these tools was gained, one realized that they were giving industry too little flexibility to curb emissions in cost effective ways. Thus, more **flexible regulations**, giving plants some more choice on how to reduce emissions, have been introduced. Gradually some **economic instruments** like taxes on emissions and harmful production inputs, emissions trading etc. have also been introduced. However, command and control approaches have remained the core policy instruments in the EU towards emissions from industry and most other sources, **regulating all the three kinds of environmental risks**. In the EU, the use of Framework Directives specifying both emissions standards and how they should be achieved through for instance using Best Available Technology shows that there is still too much inflexibility in emissions regulations in many countries.

在现代环境政策兴起之初，西方国家所采用的多数政策工具都是以**行政指令**为基础的。所有这三种类型的环境风险通常都采用相同的政策工具，但正如我们在后面几章的范例中会看到的，有些政策工具是特别针对某一两类风险的。早期很少有人提出使用其他工具的想法，人们认为直接监管可以确保快速有效的减排。在获得了较多使用这些工具的经验之后，人们逐步认识到，在以经济有效的方式控制排放方面，企业享有的灵活性太小。因而，出台了更**灵活的法规**，让企业在减排措施方面有更多的选择。同时也逐渐引入了一些**经济工具**，比如对污染排放和使用有害生产原料征税、排放交易等。然而，行政指令仍然是欧盟对工业排放和多数其他来源排放采用的核心政策工具，能够**监管所有这三种类型的环境风险**。欧盟采用的《框架指令》对排放标准以及如何通过使用最佳可行技术来达到排放标准都做了规定，这表明很多国家的排放法规非常不灵活。

**Standards** have been set more or less through cost benefit considerations, although formal cost benefit analysis have seldom been applied. Health and safety considerations have played a crucial role, based on scientific knowledge about dose response relations etc. On the other hand, the use of Best Available Technology, which was launched by EU in the 1990s, has also been an important principle behind the environmental standard setting towards industry.

**标准**是或多或少通过成本效益考虑制定的，虽然正式的成本效益分析应用得很少。根据剂量反应关系等方面的科学知识，健康和安全考虑起到了关键作用。另一方面，采用 20 世纪 90 年代欧盟推出的最佳可行技术也是制定针对工业的环境标准时所依据的一项重要原则。

### 1.2.7 How have the regulations been enforced?法规是如何执行的？

All **companies are responsible** for ensuring compliance with emissions reductions and other requirements from the authorities. The ultimate responsible is the CEO of the company. Normally, the companies are required to report at least annually to the environmental authorities on the development in emissions, concentrations and other issues required by their emission permits. Also, the authorities carry out random inspections at sites to see if the actual situation is as reported and in compliance with the regulations. Serious violations of the regulations could be punished by a fine, jail or even temporary closing down of the plant activities if the damages caused are very serious. See chapter 2 for an overview of how EU countries are handling control and enforcement of regulations.

所有**企业都有责任**确保遵守有关部门的减排要求和其他要求。最终负责人是企业的 CEO。企业通常要每年至少向环境部门报告一次排放进展情况、浓度以及企业排放许可证上所要求的其他问题。同时，有关部门到现场进行随机检查，查看实际情况是否与所报告的一致，以及是否遵守法规。严重违规可能会被处以罚款、牢狱之刑，如果所造成的损害非常严重的话，甚至还会被处以暂时停产。关于欧盟国家是如何管理和执行法规的，见第 2 章的概述。

### 1.3 About the examples (“case studies”)关于范例（“案例研究”）

The main idea with this report is to show how the EU and the US through practical policies have approached the environmental risks caused by various pollutants and sources that China could be inspired of and learn from when improving its policies to reduce environmental risk. However, there are in Western countries **no sharp distinctions between the various environmental risks** when policies are designed and implemented. Thus, most experiences from environmental policies in the EU and the US are **related to reducing accumulated, acute and regional environmental risks**. Most of the examples from the EU and the US presented in the next chapters are focused on such risk reductions. For instance, integrated river basin management (which is described in chapters 2.2.1 and 3.3) is a sort of regional environmental risk assessment and management, as it deals with a spatial scale that includes multiple habitats with multiple sources of many stressors affecting multiple endpoints. There are also some policy approaches (e.g. the EU Seveso Directive) that are mainly directed towards one type of risk (in this case acute risk).

本报告的主题思想是说明欧盟和美国如何通过实际政策来应对各种污染物引起的环境风险，并指出对于中国在改进政策以降低环境风险时有哪些启发和可借鉴之处。然而，西方国家在制定和实施政策时，**并没有显著区分各种环境风险**。因此，欧盟和美国的环境政策经验大多与**降低累积性、突发性和区域环境风险**有关。后面几章提供的欧盟和美国范例大多侧重于这些环境风险的降低。例如，综合流域管理（在 2.2.1 和 3.3 小节会介绍）就是一种区域环境风险评估和管理，它是对包含多种栖息地的空间规模进行的风险评估和管理，在这些栖息地中众多压力源影响多个端点。也有一些政策方法（例如欧盟的 Seveso 指令）主要针对一种类型的风险，即突发性风险。

The departure for choosing the examples has been some of the main environmental risk challenges China in general and the pilot areas in particular are facing. The project team

has put great emphasis in finding relevant examples representing “best international practice” that are relevant for China in its current situation.

实例选择主要从中国国家以及试点地区特别面临的一些主要环境风险挑战出发，着重于找出适合中国国情、代表“国际最佳实践”的适当例子。

The presentation of the examples is divided into two chapters. In chapter 2 we present the overall policy approach towards important environmental risks, mostly in the form of EU directives and international agreements. The chapter is divided into five sub-chapters. Chapter 2.1 shows how pollution from industrial sources is approached in the EU, while chapter 2.2 shows examples on how discharges to water have been handled in the EU. Chapter 2.3 presents examples on how releases of heavy metals and other hazardous substances have been approached through some EU directives and an international agreement. and chapter 2.4 shows how nature and soil have been protected. Finally, chapter 2.5 shows how emissions to air have been approached in the EU and the US.

范例介绍分为两章。在第 2 章我们介绍重大环境风险方面的总体政策方法，大多为欧盟指令和国际协议。第 2 章包括五节，2.1 节说明欧盟如何处理工业源污染，2.2 节通过实例说明欧盟如何处理水体的污染物排放，2.3 节通过实例说明如何通过一些欧盟指令和国际协议来处理重金属和其他有害物质的排放，2.4 节说明如何保护自然和土壤。最后，2.5 节说明欧盟和美国如何处理污染物向空气的排放。

In chapter 3 examples on how the policies have been implemented “on the ground” in various areas and towards various environmental risks are presented.

第 3 章通过实例说明不同地区如何针对各种环境风险将政策“落到实处”。

The following examples are presented:

提供了以下范例：

- *Regulating industry pollution: the EU Industrial Emissions Directive (IED) (chapter 2.1):* shows how EU applies an integrated approach to prevention and control of emissions into air, water and soil, to waste management, to energy efficiency and to accident prevention. This example shows the basic approach to regulations of **environmental risks** caused by industrial sources in the EU.  
*工业污染监管：欧盟《工业排放指令》（IED）（第 2.1 节）：*说明欧盟如何采用一体化的方法实现空气、水和土壤排放防治、废弃物管理、能源效率和事故预防。该范例说明了欧盟对工业引起的**环境风险**的基本监管方法。
- *EU's Water Framework Directive (chapter 2.2.1):* an example on how aquatic ecology and water resources are protected from **environmental and ecological risk**, within a framework of **regional environmental risk** assessment and management.  
*欧盟的《水框架指令》（第 2.2.1 节）：*在区域环境风险评估和管理框架内关于如何保护水生生态和水资源免受**环境风险**的一个范例。
- *The OSPAR Convention (chapter 2.3.1):* shows how **regional risk (mostly accumulated, but also acute)** caused by release to water from several countries is handled through an agreement between the countries.

《OSPAR 公约》（第 2.3.1 节）：说明如果通过国家之间的协议应对多个国家向水体排放污染而引起的区域风险（主要针对累积性风险，但也涉及突发性风险）。

- *EU REACH Directive (chapter 2.3.2)*: an example of how **accumulated and regional risk** from the production, use and disposal of chemicals and of products containing hazardous substances are handled by imposing common rules for this in all countries.

欧盟《REACH 指令》（第 2.3.2 节）：如何通过所有国家推行通用规则来应对化学品和含有害物质产品的生产、使用和处置引发的累积性风险和区域风险的一个范例。

- *EU: The Seveso Directives (chapter 2.3.3)*: an example on how **acute risks (and to some extent regional risks) from accidents** in industry plants are reduced by requiring them to have safety management systems and internal emergency plans etc.

欧盟：《Seveso 指令》（第 2.3.3 节）：关于如何通过要求工业企业建立安全管理体系和内部应急预案等措施降低突发事故引起的突发性风险（一定程度上也是区域风险）的一个范例。

- *The EU Habitats Directive (chapter 2.4.1)*: shows how imposing an ecological red line for preserving biodiversity in the EU contributes to reducing **ecological risk** for a decline in biodiversity and loss of species, based on **regional risk assessment and management**.

《欧盟栖息地指令》（第 2.4.1 节）：根据区域风险评估和管理，说明欧盟为保护生物多样性设置生态红线如何有利于降低生物多样性衰减和物种消失的生态风险。

- *EU Soil Thematic Strategy (chapter 2.4.2)*: shows how the EU attempts to reduce **accumulated and regional risks** caused by release of harmful substances.

《欧盟土壤保护专题战略》（第 2.4.2 节）：说明欧盟如何尝试降低有害物质释放引起的累积性风险和区域风险。

- *US Superfund (chapter 2.4.3)*: shows how **risk (mostly accumulated and regional)** have been handled when caused wholly or partly by releases from abandoned industry sites.

美国超级基金（第 2.4.3 节）：说明如何应对全部或部分由废弃工业场地引起的环境风险（主要为累积性风险和区域风险）。

- *Preparations for climate-friendly air quality management in the EU and US (chapter 2.5.1)*: about how **accumulated and regional risks** related to air pollution and climate change may be handled more cost-effectively by targeting the emission sources in an integrated way.

欧盟和美国为气候友好型空气质量管理做好准备（第 2.5.1 节）：关于如何通过把各排放源作为一个整体目标以更经济有效的方式应对与空气污染和气候变化有关的累积性风险和区域风险。

- *Summary of air pollution cases from phase I (chapter 2.5.2)*: Examples on how the EU and the US have designed their policies to improve air quality and at the same time reduce greenhouse gas emissions. These are mostly examples of reducing **accumulated and regional risk**.

期空气污染案例总结（第 2.5.2 节）：举例说明欧盟和美国如何制定政策来改善空气质量同时减少温室气体排放。这些大多为降低累积性风险和区域风险的案例。

- *APELL – Awareness and preparedness for emergencies at local level (chapter 3.1):* an example of a programme enabling governments, in co-operation with industry, to work with local leaders to identify the potential hazards in their communities and to prepare measures to respond and control emergencies to reduce **acute and regional risk**.  
*APELL-地区级突发事件意识和准备（第 3.1 节）：* 一个计划范例，该计划使政府能够在企业的配合下与地方领导联手确定社区的潜在危险，并准备应对和控制突发事件的措施，以降低突发性和区域风险。
- *Chemical industrial parks (chapter 3.2):* an example on how internal systems and guidelines in parks could contribute to reducing **acute and to some extent regional risks**.  
*化工园区（第 3.2 节）：* 关于园区内部制度和导则如何有利于降低突发性风险并一定程度上降低区域风险的一个范例。
- *Integrated River Basin Management in the transnational Rhine River Basin (chapter 3.3):* shows how a management plan among several countries contribute to manage and reduce **regional risk** from release of harmful substances into the river.  
*《跨国莱茵河流域综合流域管理》（第 3.3 节）：* 说明多个国家通过联合性的管理规划，有效管理并降低因有害物质向河体排放而引起的区域风险。
- *Decreased exposure to hazardous pollutants in the EU: how did it happen? (chapter 3.4):* shows how EU has managed to reduce the exposure to hazardous pollutants to reduce **environmental risk**.  
*欧盟减少危险污染物暴露：如何实现的？（第 3.4 节）：* 说明欧盟如何设法减少暴露于危险污染物从而降低环境风险。

## 2 Part 2: Policies handling environmental risks to public health and ecology

### 第二章应对公共健康和生态风险的策略

In this chapter we present some examples (cases) from the EU and the US on how industry pollution in the EU are regulated today (section 2.1), discharges to water (section 2.2), release of heavy metals and other hazardous substances (section 2.3), protection of nature and soil (section 2.4) and emissions to air (section 2.5) have been handled. Emphasis is put on principles and overall regulations (like the use of EU Directives). Examples on how these principles and regulations have been applied are presented in chapter 3.

本章我们介绍欧盟和美国一些关于欧盟目前如何监管工业污染（第 2.1 节）、如何处理污染物向水排放（第 2.2 节）、重金属和其他有害物质释放（第 2.3 节）、自然和土壤保护（第 2.4 节）和污染物向空气排放（第 2.5 节）的范例（案例）。以原则和总体法规（比如采用欧盟指令）为重点。第 3 章介绍了这些原则和法规的应用案例。

### 2.1 Regulating industry pollution: the EU Industrial Emissions Directive (IED) 工业污染监管：欧盟工业排放指令（IED）

#### 2.1.1 Introduction 综述

The Directive on Industrial Emissions 2010/75/EU (IED) aims to prevent, reduce and as far as possible eliminate pollution from industrial activities by establishing a general framework for the control of the main industrial activities.

《工业排放指令 2010/75/EU》（IED）旨在通过建立一个用于控制主要工业活动的框架，防止、减少并尽可能消除工业活动产生的污染。

The IED Directive was adopted on 24 November 2010 and had to be included in national legislation by Member States by 7 January 2013. The IED replaces the Directive on Industry Pollution Prevention and Control (IPPC Directive) and various sectoral directives as of 7 January 2014, with the exemption of the Large Combustion Plant (LCP) Directive, which will be repealed with effect from 1 January 2016.

IED 指令于 2010 年 11 月 24 日获得通过，到 2013 年 1 月 7 日成员国必须将其纳入国家立法。自 2014 年 1 月 7 日起，IED 取代《工业污染预防与控制指令》（《IPPC 指令》）及各种行业指令，2016 年 1 月 1 日起将废止的《大型燃烧装置（LCP）指令》除外。

The IED Directive stresses that different approaches to controlling emissions into air, water or soil separately may encourage the shifting of pollution from one environmental medium to another rather than protecting the environment as a whole. Therefore, an **integrated approach** to prevention and control of emissions into air, water and soil, to waste management, to energy efficiency and to accident prevention should be applied. **The importance of preventing accidents and incidents, and limit their consequences, are highlighted.** Liability regarding the environmental consequences of



accidents and incidents is a matter for each member state, and the directive has no particular requirements on this. However, if an EU member state fails to implement the requirements of the directive, it can be taken to the EU Court of Justice.

IED 指令强调，在控制污染物向空气、水或土壤排放各方面单独采取不同方法可能会促使污染从一个环境介质转移到另一个环境介质，而不能保护整体环境。因此，应当将**一体化方法**应用于预防和控制污染物向空气、水或土壤排放、废弃物管理、能源效率和事故预防。**强调了预防事故和事件及其后果的重要性**。事故和事件所产生的环境后果由每一个成员国自行承担，尽管该指令并没有对此提出特别要求，但是，欧盟成员国不履行该指令要求的，可被诉至欧盟法院。

The emission permit requirements in the IED are **directed at tackling both acute and accumulated environmental risks**, and few of the requirements are directed to one or another. However, some requirements are directed towards how to prevent accidents and how to handle and limit the damages when accidents causing high acute emissions occur. The permitting process **does not explicitly take into account regional environmental risk**. However, the IED Directive imposes **minimum** standards, and it does not prevent member states from maintaining or introducing more stringent protective standards or measures if this is regarded necessary.

IED 中的排放许可证要求旨在应对**突发性环境风险和累积性环境风险两者**，这些要求很少是只针对其中一种风险的。然而，也有一些要求是针对如何预防事故以及当发生引起高度突发性排放的事故时如何处理和限制损害的。许可审批程序**并未明确把区域环境风险纳入考虑**。然而，IED 指令设定了**最低标准**，而且允许成员国在其认为必要的情况下建立或出台更加严格的保护性标准或措施。

### 2.1.2 Principles

**Emission permits should be based on best available techniques (BAT)** 排放许可证建立在**最佳可行技术**（可行的）**的基础上**

The permits should include emission limit values for polluting substances, or equivalent parameters or technical measures, appropriate requirements to protect the soil and groundwater and monitoring requirements. Permit conditions should be set on the basis of best available techniques (BAT). Annex III of the Directive present some criteria on how to define BAT.

污染物质的排放限值、同等参数、技术措施、保护土壤与地下水的适当要求，以及监测要求应列入许可证。许可证条件应根据最佳可行技术设定。《指令》附录 III 列出了一些确定 BAT 的标准。

‘Best available techniques’ are defined by the Directive as “the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole”. ‘Techniques’ includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned.

《指令》对‘最佳可行技术’的定义是：“活动及其运作方法是在发展中最有效最先进的阶段，该阶段表明，特别技术在实践中能为排放限值和其他许可证条件提供依据，防止或在不可行的情况下减少排放以及对整体环境的影响。‘技术’既包括所采用的技术，也包括设备的设计、建造、维护、运行和停运方式。

‘Available techniques’ are defined as those “developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator.” ‘Best’ means most effective in achieving a high general level of protection of the environment as a whole.

‘可行技术’的定义是：“在一定规模上开发的技术，考虑了成本和优势，在经济技术可行的条件下在相关工业行业实施。该技术不论是否在所议成员国内使用或产生的，只要经营者可以合理得到这些技术”。‘最佳’是指能最有效达到很高的整体环境保护综合水平。

In order to determine BAT and to limit imbalances in the EU as regards the level of emissions from similar industrial activities, **BAT reference documents** should be drawn up, reviewed and where necessary, updated through an exchange of information with stakeholders. **BAT reference document should be a document resulting from the exchange of information, drawn up for defined activities and describing, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques.**

为了确定 BAT 并限制欧盟在类似工业活动排放水平方面的不平衡，在起草、审核并在必要时更新 BAT 参考文件等行为都应与交流利益相关者进行交流。**BAT 参考文件应当是通过信息交流产生的、为规定的活动起草的文件，特别描述了所应用的技术、当前的排放和消耗水平、确定最佳可行技术时所考虑的技术以及 BAT 结论和任何新兴技术。**

The key elements of BAT reference documents (**BAT conclusions**) should be adopted through a committee procedure. Since this is to be done at the EU level, the EU Commission should establish guidance on the collection of data, on the elaboration of BAT reference documents and on their quality assurance. **BAT conclusions should be the reference for setting permit conditions.** They can be supplemented by other sources. The EU Commission should aim to update BAT reference documents not later than 8 years after the publication of the previous version.

BAT 参考文件的关键要素（**BAT 结论**）应通过委员会程序来选定。由于这项工作要在欧盟层面完成，因此欧盟委员会应提供数据收集、BAT 参考文件的阐述及其质量保证方面的指导。**BAT 结论应作为设置许可证条件的参考**，可以由其他资料来源做补充。欧盟委员会应不晚于上一版出版 8 年后对 BAT 参考文件进行更新。

The update of BAT reference documents for the various industries should be done through an exchange of information between Member States, the industries concerned, non-governmental organizations promoting environmental protection and the Commission. The exchange of information shall, in particular, address the following:

各行业 BAT 参考文件的更新应通过欧盟成员国、有关行业、促进环保的非政府组织以及欧盟委员会之间的信息交流来完成。信息交流应特别论及以下信息：

- a. the performance of installations and techniques in terms of emissions, expressed as short- and long-term averages, where appropriate, and the associated reference conditions, consumption and nature of raw materials, water consumption, use of energy and generation of waste;  
以长期和短期平均水平表示的设备性能和排放方面的技术，适当时还有相关的基准条件、原材料的消耗和性质、水消耗、能源利用和废弃物的产生；
- b. the techniques used, associated monitoring, cross-media effects, economic and technical viability and developments;  
所用的技术、相关监测、跨媒介影响、经济技术可行性和发展动态；
- c. best available techniques and emerging techniques identified after considering the issues mentioned in points (a) and (b).  
在考虑（a）和（b）两点涉及的问题之后所确定的最佳可行技术和新兴技术。

‘Emerging technique’ means a new technique for an industrial activity that, if commercially developed, could provide either a higher general level of protection of the environment or at least the same level of protection of the environment and higher cost savings than existing best available techniques.

‘新兴技术’是指某种工业活动的新技术，该技术若得到商业开发，相较现有最佳可行技术而言，它可以带来较高或者至少相同的综合环保水平，且节省的成本更多。

### 2.1.3 Approach

#### **A large number of BREFs<sup>1</sup> have been developed 编制了大量的 BREF 文件**

BAT was defined also in the IPPC Directive, and over the years several Best Available Techniques Reference Document (BREFs) have been developed for various industries. As of April 2014 there are BREFs either being prepared or adopted for the following industries or activities:

《IPPC 指令》也对 BAT 做了定义，并且近年来编制了各行业的最佳可行技术参考文件（BREF）。截止 2014 年 4 月，编制或通过了以下行业或活动的 BREF 文件。

- Ceramic manufacturing industry  
陶瓷制造业
- Common Waste Water and Waste Gas Treatment/Management System in the Chemical Sector  
化工行业中常见的废水和废气处理/管理系统

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<sup>1</sup> BREFs can be found at <http://eippcb.jrc.ec.europa.eu/reference/>  
BREF 文件可在 <http://eippcb.jrc.ec.europa.eu/reference/> 上找到。

- Emissions from Storage and the transfer/handling of liquids, liquefied gases and solids, regardless of the sector or industry  
仓储的排放以及液体、液化气和固体的转移/处理，无论什么行业或产业
- Energy Efficiency  
能源效率
- Ferrous Metals Processing Industry  
黑金属加工行业
- Food, Drink and Milk Industries  
食品、饮料和牛奶行业
- Industrial Cooling Systems  
工业冷却系统
- Intensive rearing of Poultry and Pigs  
家禽和猪的集约饲养
- Iron and Steel Production  
钢铁生产
- Large Combustion Plants  
大型燃烧装置
- Large Volume Inorganic Chemicals – AFF and FI  
大规模无机化学品工业-AFF 和 FI
- Large Volume Inorganic Chemicals - Solids and other Industries  
大规模无机化学品工业-固体和其他
- Large Volume Organic Chemical Industry 大规模有机化学品工业
- Management of Tailings and Waste-rock in Mining Activities  
采矿中尾矿和废岩的管理
- Manufacture of Glass  
玻璃制造
- Manufacture of Organic Fine Chemicals  
有机精细化工品制造
- Non-ferrous Metals Industries  
有色金属行业
- Cement, Lime and Magnesium Oxide Manufacturing Industries  
水泥、石灰和氧化镁制造业
- Production of Chlor-alkali  
氯碱制造业
- Production of Polymers  
聚合物的生产
- Pulp and Paper Industry  
纸浆和造纸业
- Production of Speciality Inorganic Chemicals  
特种无机化学品的生产
- Refining of Mineral Oil and Gas  
矿物油和天然气精炼
- Slaughterhouses and Animals By-products Industries  
屠宰场和动物副产品工业
- Smitheries and Foundries Industry  
锻造和铸造业

- Surface Treatment of Metals and Plastics  
金属和塑料表面处理
- Surface Treatment Using Organic Solvents  
使用有机溶剂的表面处理
- Tanning of Hides and Skins  
制革业
- Textiles Industry  
纺织业
- Waste Incineration  
垃圾焚烧
- Waste Treatment  
废物处理行业
- Wood-based Panels Production  
人造板生产
- Wood and Wood Products Preservation with Chemicals  
使用化学品保存的木材和木材制品

### **The permit granting process is comprehensive 许可证审批程序综合全面**

The process of granting permits to installations is the responsibility of each EU Member State. Operators of an installation should submit permit applications containing the information necessary for the so-called “**competent authority**” (i.e. the national responsible institution) to decide permit conditions. An application for a permit should include a description of the following:

设备许可证审批是欧盟每个成员国的责任。设备经营者应提交许可证申请书，申请书应包含“**主管部门**”（即国家负责机构）确定许可证条件所必需的信息，许可证申请书应包括以下方面的描述：

- a description of the installation and its activities; 设备及其功能的描述；
- an overview of the raw and auxiliary materials, other substances and the energy used in or generated by the installation; 设备所用或产生的原材料和辅助材料、其他物质和能源的概述；
- the sources of emissions from the installation; 设备的排放源；
- the conditions of the site of the installation; 设备场地状况；
- where applicable, a baseline report describing the state of soil and groundwater contamination; 适用情况下，土壤和地下水污染状况的基线报告；
- the nature and quantities of foreseeable emissions from the installation into each medium, as well as identification of significant effects of the emissions on the environment; 设备向每种介质的可预见排放的性质和数量，以及排放对环境的重大影响的确定；
- the proposed technology and other techniques for preventing or, where this is not possible, reducing emissions from the installation; 所推荐的技术以及其他技术，这些技术用于预防或无法预防情况下减少设备的排放；
- measures for the prevention, preparation for re-use, recycling and recovery of waste generated by the installation; 设备所产生废物的预防、准备再利用、循环使用和回收措施；

- further measures planned to comply with the general principles of the basic obligations of the operator; 遵守一般原则所采取的进一步计划措施是经营者的基本义务;
- measures planned to monitor emissions into the environment; 监测污染物向环境排放的计划措施;
- the main alternatives to the proposed technology, techniques and measures studied by the applicant in outline. 所推荐技术、申请人所研究的技术和措施的主要替代方案的概括。

The Directive defines ‘**emission limit value**’ as the mass, expressed in terms of certain specific parameters, concentration and/or level of an emission, which may not be exceeded during one or more periods of time (e.g. hour, day and/or year).

《指令》对“**排放限值**”的定义是：排放物在一个或多个时期（例如小时、天和/或年）内不可被超过的质量（以某种特定参数表示）、浓度和/或水平。

The competent authority **may set less strict emission limit values than required from BAT considerations only where an assessment shows that the achievement of emission levels associated with BAT would lead to disproportionately higher costs compared to the environmental benefits** due to:

只有当评估发现达到与 BAT 相关的排放水平会因以下原因而导致成本与环境效益相比不成比例地升高时，主管部门方可设定比 BAT 考虑所要求的较为宽松的排放限值：

- the geographical location or the local environmental conditions of the installation concerned; or 有关设备的地理位置或当地环境状况；或者
- the technical characteristics of the installation concerned. 有关设备的技术特征。

In order to enable operators to **test emerging techniques** which could provide for a higher general level of environmental protection, or at least the same level of environmental protection and higher cost savings than existing BAT, the competent authority should be able to grant temporary derogations from emission levels associated with BAT.

为了让经营者能够**检验新兴技术**可以带来比现有 BAT 较高的综合环保水平或者至少相同的环保水平和更多的节约成本，主管部门应准许临时背离与 BAT 有关的排放水平。

In order to **provide existing installations with sufficient time to adapt technically to the new requirements** of the IED, some of the new requirements should apply to those installations after a fixed period from the date of application of this Directive.

为现有设备提供充足的时间，使其在技术上适应 IED 的新要求，一些新要求应在该指令实施之日起，在宽限期后适用于那些设备。

In accordance with the Århus Convention on access to information, public participation in decision-making and access to justice during the permit application process is necessary. **Members of the public concerned should be heard during the application process**, and their views taken into account when the permits are set.

根据关于信息获取的《奥胡斯公约》，公众参与决策和司法救济在许可证申请过程中是必要的。申请过程中应听取有关公众人士的意见，并在设立许可时考虑他们的意见。

#### 2.1.4 Tools

##### **The permit conditions are usually detailed 许可证条件通常很详细**

BAT conclusions shall be the reference for setting the permit conditions. Emission levels associated with BAT means “..the range of emission levels obtained under normal operating conditions using a best available technique or a combination of best available techniques, as described in BAT conclusions, expressed as an average over a given period of time, under specified reference conditions.” The conditions shall **include at least the following, aiming at reducing both acute and accumulated risks:**

BAT 结论应作为设置许可证条件的参考。与 BAT 有关的排放水平是指“.....正常操作条件下用一种最佳可行技术或组合最佳可行技术获得的排放水平范围，如 BAT 结论中所描述的，以给定时期内规定基准条件下的平均水平来表示。”**为了降低突发性风险和累积风险，许可证条件应至少包括以下内容：**

- emission limit values for polluting substances listed in the Directive, and for other polluting substances, which are likely to be emitted from the installation in significant quantities;  
指令中所列污染物质以及设备可能会大量排放的其他污染物质的排放限值；
- appropriate requirements ensuring protection of the soil and groundwater and measures concerning the monitoring and management of waste generated by the installation;  
确保保护土壤和地下水的适当要求，以及关于设备所产生废物的监测与管理措施；
- suitable emission monitoring requirements specifying measurement methodology, frequency and evaluation procedure;  
适宜的排放监测要求，规定了测量方法、频率和评估程序；
- an obligation to supply the competent authority regularly, and at least annually, with information on the basis of results of emission monitoring and other required data that enables the authority to verify compliance with the permit conditions;  
根据排放监测结果定期（至少每年）向主管部门报告信息，并提供主管部门可以验证许可证条件符合性的其他必要数据；
- appropriate requirements for the regular maintenance and surveillance of measures taken to prevent emissions to soil and groundwater, and appropriate requirements concerning the periodic monitoring of soil and groundwater in relation to relevant hazardous substances likely to be found;  
定期维护和监督为防止向土壤和地下水排放而采取的措施的适当要求，以及关于定期监测与可能发现的相关有害物质有关的土壤和地下水的适当要求；
- measures relating to conditions other than normal operating conditions such as start-up and shut-down operations, leaks, malfunctions, momentary stoppages and definitive cessation of operations;

非正常操作条件的有关措施，比如启动和停机操作、泄漏、故障、短暂停机和永久性停止运转；

- provisions on the minimization of long-distance or transboundary pollution 关于最大程度减少远距离或跨境污染的规定；
- conditions for assessing compliance with the emission limit values or to the applicable requirements specified elsewhere. 评价排放限值遵从条件的条件，或者另行规定的适用要求。

When an activity or a type of production process carried out within an installation is not covered by any of the BAT conclusions, or where those conclusions do not address all the potential environmental effects of the activity or process, the competent authority shall, after prior consultations with the operator, set the permit conditions on the basis of the best available techniques that it has determined for the activities or processes concerned.

如果任何 BAT 结论未涉及设备执行的某项活动或某类生产流程，或者那些结论没有论及活动或生产流程对环境造成的全部潜在影响，主管部门应事先与经营者协商，根据其已确定的有关活动或流程的最佳可行技术来设置许可证条件。

### **Regular monitoring is required 要求定期监测**

It is necessary to ensure that the operation of an installation comply with the permit requirements. Therefore, **permit conditions should include regular surveillance to avoid leaks, spills, incidents or accidents occurring during the use of equipment and during storage.** In order to detect possible soil and groundwater pollution at an early stage and to take appropriate corrective measures before the pollution spreads, the monitoring of soil and groundwater for relevant hazardous substances is also necessary. When determining the frequency of monitoring, the type of prevention measures and the extent and occurrence of their surveillance may be considered.

应当确保设备的运转符合许可证要求。因此，许可证条件应包括为了避免在设备使用和存放期间发生泄漏、溢出、事故而进行的定期监督。为了早期发现可能的土壤和地下水污染并在污染扩散之前采取适当的纠正措施，还必须监测土壤和地下水是否含有相关危险物质。在确定监测频率时，可以考虑预防措施的类型以及监督的范围和发生率。

Periodic monitoring shall be carried out at least once every 5 years for groundwater and every 10 years for soil, unless such monitoring is based on a systematic appraisal of the risk of contamination. Then the monitoring should be made more frequent.

地下水的定期监测至少每 5 年进行一次，土壤的定期监测至少每 10 年一次，除非这种监测以污染风险的系统性评估为基础。监测应更频繁些。

### **Compliance control and inspections are required 要求进行合规控制和检查**

In order to ensure the effective implementation and enforcement of the permit requirements, **operators should regularly report to the competent authority on compliance with permit conditions.** Member States should ensure that the operator and the competent authority each take necessary measures in the event of non-compliance with this Directive and **provide for a system of environmental**



**inspections.** The national responsible authority for compliance and control should have sufficient staff available with the skills and qualifications needed to carry out those inspections effectively.

为了确保有效实施和执行许可证要求，经营者应定期向主管部门报告遵守许可证条件的情况。成员国应确保在出现不符合本指令的情况时，经营者和主管部门各自采取必要措施，并对**环境检查制度**做出规定。负责合规与控制的机构应当有充足的、具备有效开展那些检查所需技能和资格的工作人员。

Member States must **set up a system of environmental inspections of installations addressing the examination of the full range of relevant environmental effects from the installations concerned.** Operators shall offer the control authorities all necessary assistance to enable them to carry out any site visits, to take samples and to gather any information necessary for the performance of their duties for the purposes of this Directive.

成员国必须针对有关设备造成的各种相关环境影响进行检查，建立环境检查制度。经营者应符合本指令的目的，向主管部门提供一切必要的配合，使其能够进行实地视察、采样并收集履行职责所必需的信息。

**All installations should be covered by an environmental inspection plan at national, regional or local level.** Each environmental inspection plan shall include the following:

所有设备应全部纳入国家、区域或地方层面的环境检查计划。每一项环境检查计划应包括以下内容：

- a general assessment of relevant significant environmental issues;  
对相关重大环境问题的综合评价；
- the geographical area covered by the inspection plan;  
检查计划所涉及的地理区域；
- a register of the installations covered by the plan;  
计划所涉及设备的登记簿；
- procedures for drawing up programmes for routine environmental inspections;  
例行环境检查计划的起草程序；
- procedures for non-routine environmental inspections;  
非例行环境检查的程序；
- where necessary, provisions on the cooperation between different inspection authorities.  
根据需要确定不同检查机构之间合作的规定。

The period between two site visits shall be based on a systematic appraisal of the environmental risks of the installations concerned, **and shall not exceed 1 year for installations posing the highest risks and 3 years for installations posing the lowest risks.** If an inspection has identified an important case of non-compliance with the permit conditions, an additional site visit shall be carried out within 6 months of that inspection.

两次实地视察之间的间隔时间应根据对有关设备的环境风险的系统性评估来确定，造成最高风险的设备不超过 1 年，造成最低风险的设备不超过 3 年。如果某一次检查发现不符合许可证条件的重大情况，要在那次检查 6 个月内再进行一次实地复查。

The systematic appraisal of the environmental risks shall be based on at least the following criteria:

环境风险的系统性评估应至少基于以下标准：

- the potential and actual impacts of the installations concerned on human health and the environment taking into account the levels and types of emissions, the sensitivity of the local environment and the **risk of accidents**;  
有关设备考虑了排放水平和类型对人体健康和环境的潜在与实际影响、考虑了当地环境的敏感性和**事故风险**；
- the record of compliance with permit conditions; 许可证条件符合性记录；
- the participation of the operator in the EU's eco-management and audit scheme (EMAS<sup>2</sup>).  
经营者参加欧盟的生态管理和审核计划（EMAS）。

Non-routine environmental inspections shall be carried out to investigate serious environmental complaints, serious environmental accidents, incidents and occurrences of non-compliance as soon as possible and, where appropriate, before the granting, reconsideration or update of a permit.

应及时，合适的话应在许可证颁发、复议或更新之前，进行非例行环境检查，以调查重大的环境投诉、严重的环境事故和有没有违规情况。

Following each site visit, the control authority shall prepare a report describing the relevant findings regarding compliance of the installation with the permit conditions and conclusions on whether any further action is necessary. The report shall be notified to the operator concerned within 2 months after the site visit taking place, and made publicly available by the control authority within 4 months after the site visit. The control authority shall ensure that the operator takes all the necessary actions identified in the report within a reasonable period.

每次实地视察之后，主管部门应编制报告，描述设备许可证条件符合性方面的相关调查结果以及是否有必要采取进一步行动的结论。报告应在实地视察后 2 个月内向经营者通报。主管部门应确保经营者在合理期限内采取报告中所确定的一切必要行动。

Member States should lay down rules on penalties applicable to operators in the case of non-compliance with the permit requirements. **The penalties should be effective,**

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<sup>2</sup> The EU Eco-Management and Audit Scheme (EMAS) is a management instrument developed by the European Commission for companies and other organisations to evaluate, report, and improve their environmental performance.

欧盟生态管理与审核计划（EMAS）是欧盟委员会为企业和其他组织制定的一个管理文件，用来评价、报告和改进其环境绩效。

**proportionate and dissuasive.** In the event of a breach of the permit conditions, the operator should immediately inform the control authority and immediately take the measures necessary to ensure that compliance is restored within the shortest possible time. The control authority should require that the operator take any appropriate complementary measures that the control authority considers necessary to restore compliance.

针对经营者有不符合许可证要求的情况，成员国应制定适用于经营者的处罚的规则。**处罚应当是有效的、相称的和劝诫性的。**如果违反许可证条件，经营者应立即通知主管部门，并立即采取必要的措施确保在最短时间内恢复满足许可证条件。主管部门应要求经营者采取主管部门认为恢复满足许可证条件所必需的任何恰当的补充措施。

If the breach of the permit conditions poses an immediate danger to human health or threatens to cause an immediate significant adverse effect upon the environment until compliance is restored, the operation of the installation shall be suspended.

如果违反许可证条件的情况对人类健康造成直接危险，或者可能会对环境造成直接的重大不利影响，应暂停设备运转。

### **Incidents and accidents should be prevented and damages limited**

#### **防止意外事故，限制危害**

In the event of any incident or accident significantly affecting the environment, the competent authority shall take the necessary measures to ensure that:

若发生严重影响环境的事故，主管部门应采取必要措施，以确保：

- the operator informs the authorities immediately;经营者立即通知有关主管部门；
- the operator immediately takes the measures to limit the environmental consequences and to prevent further possible incidents or accidents;经营者立即采取措施，以限制环境后果，并防止进一步的可能事故；
- requires the operator to take any appropriate complementary measures that the competent authority considers necessary to limit the environmental consequences and to prevent further possible incidents or accidents.要求经营者采取主管部门认为限制环境后果和防止进一步可能事故所必需的补充措施。

### **Reconsideration and updating of permit conditions should be done regularly**

#### **定期进行许可证条件的复议和更新**

The national authorities should periodically reconsider all permit conditions and, where necessary to ensure compliance with the IED, update those conditions. At the request of the competent authority **the operator shall submit all the information necessary for the purpose of reconsidering the permit conditions, including results of emission monitoring and other data**, that enables a comparison of the operation of the installation with the BAT described in the applicable BAT conclusions and with the emission levels associated with the best available techniques. When reconsidering permit conditions, the authorities shall use any information resulting from monitoring or inspections.

国家有关部门应定期复查各项许可证条件，并在需要确保符合 IED 时，更新许可证条件。应主管部门的要求，经营者应提交许可证条件复议所必需的全部资料，包括排放监测结果和其他资料，使设备运行可以和适用 BAT 结论中所描述的 BAT 进行比较，并且和与最佳可行技术相关的排放水平进行比较。在复议许可证条件时，有关部门应利用监测或检查所产生的任何资料。

Operators should notify the competent authority of any planned change to an installation which might affect the environment. Substantial changes to installations which may have significant negative effects on human health or the environment should not be made without a permit granted in accordance with this Directive.

设备的计划改造可能会影响环境的，经营者应将改造情况通知主管部门。设备的重大改造可能对人体健康或环境有重大负面影响的，未取得本指令颁发的许可证不可进行。

In order to take account of developments in best available techniques or other changes to an installation, **permit conditions should be reconsidered regularly and, where necessary, updated, in particular where new or updated BAT conclusions are adopted.** Within 4 years of publication of decisions on BAT conclusions relating to the main activity of an installation, the authorities shall ensure that all the permit conditions for the installation concerned are reconsidered and, if necessary, updated to ensure compliance. The reconsideration shall take into account all the new or updated BAT conclusions applicable to the installation since the permit was granted or last reconsidered.

为了充分考虑最佳可行技术的发展动态或者对设备的其他改造，应定期复议、必要时更新许可证条件，特别是在通过了新的或更新后的 BAT 结论时。在公布与某设备主要活动有关的 BAT 结论的决定 4 年内，有关部门应确保对该设备的全部许可条件进行复查、必要时进行更新，以确保许可证条件得到遵守。复议应考虑自许可证颁发或上次复议以来适用于该设备的全部新的或更新后的 BAT 结论。

The permit conditions shall be reconsidered and, where necessary, updated at least in the following cases:

以下情况应对许可证条件进行复查，必要时进行更新：

- when the pollution caused by the installation is of such significance that the existing emission limit values of the permit need to be revised or new such values need to be included in the permit;  
设备引起的污染非常严重，以致于许可证的现有排放限值需要修改，或者新的排放限值需要列入许可证时；
- when the operational safety requires other techniques to be used;  
操作安全性需要采用其他技术时；
- where it is necessary to comply with a new or revised environmental quality standard. 必须遵守新的或修订后的环境质量标准时。

### 2.1.5 Results

#### Facilities are required to report their emissions to E-PRTR

##### 企业要向 E-PRTR 报告排放情况

The European Pollutant Release and Transfer Register (E-PRTR)<sup>3</sup> is the Europe-wide register that provides easily accessible key environmental data from industrial facilities in EU Member States and in Iceland, Liechtenstein, Norway, Serbia and Switzerland. The register contributes to transparency and public participation in environmental decision-making.

《欧洲污染物排放与转移登记》（E-PRTR）要求在欧洲范围内进行登记，便于人们获取欧盟成员国以及冰岛、列支敦士登、挪威、塞尔维亚和瑞士工业企业的关键环境数据。登记有利于透明度和公众参与环境决策。

**The register contains data reported annually by more than 30,000 industrial facilities covering 65 economic activities across Europe within the following 9 industrial sectors:**

登记内容包括每年 3 万多家工业企业报告的数据，涉及全欧洲以下 9 个工业门类内的 65 类经济活动：

- energy 能源
- production and processing of metals 金属生产和加工
- mineral industry 矿产业
- chemical industry 化工
- waste and waste water management 废弃物与废水管理
- paper and wood production and processing 纸和纸浆生产与加工
- intensive livestock production and aquaculture 集约畜牧业和水产业
- animal and vegetable products from the food and beverage sector, and 食品和饮料业的动物和蔬菜产品，以及
- other activities. 其他活动。

For each facility, information is provided concerning the amounts of pollutant releases to air, water and land as well as off-site transfers of waste and of pollutants in waste water from a list of **91 key pollutants**<sup>4</sup> falling under the following 7 groups:

每个企业要提供向空气、水和土地排放污染物的排放量信息，以及废物在厂区外转移和废水中污染物的厂区外转移信息，这些污染物属于以下 7 个组别的 **91 项关键污染物清单**所列项目：

- Greenhouse gases 温室气体
- Other gases 其他气体

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<sup>3</sup> <http://prtr.ec.europa.eu/>

<sup>4</sup> For a list of the pollutants, see <http://prtr.ec.europa.eu/> 污染物清单见 <http://prtr.ec.europa.eu/>

- Heavy metals 重金属
- Pesticides 杀虫剂
- Chlorinated organic substances 有机氯化物
- Other organic substances 其他有机物质
- Inorganic substances.无机物质。

Data are provided from the year 2007. Some information on releases from diffuse sources is also available and will be gradually enhanced. The reported releases include any introduction of any of the listed pollutants into the environment as a result of any human activity, whether deliberate, accidental, routine or non-routine, at the site of the facility.

提供 2007 年及以后的数据。一些关于分散污染源的排放信息也可供使用，并且会逐渐得到强化。所报告的排放包括清单上所列的任何污染物因企业场址上蓄意、意外、例行或非例行的人类活动而传入环境的情况。

**Data are reported by each facility** to the relevant national authorities **on an annual basis**. The competent authorities in the countries compile and check the quality of the reported data. The data are then provided to the European Commission and the European Environment Agency for compilation and dissemination on this E-PRTR website<sup>5</sup>.

企业每年向各成员国有关部门上报数据。各成员国主管部门汇编所报数据，并检查数据质量。然后，数据被提供给欧盟委员会和欧洲环境署进行汇编，并公布在本 E-PRTR 网站上。

### 2.1.6 Lessons and suggestions for China 对中国的启示和建议

The requirements regarding emission levels and other conditions in the emission permits specified in the IED are based on the experiences in the EU countries since the 1970s on how to regulate pollution from industry sources. There has been some “trial and error” over the years on how to do this in a most cost effective way. Thus, the requirements in the IED Directive should in many ways represent current “best practice” in the EU on how to grant emission permit, what they should contain and how the regulations should be monitored and enforced. It should therefore be a lot to learn from the IED for Chinese environmental authorities.

《工业排放指令》中规定的排放许可证中有关排放水平的要求和其他条件以欧洲国家 20 世纪 70 年代以来如何监管工业所致污染方面的经验为基础。多年来在如何以最大的成本效益进行监管方面有一些“经验和教训”。因此，《工业排放指令》中的要求在很多方面代表着欧盟当前在如何发放排放许可证、许可证应包括哪些内容以及如何监控和执行法规方面的“最佳实践”。所以《工业排放指令》有很多值得中国环保部门学习的东西。

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<sup>5</sup> <http://prtr.ec.europa.eu/>

An approach for China could be to start out with the BREFs for the various industries when deciding what level of emission reductions to impose on industries. The Best Available Techniques specified in the BREFs could eventually be adjusted to local Chinese conditions, taking into account issues like what technologies could be available and most suitable, what it would cost to replace existing technologies with BAT applying some cost benefit considerations etc. In this respect it should also be considered if some simpler, perhaps cheaper “en-of pipe” solutions (i.e. installing cleaning devises) could be more cost effective and yield environmental improvements quicker instead of changing (larger parts of) the production processes.

中国可采用的方法是，在确定对企业设定减排水平时，可以从各种行业的 BREF 文件着手。BREF 文件中规定的最佳可行技术最终可按中国国情进行调整，将以下问题考虑在内：有哪些可用的最合适的技术，从成本效益角度考虑用 BAT 取代现有技术需要多少费用等。在这方面还应考虑的问题是：是否有更简单、或许更廉价的“末端”解决方案（即安装清洁装置）比改变（大部分）生产流程更具经济效益，并且能更快地带来环境改善效益。

Other conditions regarding the permitting granting process, monitoring and enforcement etc. should be considered carefully and eventually adjusted to local Chinese conditions and legal traditions.

其他关于许可程序、监测和执行等的条件应予以仔细考虑，并最终结合中国国情和法律传统进行调整。

Also, regional risks should be considered when setting the individual permits, since this could be far more important in China than in the EU since there are many areas/regions in China with several different pollution sources which contribute to the regional risk.

另外，在设置个别许可证时，还要考虑区域风险，因为相比欧盟而言，中国的很多地区或区域有多种不同的污染源，易造成区域风险，所以中国更需要考虑这一情况。

## 2.2 Discharges to water:EU's Water Framework Directive 污染物向水中排放：欧盟水框架指令

In this section we present the EU Water Framework Directive as examples on how to approach releases to water.

本节我们以《欧盟水框架指令》为例，说明如何处理污染物向水中排放的问题。

### 2.2.1 Introduction 引言

The EU Water Framework Directive (WFD) came into force in 2000 and is a directive providing the legal framework for all water management in the EU. The WFD contributes to reduce regional environmental risk related to water by monitoring and imposing environmental standards and integrated management at river basin level. It commits EU member states to achieve good qualitative and quantitative status of all water bodies (including marine waters up to one nautical mile from shore) by 2015. The goal of the directive is to prevent further deterioration of aquatic ecology, as well as terrestrial ecosystems and wetlands that depend on aquatic ecology, to improve their status as close to natural conditions as possible, and to promote sustainable water use based on a long-term protection of available water resources. It is a framework in the sense that it prescribes steps to reach the common goal rather than adopting the more traditional limit value approach.

《欧盟水框架指令》（WFD）于 2000 年生效，是一个为欧盟全部水管理提供法律框架的指令。《欧盟水框架指令》通过实施流域环境标准和综合管理及监督这些标准和管理措施的执行情况，有利于减少与水相关的区域环境风险。它规定欧盟成员国要使全部水体（包括离海岸一海里以内的海域）达到良好的质量和数量状态。指令的目的是防止水生生态以及依赖水生生态的陆地生态系统和湿地的进一步恶化，将其状态改善到尽可能接近自然状况，并在长期保护可用水资源的基础之上促进可持续用水。它是一个框架，其意义在于规定达到共同目标的步骤，而非采用更为传统的限值方法。

Sustainable and economically optimal water use is a great challenge in Europe, following more than a century of over-use and exploitation. Europeans have for centuries altered European surface waters (straightening and canalization, disconnection of flood plains, land reclamations, dams, weirs, bank reinforcements, etc.) to facilitate agriculture, industrial development and urbanization, to produce energy and protect against flooding. The activities have resulted in damage to the morphology and hydrology of the water bodies. Such activities have resulted in altered habitats and have severe and significant impacts on the status of aquatic ecosystems. There are several hundred thousand barriers and transverse structures in European rivers. In many river basins, the continuity of the rivers is interrupted every second kilometer. Many watercourses have their seasonal or daily flow regimes changed for various purposes, including damming for hydropower production and storage of irrigation water. Transitional and coastal habitats have also been altered in many ways; by dredging, land reclamation and hard infrastructure for coastal protection and erosion management. A recent poll among citizens of the EU-25 showed that nearly half of the respondents are worried about “water pollution” (47%), with figures for individual countries going up as far as 71% (EC, 2014a).



经过一百多年的过度使用和开发之后，实现水的可持续、经济上最优的使用已成为欧洲的一项巨大挑战。几百年来，欧洲人对欧洲地表水体进行改造（调直和开掘运河、截断洪泛区、土地开垦、水坝、溢流堰、河岸加固等），以便促进工农业发展、加快城镇化进程和促进发电并防范洪水泛滥。以上活动对水体的形态和水文造成了损害。这些活动导致栖息地改变，对水生生态系统的状况产生了重大而严重影响。欧洲河流里有几十万个栅栏和横截构筑物。在许多流域，河流的连续性每隔两公里就被打断。很多河道的季节流态和每日流态出于各种目的被改变，如：为水力发电筑坝和贮存灌溉用水等。过渡性栖息地和海岸栖息地也遭到了很多方式的改变。如：疏浚、土地开垦和用于海岸保护及侵蚀管理的硬基础设施建设。最近对欧盟 25 国市民进行的一项民意调查显示，近半数受访者对“水污染”表示担忧（47%），个别国家的这一比例高达 71%（EC, 2014a）。

Water is in Europe still a limited resource at severe risk of over-exploitation and pollution (EC, 2010):

在欧洲，水仍是一种有限的资源，面临过度开发和污染的严重风险（EC, 2010）：

- 75% of groundwater and 70% of surface water in Europe is considered to be at serious risk from pollution and other challenges.  
欧洲 75% 的地下水和 70% 的地表水被认为面临污染和其他挑战的严重风险。
- 60% of European cities over-exploit their groundwater resources.  
60% 的欧洲城市过度开发其地下水资源。
- 50% of wetlands are endangered due to over-exploitation of groundwater.  
50% 的湿地因地下水的过度开发而濒临消失。

Unsustainable use of water leads to many risks. Water is a crucial resource: As drinking water; for hygienic and sanitation purposes; as a core element in natural ecosystems and climate regulation; to generate and sustain economic growth and prosperity through activities such as farming, commercial fishing, energy production, manufacturing, transport and tourism; and for recreational activities such as bathing, fishing or just for enjoying the beauty of coasts, rivers and lakes. Water pollution and water scarcity thus pose threats to human health and quality of life, to ecosystems that uphold biological diversity and provide natural regulating and other services of importance to man, and to the ability of society to generate and sustain economic growth and prosperity.

不可持续的用水会带来很多风险。水是一种至关重要的资源，主要体现在用作饮用水；用于清洁和卫生；是自然生态系统和气候调节中的核心要素；可以通过耕作、商业捕鱼、发电、制造、运输和旅游等活动实现和维持经济增长和繁荣；用于游憩活动，比如海水浴、捕鱼或仅仅是享受美丽的海岸、江河与湖泊风光。因而，水污染和水短缺会威胁人类健康和生活质量、支撑生物多样性并提供自然调节服务和其他对人类重要的服务的生态系统，以及社会实现和维持经济增长和繁荣的能力。

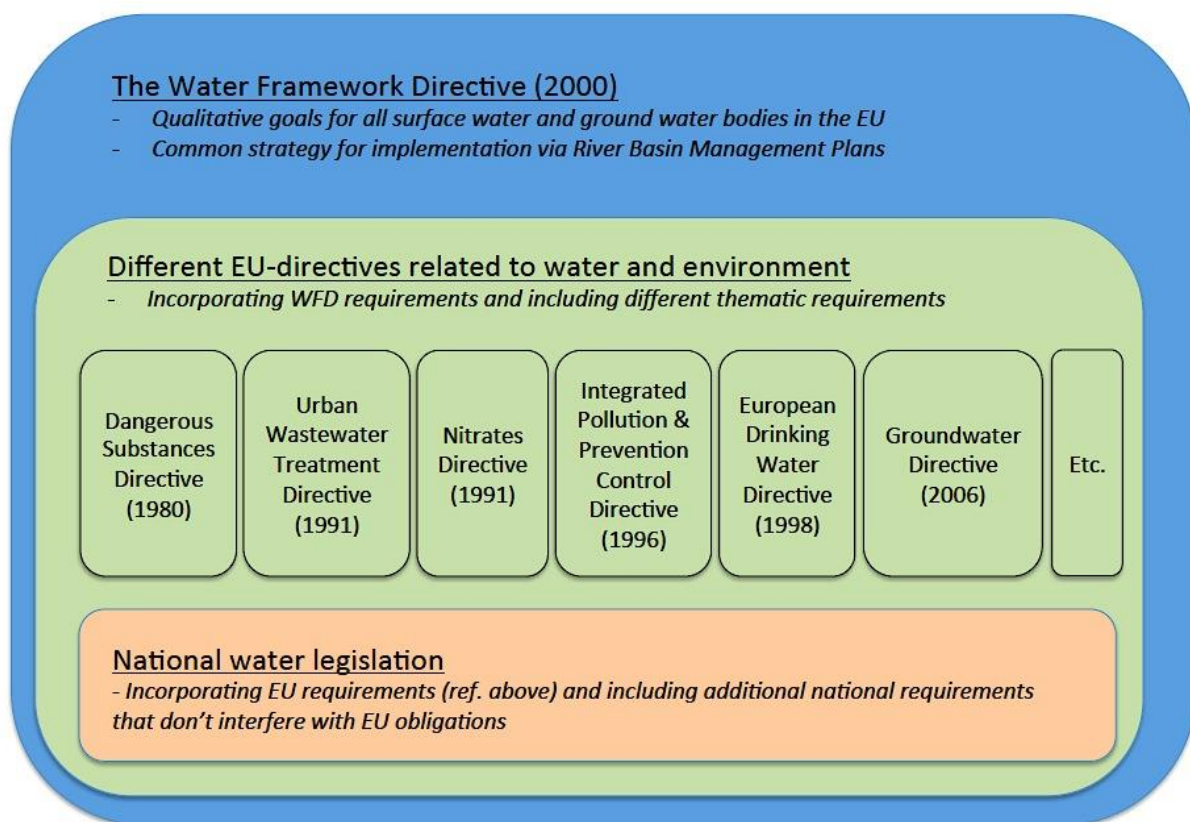
In Europe, many European countries have had water policies in place for decades and also at the EU level Member countries have agreed on common water policies in certain areas (such as standards for drinking water) from the 1980s and onwards. During the last 25 years, significant progress has been made in numerous European waters in reducing pollution. This progress includes improved wastewater treatment (reducing point charges of nutrients and organic pollution to freshwater bodies) leading to

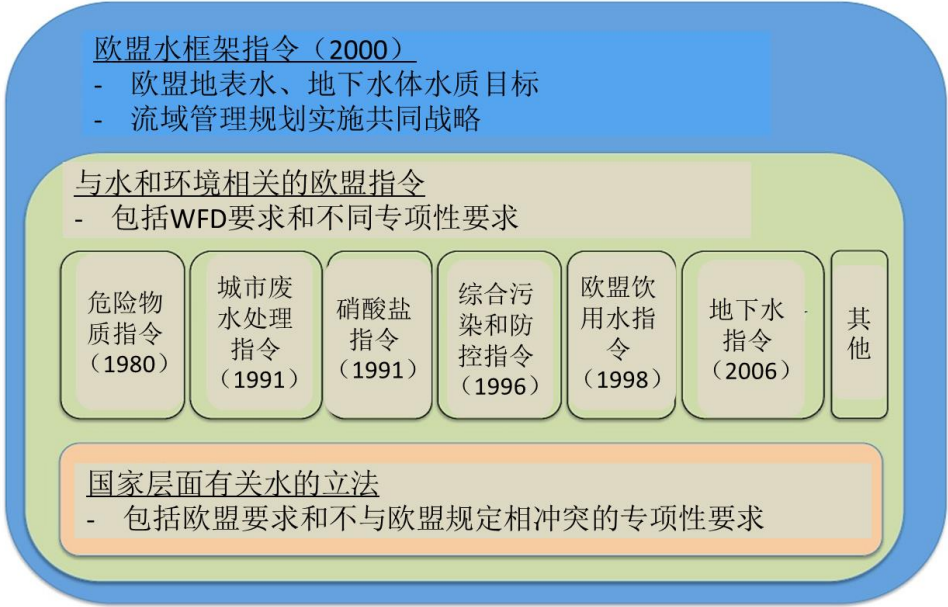
significant improvements in water quality, reduced volumes of industrial effluents, reduced use of fertilizers, reduced or banned phosphate content in detergents, as well as reduced atmospheric emissions.

在欧洲，很多国家几十年来制定了有关水的政策。而在欧盟层面，成员国从 20 世纪 80 年代开始就某些领域有关水的共同政策达成了一致（如饮用水标准）。最近 25 年，众多欧洲水体在减少污染方面取得了巨大进步。这种进步包括：废水处理水平的提高（减少营养物和有机污染向淡水水体的点源排放）使得水质大幅提高、工业废水减少、化肥使用减少、洗涤剂中磷含量减少或受禁，以及大气污染物排放减少。

**Figure 2.1 The hierarchy of water legislation in the EU**

**图 2.1 欧盟水立法的层次结构**





Source: Vista Analysis 来源： Vista Analysis

The challenge to ensure a sustainable use and management of water resources in Europe has still not been fully solved. Moreover, ensuring sustainable water management is often complicated by the fact that water basins often extend over different regional or national borders, thereby making a coordinated policy response difficult as it involves many different parties. In 1995 it was widely recognized by politicians in the EU that there was a need for higher standards for water management, as a consequence of the over-exploitation and pollution threats and in line with increasing awareness and demand from citizens. Unsustainable water use and management posed a risk to human society and nature, and the then current water policies in the EU countries and in the EU were too weak and too fragmented (see the green box in figure 2.1 above). In order to reduce the multiple risks arising from unsustainable use of water, the next step was to ensure higher and common standards for water management across the EU that could be implemented in a common manner while adapting to local circumstances. The instrument to do this was to be the Water Framework Directive (WFD).

欧洲确保水资源的可持续利用和管理的问题尚未完全解决。而且，确保可持续的水管理常常因以下事实而变得复杂：河流常常穿过不同的区域边界或国家边界，流域管理涉及很多不同当事方，很难做出协调的政策响应。由于过度开发和污染造成的威胁以及公民意识和需求的日益提高，1995 年开始欧盟国家普遍认为有必要提高水管理标准。不可持续的水利用和管理对人类社会和自然造成了威胁，而且欧盟国家当时执行的水政策太薄弱、太分散（见上面图 2.1 中的绿色文本框）。为了降低不可持续用水引起的多重风险，接下来要做的就是确保欧盟提高共同的水管理标准，因地制宜地共同实施。做到这一点要使用的工具就是《水框架指令》（WFD）。

**Box 2.1 The purpose of the Water Framework Directive, according to Article 1**

框 2.1 《水框架指令》的目的，根据第 1 条

Article 1 第1条

Purpose 目的

*The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which:*

本指令的目的是建立一个保护内陆地表水、过渡水体、海岸水体和地下水的框架，它可以：

*(a) prevents further deterioration and protects and enhances the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;*

保护并改善水生生态系统、及直接依赖水生生态系统的陆地生态系统和湿地，防止其进一步恶化；

*(b) promotes sustainable water use based on a long-term protection of available water resources;*

在长期保护可用水资源的基础之上，促进水的可持续利用；

*(c) aims at enhanced protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances and the cessation or phasing-out of discharges, emissions and losses of the priority hazardous substances;*

旨在加强保护并改善水生环境，具体措施是逐渐减少重点控制物质的排放和流失以及停止或逐步消除重点控制危险物质的排放和流失等。

*(d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution, and*

确保地下水污染逐渐减少，并防止进一步污染，并且

*(e) contributes to mitigating the effects of floods and droughts*

有利于缓解旱涝灾害的影响

*and thereby contributes to:* 进而有利于：

*- the provision of the sufficient supply of good quality surface water and groundwater as needed for sustainable, balanced and equitable water use,*

提供充足的优质地表水和地下水，确保水资源的可持续、均衡和平等利用， - a significant reduction in pollution of groundwater, 显著减少地下水污染；

*- the protection of territorial and marine waters, and* 保护领海和海域，并且

*- achieving the objectives of relevant international agreements, including those which aim to prevent and eliminate pollution of the marine environment, by Community action under Article 16(3) to cease or phase out discharges, emissions and losses of priority hazardous substances, with the ultimate aim of achieving concentrations in the marine environment near background values for naturally occurring substances and close to zero for man-made synthetic substances.*

实现相关国际协议的目标，包括为了停止或逐步消除重点控制危险物质的排放和流失，而由欧共体根据第16（3）条开展的旨在防止并消除海洋环境污染的那些协议，

最终目的是实现海洋环境中天然物质的浓度接近背景值，人工合成物质的浓度接近零。

There is a large literature about how to implement the WFD, which is publicly available but may not always be easy to find.<sup>6</sup> The most important are the 29 Guidance Documents published by different expert work groups in order to ensure common, consistent and high quality implementation of the different aspects of the directive. Together with the WFD itself, the guidance documents constitute the foundation for the Common Implementation Strategy for the directive. The common strategy (WD, 2001)<sup>7</sup> pulls the responsible water management institutions across the EU together in a joint process, which contributes to mainstreaming of efforts and coordination between the countries. The 29 guidance documents covers all kind of issues in detail; Organizational and management issues, how to set ecological targets for different types of water bodies, technical guidance on methodologies to be applied for environmental monitoring, economic assessments, river basin planning etc., as well as guidelines on public participation.

有大量关于如何实施 WFD 的文献可公开获取，但不一定容易找到。最重要的是由不同专家工作组为了确保指令的不同内容得到一致和高质量的共同实施而发表的 29 套指导文件。指导文件与 WFD 本身一起构成该指令共同实施战略的基础。共同战略（WD, 2001）使得整个欧盟范围内的水管理负责机构通力配合，这有利于各项工作的整合以及各国之间的协调。这 29 套指导文件详细探讨了各种各样的问题：组织和管理问题，如何设定不同类型水体的生态目标，关于环境监测、经济评估、流域规划等要采用的方法的技术指导，以及关于公众参与的导则。

We have in the following chosen to go into some detail with regards to issues we believe may be of particular interest in a Chinese context:

下面我们选择了我们认为在中国背景下特别受关注的问题进行深入探讨：

- The fundamental principles of the directive 指令的基本原则
- The approaches of the directive 指令的方法
  - *Types and standards of the environmental goals* 环境目标的类型和标准
  - *River basin management and cyclical implementation* 流域管理和周期性实施
  - *Public participation* 公众参与
- The tools of the directive 指令的工具
  - *How to set targets for different types of water bodies (inter-calibration)*

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<sup>6</sup> To access more information about WFD, a good starting point is 获取更多关于 WFD 的信息可访问 <http://ec.europa.eu/environment/water/water-framework/>, The 29 WFD guidance documents are listed at 获取 29 套 WFD 指导文件可访问 [http://ec.europa.eu/environment/water/water-framework/facts\\_figures/guidance\\_docs\\_en.htm](http://ec.europa.eu/environment/water/water-framework/facts_figures/guidance_docs_en.htm)

<sup>7</sup> The Common Implementation Strategy for the Water Framework Directive (2001), is available here: 获取更多关于《水框架指令共同实施战略（2001）》的信息可访问：  
<http://ec.europa.eu/environment/water/water-framework/objectives/pdf/strategy.pdf>

如何设定不同类型水体的目标（相互校准）

- *Monitoring requirements* 监测要求
- *Co-ordination of measures in a river basin management plan*  
一项流域管理规划中各种措施的协调

We will describe more specifically how the WFD has been used to reduce various forms of environmental risk within a framework of regional environmental risk assessment and management in a specific river basin (the Rhine) in chapter 3.

在第 3 章我们会更加具体地描述如何用 WFD 来降低一个区域环境风险评估和管理框架下某特定流域（莱茵河）各种形式的环境风险。

### **Box 2.2: Integrated River Basin Management and Regional Risk Assessment and management**

#### **Integrated River Basin Management – a form of Regional Risk Assessment and Management**

Integrated river basin management is a form of regional environmental risk assessment and management, as it involves monitoring of environmental status and risks, application of common environmental standards, and deals with a spatial scale (river basin and sub-river basins) that includes multiple habitats with multiple sources of stressors that affect multiple endpoints.

#### **综合流域管理—区域风险评估和管理的一种形式**

综合流域管理是区域环境风险评估和管理的一种形式，包括监测环境状况和风险、使用通用的环境标准，它对包含多种栖息地的空间规模（流域和分流域）进行风险评估，在这些栖息地中压力源影响多个端点。

### **框 2.2：综合流域管理和区域风险评估和管理**

#### **2.2.2 Principles [指令原则]**

The text in the WFD (EC, 2000) begins with a preamble, stating a number of principles and other considerations that serve as a foundation for the directive. Fundamental principles are:

WFD（EC，2000）的文本开头是一篇序文，叙述了很多作为该指令基础的原则和其他注意事项。基本原则有：

- Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such.  
水和其他东西不一样，不是一种商品，而是一种遗产，必须像保护、捍卫和对待遗产一样保护、捍卫和对待它。



- The WFD and EU environmental policy is based on the precautionary principle and on the principles that preventive action should be taken, environmental damage should, as a priority, be rectified at source and that the polluter should pay.

WFD 和欧盟环境政策以风险预防原则和以下原则为基础：采取预防措施，优先从源头上治理环境损害，以及污染者付费。

- When developing environmental policy, the EU is to take account of available scientific and technical data, environmental conditions in the various regions, and the economic and social development of the EU as a whole and the balanced development of its regions as well as the potential benefits and costs of action or lack of action.

在制定环境政策时，欧盟要考虑可用的科学技术数据、各地区的环境状况、欧盟整体的社会经济发展、欧盟各地区的均衡发展以及行动或缺乏行动的潜在效益和成本。

- There are diverse conditions and needs in the EU which require different specific solutions. This diversity should be taken into account in the planning and execution of measures to ensure protection and sustainable use of water in the framework of the river basin. With reference to the principle of subsidiarity, decisions should be taken as close as possible to the locations where water is affected or used and priority should be given to action at regional and local levels in accordance with regional and local conditions.

欧盟有各种不同的情况 and 需求，需要不同的具体解决对策。在制定和执行措施时应考虑差异性，以确保流域范围内的水得到保护和可持续的利用。关于辅助性原则，应尽可能按照水资源受影响之地或用水之地的情况做出决定，并且优先考虑根据区域和地方情况采取区域和地方层面的行动。

- Water policy at the EU level requires a transparent, effective and coherent legislative framework, with overall common principles and an overall framework for action. The WFD shall provide such a framework and further develop overall principles and structures for protection and sustainable use of water in the EU, leaving specific decisions and measures to the national and local levels to the extent possible.

欧盟层面的水政策需要一个透明、有效和统一的立法框架，使行动有总体共同原则和一个总体框架。WFD 应提供这样一个框架，并进一步为欧盟的水资源保护和可持续利用制定总体原则和结构，尽可能把具体决策和措施留给国家和地方层面来制定。

- Further integration of protection and sustainable management of water into other EU policy areas such as energy, transport, agriculture, fisheries, regional policy and tourism is necessary. This Directive shall provide a basis for a continued dialogue and for the development of strategies towards a further integration of policy areas.

必须进一步把水资源保护和可持续管理融入到欧盟其他政策领域，比如能源、运输、农业、渔业、区域政策和旅游业。本指令应为持续对话和制定战略，实现政策方面的进一步整合提供依据。

- The principle of recovery of the costs of water services, including environmental and resource costs associated with damage or negative impact on the aquatic environment should be taken into account in accordance with, in particular, the polluter-pays principle. For this purpose, an economic

analysis of water services based on long-term forecasts of supply and demand for water in the river basin district is necessary.

特别根据污染者付费原则，应考虑供水服务成本的收回，包括与水生环境受到的损害或负面影响有关的环境成本和资源成本。为此，必须根据对流域地区水资源供需情况的长期预测对供水服务进行经济分析。

- The success of this Directive relies on close cooperation and coherent action at EU, Member State and local level as well as on information, consultation and involvement of the public, including users.

本指令的成功有赖于欧盟、成员国和地方层面的紧密合作与统一行动，也有赖于信息、协商和包括用户在内的公众参与。

- Full implementation and enforcement of environmental legislation for the protection of waters should be ensured. It is necessary to ensure the proper application of such legislation throughout the EU by appropriate penalties provided for in Member States' legislation. Such penalties should be effective, proportionate and dissuasive.

应确保充分实施和执行适用于水体保护的环境立法。必须通过成员国立法中规定的适当处罚措施确保该等立法在整个欧盟范围内妥善实施。处罚措施应当是有效的、相称的和劝诫性的。

### 2.2.3 Approaches

#### The environmental goals: Types and standards 环境目标：类型和标准

The WFD sets forth **qualitative goals** for water bodies and the Member States are required to carry out the necessary measures to reach these qualitative goals.<sup>8</sup> A water body is a water area within a river basin with common and distinct characteristics. Each river basin will have many water bodies. There are different types of water bodies (surface water bodies and groundwater bodies) and the directive therefore operates with **different qualitative goals that apply for the different types of water bodies**.

WFD 设定了水体质量目标，成员国必须执行必要的措施来达到这些质量目标。水体就是一个河流流域内具有共同和鲜明特征的一块水域。每个河流流域都会有很多水体。水体有不同的类型（地表水水体和地下水水体），因此本指令按照适用于不同类型水体的不同质量目标来设施。

WFD provides a general requirement for ecological protection and a general minimum chemical standard for all **surface waters** in the EU. These requirements are referred to

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<sup>8</sup> This approach differs from the more common environmental policy approach of setting requirements for reduction of certain pollutants or pressures (which are used in different thematic EU water directives, ref. figure x above). By focusing on the actual status in surface and ground waters, the WFD ensures that necessary measures are taken in addition to those triggered by the requirements of the different thematic directives such as the Urban Wastewater Management Directive and the Nitrates Directive.这种方法不同于较常见的设定某些污染物或压力减少要求的环境政策方法（用于不同主题的欧盟水指令，参阅上面图x）。WFD 注重地表水域和地下水域中的实际状况，确保除了按照《城市废水管理指令》和《硝酸盐指令》等不同主题指令的要求采取的措施外，还采取其他必要的措施。



as "Good Ecological Status" and, for so-called *modified water bodies*, "Maximum Ecological Potential".<sup>9</sup> **Good Ecological Status** is reached for a water body when there is only a slight departure from the biological community that would be expected in conditions of minimal anthropogenic impact. Good Ecological Status is defined in terms of the quality of the biological community, the hydrological characteristics and the chemical characteristics. Due to ecological variability, absolute standards for biological quality cannot be set which apply across the EU. Therefore **the goal is specified as allowing only a slight departure from the natural condition**. A set of procedures for identifying that condition for a given body of water is provided in the guidance documents, together with a system for ensuring that each Member State interprets the procedure in the same way (see more on this in chapter 2.2.1.4 below). The system is somewhat complicated, due to the extent of ecological variability and the large number of parameters that are dealt with. Good Ecological Status also requires **Good Chemical Status**, which is reached for a water body when it complies with the environmental quality standards for the 33 Priority Substances and 8 Other Pollutants, as defined in the directive and the daughter directive for Environmental Quality Standards (Directive 2008/105/EC).<sup>10</sup> The list includes substances such as cadmium, lead, mercury, nickel and its compounds, benzene, poly-aromatic hydrocarbons and DDT. The WFD goal of good chemical status is backed up by other EU legislation such as the REACH regulation on chemicals (see chapter 2.3.2), the Directive for Integrated Pollution and Prevention Control (IPPC) for industrial installations and its recent successor the Industrial Emissions Directive.

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<sup>9</sup> Maximum Ecological Potential is sometimes referred to as "Good Ecological Potential". In the context of the WFD Maximum Ecological Potential and Good Ecological Potential this refer to the same ecological goal applying to heavily modified water bodies. 最大生态潜力有时又称为“良好生态潜力”。在 WFD 最大生态潜力和良好生态潜力背景下，指适用于被严重干扰水体的相同的生态目标。

<sup>10</sup> The Directive on environmental quality standards in the field of water policy, including the standards for 33 priority substances and 8 other pollutants, can be downloaded here: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0084:01:EN:HTML> Note that the EU Commission has proposed a new directive (COM (2011) 876) amending the current list of priority substances and other pollutants. The proposal includes a revised list of priority substances and provisions to improve the functioning of the legislation. The main features are: 15 additional priority substances (6 of them priority hazardous substances), stricter environmental quality standards for four existing priority substances, designation of two existing priority substances and priority hazardous substances, introduction of biota standards for several substances and provisions to improve the efficiency of monitoring. The proposal as well as background reports can be downloaded here: [http://ec.europa.eu/environment/water/water-dangersub/lib\\_pri\\_substances.htm#prop\\_2011\\_docs](http://ec.europa.eu/environment/water/water-dangersub/lib_pri_substances.htm#prop_2011_docs)

关于水政策领域环境质量标准的指令，包括 33 种重点控制物质和 8 种其他污染物的标准，可在以下网址下载：<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0084:01:EN:HTML>。注意，欧盟委员会提出了新的指令（COM(2011)876）修改目前的重点控制物质和其他污染物清单。提案包括修订后的重点控制物质清单和改进立法作用的规定。主要特点是：增加了 15 种重点控制物质（其中 6 种为重点控制危险物质），四项现有重点控制物质的环境质量标准更加严格，认定两项现有重点控制物质和重点控制危险物质，引入几种物质的生物群标准，规定提高检测效率。提案及背景报告在以下网址下载：[http://ec.europa.eu/environment/water/water-dangersub/lib\\_pri\\_substances.htm#prop\\_2011\\_docs](http://ec.europa.eu/environment/water/water-dangersub/lib_pri_substances.htm#prop_2011_docs)

WFD 规定了生态保护的一般要求，并规定了欧盟所有**地表水域**的一般最低化学标准。这些要求被称为“**良好生态状况**”，对于所谓的**被干扰水体**则称为“最大生态潜力”。当在最小人为影响的情况下仅会出现轻微背离生物群落的情况时，水体即达到了**良好生态状况**。“良好生态状况”用生物群落质量、水文特征和化学特征来定义。由于生态状况的差异性，导致无法制定适用于整个欧盟的生物质量绝对标准。因此，**目标被规定为仅允许轻微背离自然状况**。指导文件中提供了一套识别一个给定水体的良好生态状况的程序，同时还提供了一个用于确保每个成员国对这种程序的解释均相同的体系（具体见下文第 2.2.1.4 节）。由于生态差异性很大，需要处理的参数很多，因而该体系有点复杂。良好生态状况还需要**良好化学状况**。当一个水体达到水框架指令以及《环境质量标准》子指令（指令 2008/105/EC）中规定的 33 种重点控制物质和 8 种其他污染物的环境质量标准时，它就达到了良好化学状况。该清单包括镉、铅、汞、镍及其合成物、苯、多环芳烃和 DDT 等物质。WFD 的良好化学状况目标有其他欧盟立法作支持，比如关于化学品的 REACH 法规（见第 2.3.2 节）、用于工业生产设备的《综合污染预防与控制指令》（IPPC）以及最近出台的其改进版的《工业排放指令》。

There are **more specific requirements and goals for surface water in specific areas**, in addition to the general requirements of “Good Ecological Status” and “good chemical status”. Examples may be aquatic biodiversity that is protected under EU nature protection legislation (such as the Habitats Directive, see below), drinking water sources for which there are special requirements (in accordance with the European Drinking Water Directive), or requirements for bathing water quality in certain areas used for such purposes (regulated in detail in the Bathing Water Quality Directive). The maybe simplest way to incorporate such specific requirements is to designate specific protection zones within the river basin, in which such more specific objectives must be met. The overall plan of objectives for the river basin will then require ecological and chemical protection everywhere as a minimum, but where more stringent requirements are needed for particular uses, zones will be established and higher objectives set within them in order to address high local risk levels (accumulated and/or acute).

除了“良好生态状况”和“良好化学状况”一般要求之外，还有**特定领域更具体的地表水要求和目标**。这些领域包括受欧盟自然保护立法（比如《栖息地指令》，见下文）保护的水生生物多样性，有特别要求的饮用水水源（根据《欧洲饮用水指令》），或者某些地区用于洗浴的洗浴水质量要求（在《洗浴水质量指令》中详细规定）。整合该等特定要求的最简单方式或许是在河流流域内指定特定的保护区，在保护区内必须达到该等较具体的目标。于是，河流流域目标总体计划就要求每个地方都要以生态保护和化学保护作为最低要求，但如果特殊用途需要更严格的要求，就会建立保护区，并在保护区内设立较高的目标，以应对当地的高风险水平（累积性风险和/或突发性风险）。

In certain cases there are exceptions with regards to reaching the environmental requirements. Certain water uses may compromise the natural condition of a water body but be considered essential to uphold in spite of the negative ecological impact.

Typical examples being flood protection and essential drinking water supply.<sup>11</sup> In such cases, the water bodies in question may be exempt from the normal goal of Good Ecological Status. For such **heavily modified water bodies**, an alternative environmental goal referred to as **Maximum Ecological Potential** applies, referring to a state in which all the appropriate ecological mitigation measures have been taken.<sup>12</sup>

某些情况下，环境要求的满足也存在例外。某些用水可能会危害某个水体的自然状况，尽管有负面生态影响，但却被认为是必须维持的，典型例子有防洪和基本供水供应。这种情况下，该水体可免于达到正常的良好生态状况目标。对于该等**严重被干扰水体**，适用另一种被称为**最大生态潜力**的环境目标。最大生态潜力是指采取了一切适当的生态缓和措施之后所达到的状态。

The WFD thus recognizes two types of surface water bodies - normal water bodies and heavily modified water bodies -, which we have described above. In each case, **water bodies are classified in accordance with a 5-tier scale**:

因而，WFD 确认了两类地表水体——正常水体和严重被干扰水体，我们已在上文描述了这些水体。这两类水体分别按 5 级进行划分：

- **High status: Practically no deviation from the natural state**  
优等状况：几乎未背离自然状态
- **Good status: Slight deviation from the natural state**  
良好状况：轻微背离自然状态

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<sup>11</sup> Less clear-cut cases than flood protection and drinking water supply, are navigation and power generation where the activity is open to alternative approaches (transport can be switched to land, other means of power generation can be used). Derogations may be provided for those cases also, but subject to three tests: that the alternatives are technically impossible, that they are prohibitively expensive, or that they produce a worse overall environmental result.

与防洪和供水相比不太明确的情况有灌溉和发电，这种活动可以有备选方法（运输可以改到陆上，可采用其他发电手段）。对这些情况降低要求，但须经三项检验：备选方案在技术上是不可行的，花费太大，产生的总体环境结果较差。

<sup>12</sup> For more information about the classification of ecological status and ecological potential, see ECOSTAT (2003): *Overall Approach to the Classification of Ecological Status and Ecological Potential*. The reference condition when assessing Good Ecological Potential is here referred to as Maximum Ecological Potential, and defined as the state where "the values of the relevant biological quality elements reflect, as far as possible, those associated with the closest comparable surface water body type, given the physical conditions which result from the artificial or heavily modified characteristics of the water body." The document is available here: <https://www.uni-due.de/kobio/docs/Ecological%20Classification%20Guidance.pdf>

更多关于生态状况和生态潜力分等的信息见ECOSTAT（2003）：《生态状况和生态潜力分等总体方法》。评定良好生态潜力时的参考状况在此指的是最大生态潜力，定义为“考虑到水体的人造或严重被干扰特征引起的物理状况，相关生态质量要素的价值尽可能地反映与最靠近的可比地表水体类型有关的价值”是的状态。获取该文件的网址是：<https://www.uni-due.de/kobio/docs/Ecological%20Classification%20Guidance.pdf>

- Moderate status: Moderate deviation from the natural state  
中等状况：适度背离自然状态
- Poor status: Significant deviation from the natural state  
较差状况：显著背离自然状态
- Bad status: Major deviation from the natural state.  
很差状况：严重背离自然状态

The exact standards and thresholds between the different tiers, are set in the inter-calibration process *for each type of water body* (see more about this in chapter 2.2.1.4 below). In order to meet the WFD goals, a water body should have “high status” or “good status” (the criteria of which will differ for different types of water bodies). For all the water bodies with “moderate status” or below, EU Member States are obliged by the directive to ensure that the condition of these water bodies is improved so that the criteria for “good status” or “high status” is achieved.

每类水体的相互校准过程中设定了区分不同层级的确切标准和阈值（具体见下文第 2.2.1.4 节）。为了实现 WFD 目标，水体应达到“优等状况”或“良好状况”（其标准因不同类型的水体而各异）。对于“中等状况”或以下的所有水体，水框架指令要求欧盟成员国确保这些水体的状况得到改善，以便达到“良好状况”或“优等状况”标准。

The case of **groundwater** is somewhat different than for surface water, as the presumption in relation to groundwater should broadly be that it should not be polluted at all. Groundwater bodies are classified in two categories only: Natural or polluted. For the general protection of groundwater, EU takes a **precautionary approach**. This takes the form of a prohibition on direct discharges to groundwater. In addition, water authorities in the river basins are required to monitor groundwater bodies so as to detect changes in chemical composition (which may arise from indirect discharges), and to reverse any upward pollution trend that is caused by human activity. Taken together, these measures should ensure the protection of groundwater from all contamination, according to the principle of minimum anthropogenic impact. Quantity is also a major issue for groundwater. There is only a certain amount of recharge into a groundwater each year, and of this recharge, some is needed to support connected ecosystems. A sustainable use of groundwater thus entails that the **quantitative status** of the groundwater should be upheld by not abstracting more than the portion of the overall recharge not needed by the ecological systems. The WFD limits the abstraction of groundwater to this quantity.

地下水的情况与地表水略有不同，因为广义上对地下水的假定是：应当丝毫不被污染。地下水体仅分为两类：天然的和被污染的。对于地下水的一般保护，欧盟采用**风险预防方法**。具体作法就是禁止向地下水直接排放。另外，流域内的水务部门被要求监测地下水水体，以发现化学成分的变化（可能由间接排放引起的），并扭转人类活动造成的污染加重的趋势。这些措施加在一起，根据最小人为影响原则，应该可以确保地下水免遭各种污染。水量也是地下水的一个大问题。每年仅对地下水进行一定量的补给，其中一部分补给是支撑互联生态系统所需要的。因而，要想可持续地使用地下水，地下水的**量化状况**就应维持在这样的状况：抽取量不多于补给总量中生态系统不需要的部分。WFD 按照量化状况限制地下水抽取。

## Integrated river basin management and cyclic implementation

### 综合流域管理和周期性实施

The directive builds on the view that the best model for a single system of water management is **management by river basin** – which is the natural geographical and hydrological unit – instead of according to administrative or political boundaries. The river basin approach means that the WFD in practice functions as a tool for regional environmental risk assessment and management related to water. As can be seen in the map below (figure 2.2), most river basins in the EU does not conform to administrative and political boundaries at local or national levels. For instance, the Rhine river basin (see chapter 3.3) is mainly situated in four different provinces of Germany, but the upper part of the watershed includes areas in Switzerland and Austria, the middle part includes areas in France, Belgium and Luxembourg, and the lower parts are entirely in the Netherlands.

水框架指令建立在这样的观点之上：单一水管理体系的最佳模式是**按流域管理**，而不是按行政边界或政治边界来管理。流域是自然地理和水文单位。按流域管理意味着 WFD 作为水体区域环境风险评估和管理的工具。从下图（图 2.2）可以看出，欧盟多数流域在地方或国家层面上与行政边界并不一致。例如，莱茵河流域（见第 3.3 节）主要位于德国四个不同的省，但流域上游却包含瑞士和奥地利的区域，中游包含法国、比利时和卢森堡的区域，下游则全部位于荷兰。

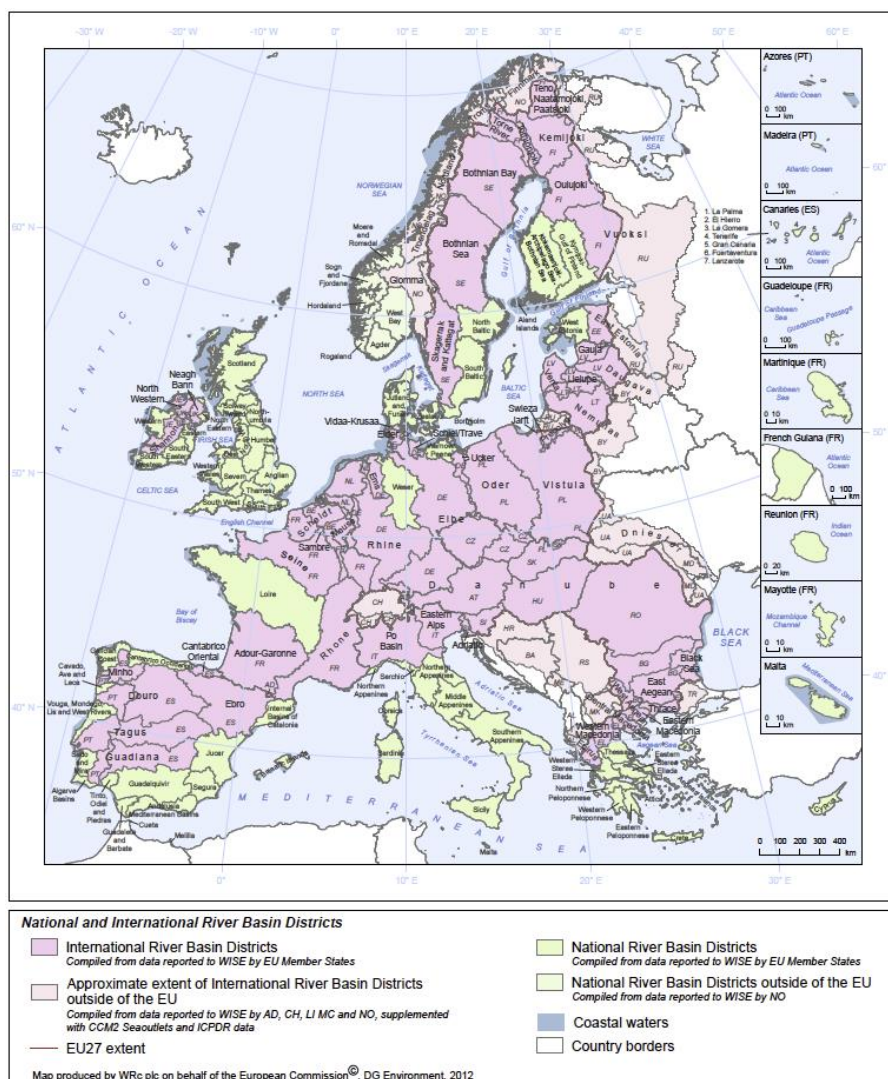
**Figure 2.2 Map of national and international river basin districts in the EU (2012)**

**图 2.2 欧盟国家和国际流域图（2012 年）**



## Tackling environmental risks with environmental planning: international experiences

### 通过环境规划解决环境风险：国际经验



Source: European Commission (EC 2014b).来源：欧盟委员会（EC 2014b）

For each river basin district a river basin management plan shall be established and updated every six years, constituting the platform for implementing measures to reach the WFD goals for ecological and chemical status. This means that the relevant administrative and political bodies in each river basin district - whether on local, regional, national, and trans-national levels - must cooperate in planning and implementation.

制定每个流域区的流域管理规划，并且每六年更新一次，作为实施达到 WFD 生态状况和化学状况目标的措施的平台。这意味着每个流域区的相关行政部门和政治部门，无论是地方级、国家级还是跨国级的，都必须合作进行规划与实施。

The main framework of implementation is the **river basin management plan**. Each river basin is broken down into “water bodies”, which are water areas within the river basin with common and distinct characteristics and for which different measures will be applied. For each river basin district a river basin management plan will be established and updated every six years, constituting the platform for implementing measures to reach the WFD goals in the river basin as a whole. In other words, the river basin management plan is a detailed account on how the objectives for the river basin are to be reached in the coming 6-year period (this is described in more detail below). The

WFD opens for three “rounds of implementation” whereby the relevant authorities for each river basin district can gradually move towards full realization of the objectives of the directive. The first implementation period is 2009-2015, the second 2016-2021, and the third 2022-2027. The timeline for the implementation of the WFD is presented in table 2.1 below.

主要实施框架为**流域管理规划**。每个流域被分解为多个“水体”。水体就是流域内具有共同和鲜明特征、适用不同措施的水域。制定每个流域区的流域管理规划，并且每六年更新一次，作为实施达到整个流域 WFD 目标的措施的平台。换言之，流域管理规划就是详细说明在未来 6 年时间里如何达到流域的目标（详细描述见下文）。WFD 设置了三“轮实施”。通过这三轮实施，每个流域区的有关部门可以向着完全实现指令的目标逐渐前进。第一个实施期为 2009-2015 年，第二个实施期为 2016-2021 年，第三个实施期为 2022-2027 年。下面表 2.1 提供了 WFD 的实施时间表。

Table 2.1 Timeline for the implementation of the Water Framework Directive

表 2.1 水框架指令实施时间表

Timeline for implementation of the Water Framework Directive 水框架指令实施时间表	
2000	Water Framework Directive (WFD) comes into legal force at EU level 水框架指令在欧盟开始生效。
2003	Deadline for Member States to adapt national legislation to WFD requirements 成员国将 WFD 要求转换为国家立法的限期
2004	Deadline for Member Status to describe status for their water bodies in accordance with WFD criteria 成员国按照 WFD 标准描述各自水体状况的期限
2006	Monitoring programs at river basin level ready for implementation 制定可实施的流域监测计划
2009	The first 6-year river basin management plan (2009-2015) with programs of measures to be in place. (The measures are activities aiming to bridge the gap between current status and goals.) The first 6-year river basin management plan period begins. 制定第一个 6 年流域管理规划（2009-2015）及措施计划。 （措施就是旨在缩小现状与目标之间差距的活动）。 第一个 6 年流域管理规划期开始。
2012	Implementation of relevant measures for the first period has taken place during the first half of the period (2009-2012) and in the second half of the period (2012-2015) they effect aquatic ecology. 上半期（2009-2012）落实第一个周期的相关措施，下半期（2012-2015）对这些相关措施对水生生态产生影响。
2015	Results of the first period have been assessed and the second 6-year river basin management plan (2016-2021) with program of measures to be in place. The second 6-year river basin management plan begins. 评估第一个周期的结果，制定第二个 6 年流域管理规划（2016-2021）及措施计划。 第二个 6 年流域管理规划开始。
2018	Implementation of relevant measures for the second period has taken place. 落实第二个周期的相关措施。
2021	Results of the second period have been assessed and the third 6-year river basin management plan (2021-2027) with program of measures to be in place. The third 6-year river basin management plan begins. 评估第二个周期的结果，制定第三个 6 年流域管理规划（2021-2027）及措施计划。 第三个 6 年流域管理规划开始。
2024	Implementation of relevant measures for the third period have taken place 落实第三个周期的相关措施。
2027	Final deadline for the achievement of WFD objectives

实现 WFD 目标的最后期限。

Source: Vista Analysis, based on WFD guidance documents.

来源：Vista Analysis，根据 WFD 指导文件。

## Public participation 公众参与

Implementation of the WFD requires a complex process involving a large number of stakeholders at various levels in 6-year cycles of implementation towards 2027. There are two main reasons why the WFD explicitly requires and encourages **public participation**(EC, 2003a)<sup>13</sup>. The first is that the decisions on the most appropriate measures to achieve the objectives in the river basin management plan will involve balancing the interests of various groups. It is therefore important that the process is open to the scrutiny of those who will be affected. The second reason concerns enforceability. The greater the transparency in the establishment of objectives, the imposition of measures, and the reporting of standards, the greater the care EU Member States will take to implement the legislation in good faith.

WFD 的实施需要一个复杂过程，需要各个层面的众多利益相关者参与到结束于 2027 年的 6 年实施周期中。WFD 之所以明确要求并鼓励**公众参与**有两个原因（EC, 2003a）：第一是因为在确定实现流域管理规划目标的最恰当措施时，需要平衡各种团体的利益，因此这个决策过程要接受受影响者的监督；第二个原因涉及到可执行性，制定目标、推出措施和汇报标准的过程越透明，欧盟成员国就会越注意真诚执行立法。

Transparency is also a prerequisite for empowering the citizens to influence the direction of environmental protection, whether through consultation or, if disagreement persists, through the complaints procedures and the courts. The rights of the European public (individuals and associations) with regard to the environment, is secured by the *Aarhus Convention on Access to Information, Public Participation, in Decision-Making and Access to Justice in Environmental Matters* (1998) of the UN Economic Commission for Europe.

透明还是一个使公民有权通过协商、协商不一致的话通过投诉程序或法院来影响环境保护方向的前提条件。欧洲公众（个人和社团）在环境方面的权利通过联合国欧洲经济委员会的奥胡斯《在环境问题上获得信息、公众参与决策和诉诸法律的公约》（1998 年）得到保障。

### 2.2.4 Tools

#### 2.2.4 水框架指令的工具

##### How to set environmental targets for different types of water bodies(inter-calibration)

##### 如何设定不同类型水体的环境目标（相互校准）

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<sup>13</sup> Guidance document No 8: Public Participation in relation to the Water Framework Directive, is available here: 以下网址可获取第 8 号指导文件：涉及水框架指令的公众参与：

<http://www.waterframeworkdirective.wdd.moa.gov.cy/docs/GuidanceDocuments/Guidancedoc8Publicparticipation.pdf>



In order to ensure a common ecological scale across Europe, an **inter-calibration exercise** had to be carried out before defining the precise ecological objectives for each type of water body. The species of fish, invertebrates and plants in Baltic rivers differ from those in Alpine rivers, which in turn differ from those found in Mediterranean rivers. Since aquatic ecosystems vary widely across Europe, defining the ecological condition that corresponds with “high” or “good” status had to be done for different biogeographic regions.

为了保证整个欧洲达到共同的生态规模，在确定每一类水体的确切生态目标之前必须开展**相互校准运动**。波罗的海河流里的鱼、无脊椎动物和植物种类与阿尔卑斯山河流里的不同，而阿尔卑斯山河流里的又和地中海河流里的不同。由于欧洲各地的水生生态系统千差万别，因此在确定生态条件达到“优等”或“良好”状况时，要针对不同的生物地理区域进行。

The inter-calibration exercise took place between 2003 and 2007 and involved hundreds of experts across Europe. The European Commission's Joint Research Centre in Ispra, Italy, coordinated the technical work. 14 different Geographical Inter-calibration Groups (GIGs) were set up. For example, experts from Italy, France, Germany, Austria and Slovenia collaborate in the GIG for Alpine lakes. Waters also differ within each inter-calibration group. Experts in the Alpine group identified two types of Alpine lakes with distinct ecological characteristics, one at lower and one at higher altitude. Eleven countries participated in the inter-calibration group for North-East Atlantic coastal and transitional waters, comparing the ecosystems of seven different types of waters, from shallow coastlines to deep northern fjords. The experts first identified and studied almost 1500 sites in rivers, lakes and coastal and transitional waters across Europe, in order to mainstream the understanding of Good Ecological Status for different water body types. This network of 1500 sites was later expanded, and the inter-calibration exercise has used data from many thousands of sites and water bodies across Europe.<sup>14</sup>

相互校准运动是在 2003 和 2007 年之间进行的，欧洲各地数百位专家参与其中。位于意大利伊斯普拉的欧盟委员会联合研究中心负责技术协调工作。成立了 14 个不同的地理相互校准组（GIG）。例如，来自意大利、法国、德国、奥地利和斯洛文尼亚的专家在阿尔卑斯山湖群 GIG 里合作。每个相互校准组内的水域也各不相同。阿尔卑斯山组的专家确定了两类具有鲜明生态特征的阿尔卑斯山湖，一类海拔高度较低，一类海拔高度较高。11 个国家参加了大西洋东北沿岸和过渡性水域相互校准组，比较了从浅海岸到北部深峡湾七种不同类型水域的生态系统。专家们首先确定和研究了整个欧洲河流、湖泊及沿海水域和过渡性水域里的将近 1500 个站点，以便对不同水体类型的

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<sup>14</sup> More than 300 ecological assessment methods have been developed in Europe. The WISER database contains information about the national assessment methods used to classify the ecological status of rivers, lakes, coastal and transitional waters. Member States of the European Union apply these methods in their monitoring programmes according to the EU Water Framework Directive. The database is available here: <http://www.wiser.eu/results/method-database/>

欧洲开发了 300 多种生态评估方法。WISER 数据库里有关于用来对河流、湖泊、沿海水域和过渡性水域进行分等的国家评估方法的信息。欧盟成员国根据欧盟水框架指令将这些方法用于监测其各项计划。获取数据库的网址是：<http://www.wiser.eu/results/method-database/>

良好生态状况达成共识。后来，这个有 1500 个站点的网络扩大了，相互校准运动使用了来自欧洲各地数千个站点和水体的数据。

## Methodologies for assessing ecological status and classification

### 生态状况评估和分级方法

The WFD and the guiding documents provide **quality elements** that are to be used when assessing ecological status in different types of water bodies (rivers, lakes, coastal waters etc.). This includes biological elements, hydro-morphological elements supporting the biological elements, and also chemical and physiochemical elements supporting the biological elements. A list of the quality elements for rivers, lakes, transitional waters and coastal waters is provided below.

WFD 和指导文件提供了在评估不同类型水体（河流、湖泊、沿海水域等）的生态状况时要使用的质量要素。这些要素包括生物学要素、支持生物学要素的水形态学要素，还有支持生物学要素的化学要素和理化要素。下面提供了河流、湖泊、过渡性水域和沿海水域质量要素的清单。

Good Ecological Status requires Good Chemical Status, which is reached for a water body when it complies with the environmental quality standards for the 33 Priority Substances and 8 Other Pollutants. For these substances, two types of concentration standards are used: The average value or concentration of the substance concerned calculated over a one-year period. The purpose of this standard is to ensure the long-term quality of the aquatic environment. The purpose of the second standard is to limit short-term pollution peaks. The quality standards are differentiated for inland surface waters (rivers and lakes) and other surface waters (transitional, coastal and territorial waters). Specific standards are also set for metals and certain other substances. Member States must ensure compliance with these standards. They must also verify that the concentration of substances concerned does not increase significantly in sediments and/or the relevant biota.<sup>15</sup>

良好生态状况需要良好化学状况。当一个水体达到 33 种重点控制物质和 8 种其他污染物的环境质量标准时，它就达到了良好化学状况。对于这些物质，采用两类浓度标准：平均值，或者有关物质在一年期间的浓度。第一个标准的目的是保证水生环境的长期质量。第二个标准的目的是限制短期污染峰值。内陆地表水（河流与湖泊）和其他地表水（过渡性水域、沿海水域和领海）有不同的质量标准。同时还为金属和其他某些物质设立了特殊标准。成员国必须保证遵守这些标准，同时还必须核实沉积物和/或相关生物群有关物质的浓度没有大幅增大。

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<sup>15</sup> The following guidance documents describe chemical monitoring requirements in more detail: No 15: *Groundwater monitoring*, No 16 *Groundwater in Drinking Water Protected Areas*, No 19: *Surface Water Chemical Monitoring*, No 28: *Preparation of Priority Substances Emissions Inventory*. These documents can be found on the internet if one searches by name. 以下指导文件更详细地描述了监测要求：第 15 号文件：地下水监测，第 16 号文件：饮用水保护区里的地下水，第 19 号文件：地表水化学监测，第 28 号文件：编制重点控制物质排放清单。按名称搜索可在互联网上找到这些文件。

**Table 2.2 Quality elements used for assessment of ecological status/ecological potential in different types of surface water bodies**

**表 2.2 用于评估不同类型地表水水体生态状况/生态潜力的质量要素**

Annex V 1.1.1. RIVERS	Annex V 1.1.2. LAKES	Annex V 1.1.3. TRANSITIONAL WATERS	Annex V 1.1.4. COASTAL WATERS
<b>BIOLOGICAL ELEMENTS</b>			
<ul style="list-style-type: none"> <li>Composition and abundance of aquatic flora<sup>3</sup></li> <li>Composition and abundance of benthic invertebrate fauna</li> <li>Composition, abundance and age structure of fish fauna</li> </ul>	<ul style="list-style-type: none"> <li>Composition, abundance and biomass of phytoplankton</li> <li>Composition and abundance of other aquatic flora<sup>4</sup></li> <li>Composition and abundance of benthic invertebrate fauna</li> <li>Composition, abundance and age structure of fish fauna</li> </ul>	<ul style="list-style-type: none"> <li>Composition, abundance and biomass of phytoplankton</li> <li>Composition and abundance of other aquatic flora<sup>5</sup></li> <li>Composition and abundance of benthic invertebrate fauna</li> <li>Composition and abundance of fish fauna</li> </ul>	<ul style="list-style-type: none"> <li>Composition, abundance and biomass of phytoplankton</li> <li>Composition and abundance of other aquatic flora<sup>6</sup></li> <li>Composition and abundance of benthic invertebrate fauna</li> </ul>
<b>HYDROMORPHOLOGICAL ELEMENTS SUPPORTING THE BIOLOGICAL ELEMENTS</b>			
<ul style="list-style-type: none"> <li>Hydrological regime → quantity and dynamics of water flow</li> <li>→ connection to ground water bodies</li> <li>River continuity</li> <li>Morphological conditions → river depth and width variation</li> <li>→ structure and substrate of the river bed</li> <li>→ structure of the riparian zone</li> </ul>	<ul style="list-style-type: none"> <li>Hydrological regime → quantity and dynamics of water flow</li> <li>→ residence time</li> <li>→ connection to the ground water body</li> <li>Morphological conditions → lake depth variation</li> <li>→ quantity, structure and substrate of the lake bed</li> <li>→ structure of the lake shore</li> </ul>	<ul style="list-style-type: none"> <li>Tidal regime → freshwater flow</li> <li>→ wave exposure</li> <li>Morphological conditions → depth variation</li> <li>→ quantity, structure and substrate of the bed</li> <li>→ structure of the intertidal zone</li> </ul>	<ul style="list-style-type: none"> <li>Tidal regime → direction and dominant currents</li> <li>→ wave exposure</li> <li>Morphological conditions → depth variation</li> <li>→ structure and substrate of the coastal bed</li> <li>→ structure of the intertidal zone</li> </ul>
<b>CHEMICAL AND PHYSICO-CHEMICAL ELEMENTS SUPPORTING THE BIOLOGICAL ELEMENTS</b>			
<ul style="list-style-type: none"> <li>General → Thermal conditions</li> <li>→ Oxygenation conditions</li> <li>→ Salinity</li> <li>→ Acidification status</li> <li>→ Nutrient conditions</li> <li>Specific pollutants → Pollution by priority substances identified as being discharged into the body of water</li> <li>→ Pollution by other substances identified as being discharged in significant quantities into the body of water</li> </ul>	<ul style="list-style-type: none"> <li>General → Transparency</li> <li>→ Thermal conditions</li> <li>→ Oxygenation conditions</li> <li>→ Salinity</li> <li>→ Acidification status</li> <li>→ Nutrient conditions</li> <li>Specific pollutants → Pollution by priority substances identified as being discharged into the body of water</li> <li>→ Pollution by other substances identified as being discharged in significant quantities into the body of water</li> </ul>	<ul style="list-style-type: none"> <li>General → Transparency</li> <li>→ Thermal conditions</li> <li>→ Oxygenation conditions</li> <li>→ Salinity</li> <li>→ Nutrient conditions</li> <li>Specific pollutants → Pollution by priority substances identified as being discharged into the body of water</li> <li>→ Pollution by other substances identified as being discharged in significant quantities into the body of water</li> </ul>	<ul style="list-style-type: none"> <li>General → Transparency</li> <li>→ Thermal conditions</li> <li>→ Oxygenation conditions</li> <li>→ Salinity</li> <li>→ Nutrient conditions</li> <li>Specific pollutants → Pollution by priority substances identified as being discharged into the body of water</li> <li>→ Pollution by other substances identified as being discharged in significant quantities into the body of water</li> </ul>

Source: ECOSTAT (2003)

附录 V 1.1.1  
河流

附录 V 1.1.2  
湖泊

附录 V 1.1.3  
过渡性水域

附录 V 1.1.4  
沿海水域

**生物学要素**

- 水生植物群的构成和丰度
- 浮游植物群落的构成和丰度
- 浮游植物群落的构成和丰度
- 浮游植物群落的构成和丰度

- |                  |                  |                  |                  |
|------------------|------------------|------------------|------------------|
| ● 底栖无脊椎动物群的构成和丰度 | 和生物量             | 和生物量             | 和生物量             |
| ● 鱼类构成、丰度和鱼龄结构   | ● 其他水生植物群的构成和丰度  | ● 其他水生植物群的构成和丰度  | ● 其他水生植物群的构成和丰度  |
|                  | ● 底栖无脊椎动物群的构成和丰度 | ● 底栖无脊椎动物群的构成和丰度 | ● 底栖无脊椎动物群的构成和丰度 |
|                  | ● 鱼类构成、丰度和鱼龄结构   | ● 鱼类构成、丰度和鱼龄结构   |                  |

#### 支持生物学要素的水形态学要素

- |  |  |                         |                             |
|--|--|-------------------------|-----------------------------|
| ● 水文状况<br>→水流量和动态<br>→与地下水水体的连接              | ● 水文状况<br>→水流量和动态<br>→逗留时间<br>→与地下水水体的连接   | ● 潮汐状况<br>→淡水流<br>→波浪冲击 | ● 潮汐状况<br>→方向和主导洋流<br>→波浪冲击 |
| ● 河流连续性                                      |  | ● 形态学状况<br>→深度变化        | ● 形态学状况<br>→深度变化            |
| ● 形态学状况<br>→河流深度和宽度变化<br>→河床构成和基质<br>→河岸区的结构 | ● 形态学状况<br>→湖泊深度变化<br>→湖床的量、结构和基质<br>→湖岸结构 | →海床的量、结构和基质<br>→潮间带的结构  | →沿岸海床的结构和基质<br>→潮间带的结构      |

#### 支持生物学要素的化学和理化要素

- |   |   |   |   |
|---|---|---|---|
| ● 一般情况<br>→热状况<br>→氧化状况<br>→盐度<br>→酸化状况<br>→营养物状况 | ● 一般情况<br>→透明度<br>→热状况<br>→氧化状况<br>→盐度<br>→酸化状况<br>→营养物状况   | ● 一般情况<br>→透明度<br>→热状况<br>→氧化状况<br>→盐度<br>→营养物状况  | ● 一般情况<br>→透明度<br>→热状况<br>→氧化状况<br>→盐度<br>→营养物状况  |
| ● 特定污染物<br>→被确定排入水体的重点控制物质污染<br>→被确定大量排入水体的其他物质污染 | →营养物状况<br>● 特定污染物<br>→被确定排入水体的重点控制物质污染<br>→被确定大量排入水体的其他物质污染 | ● 特定污染物<br>→被确定排入水体的重点控制物质污染<br>→被确定大量排入水体的其他物质污染 | ● 特定污染物<br>→被确定排入水体的重点控制物质污染<br>→被确定大量排入水体的其他物质污染 |

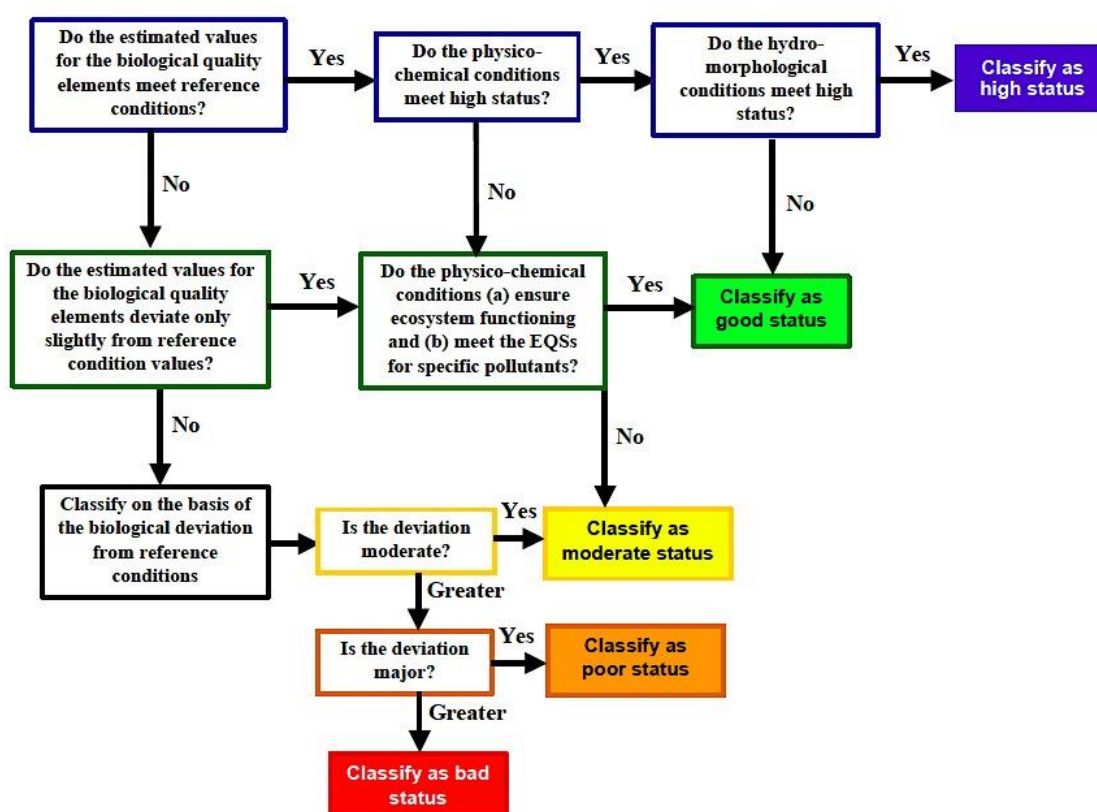
## 污染

来源：ECOSTAT（2003 年）

When classifying water bodies in accordance with the 5-tier system of the WFD (water bodies either have high, good, moderate, poor, or bad status), a stepwise approach is applied. By asking basic questions in a certain order, positive answers lead to the result “high status” while negative answers means that the water body in question slips down on the ranking. This is shown in figure 2.3 and 2.4 below. As different environmental goals pertain to normal surface water bodies and the heavily modified water bodies, the steps are different for the two types of surface water bodies.

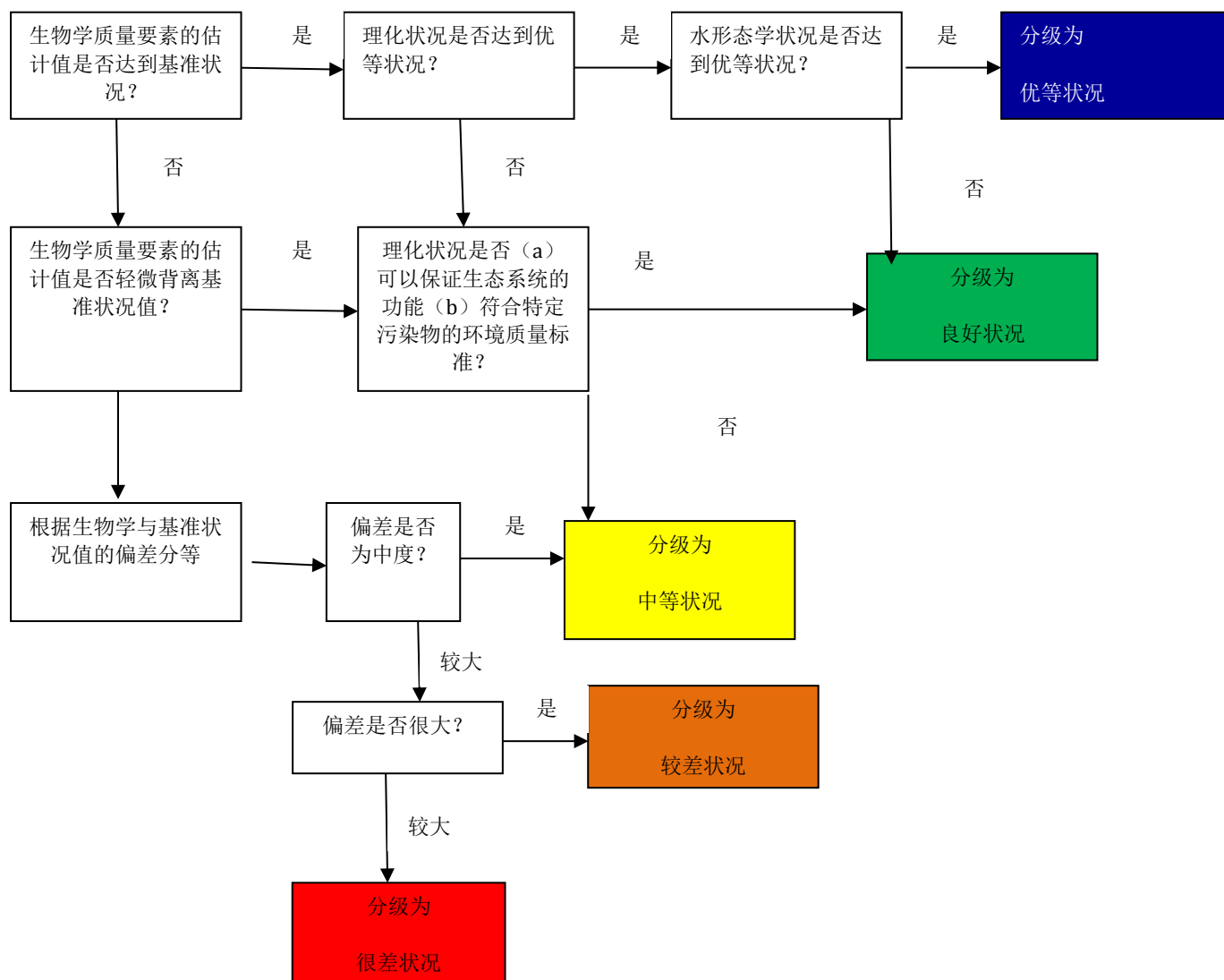
根据 WED 的 5 级制对水体进行分级（水体状况是优等、良好、中等、较差还是很差）时，采用分步法。按一定顺序提出基本问题，给出肯定答案的就得出“优等状况”结果，给出否定答案的就说明所议水体的等级在下降，如下面图 2.3 和图 2.4 所示。由于对正常地表水水体和严重被干扰水体设定了不同的环境目标，因此这两类地表水水体遵循的步骤也不同。

**Figure 2.3 Steps when classifying normal water bodies**



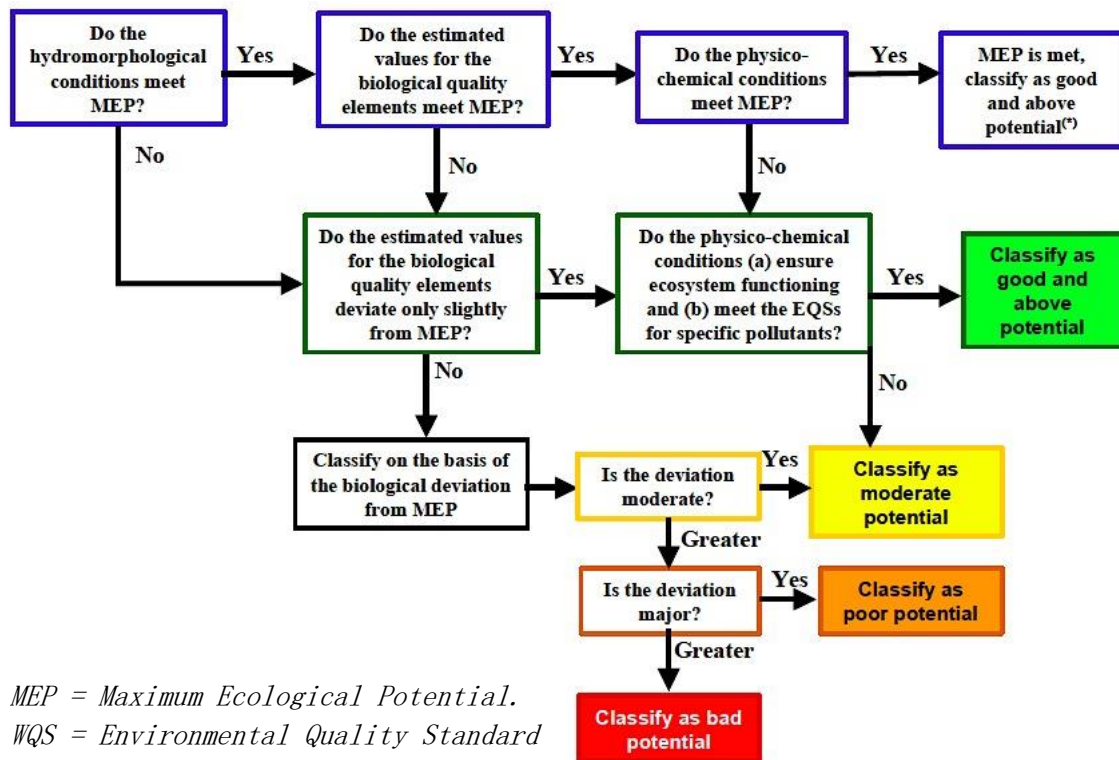
Source: ECOSTAT (2003)

图 2.3 对正常水体进行分级时的步骤



来源：ECOSTAT（2003 年）

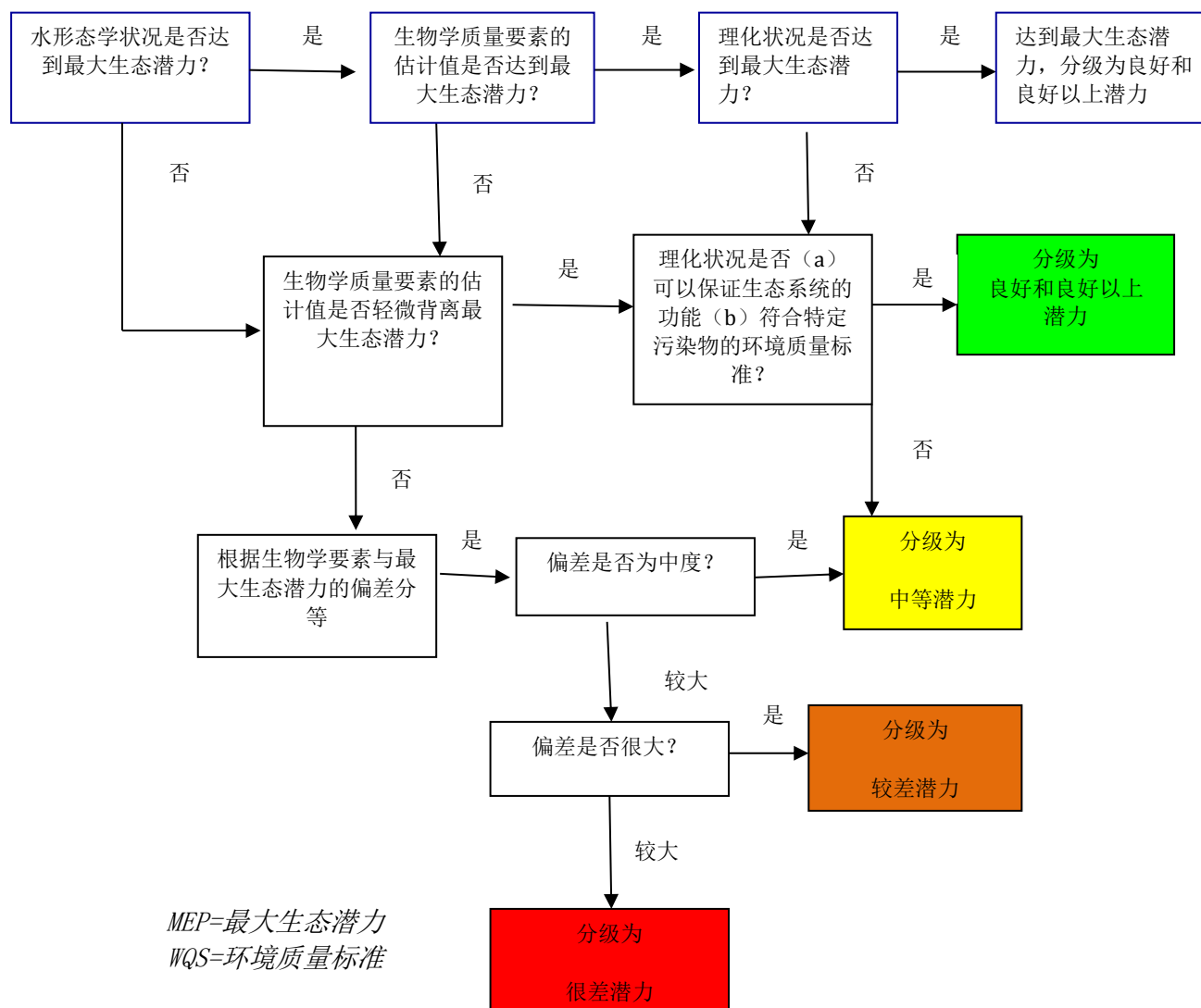
Figure 2.4 Steps when classifying heavily modified water bodies



Source: ECOSTAT (2003)来源：ECOSTAT（2003 年）



图 2.4 对严重被干扰的水体进行分级时的步骤



## Monitoring 监测

The quality elements are applied for monitoring. In order to ensure that the necessary data is available and in a form that can be compared between river basins, the WFD sets out the requirements for the **monitoring** of surface water status, groundwater status and protected areas in each river basin district. The monitoring is the tool to provide an overview of the situation in each river basin district and the monitoring programs shall include classification of all surface water bodies (into one of five categories) and all groundwater bodies (into one of two categories).

质量要素用于进行监测。为了确保可获得流域之间可比的必要数据，WFD 提出了对每个流域区的地表水体状况、地下水状况和保护区进行**监测**的要求。监测是简要了解流域区情况的手段，监测计划应包括对所有地表水体（分为五类）和所有地水水体（分为两类）的分级。



The monitoring programs shall also provide information that is crucial to enable regional cooperation and reducing risks to the environment, such as estimates of the direction and rate of flow in groundwater bodies that cross EU Member State boundaries, estimates of pollutant loads transferred across international boundaries or discharged into seas, assessments of changes in water bodies, the magnitude and impacts of accidental pollution, compliance assessments with the standards and objectives of Protected Areas, and quantification of reference conditions for different types of surface water bodies.<sup>16</sup>

监测计划还应提供对于实现区域合作和降低环境风险至关重要的信息，比如穿越欧盟成员国边界的地下水体水流方向和流速的估计值，穿越国际边界转移的或者排入大海的污染物负荷量的估计值，水体变化评价，意外污染的程度和影响，保护区标准和目标的符合性评价，以及不同类型地表水体基准状况的量化等。

### Co-ordination of measures and the river basin management plan

#### 措施协调与流域管理规划

The WFD provides the framework for a **co-ordination of measures** at a river basin level, thereby addressing and reducing regional environmental risk.

WFD 提供流域层面的**措施协调**框架，用于处理和减少区域环境风险。

There are a number of measures taken at EU level to tackle particular pollution problems, as exemplified by various directives (e.g. Urban Waste Water Treatment Directive and the Nitrates Directive). The WFD ensures co-ordination of measures by requiring the following step-wise process:

欧盟采取很多措施来解决特殊污染问题，有各种指令为证（例如《城市废水处理指令》和《硝酸盐指令》）。WFD 通过要求执行以下分步过程，确保各种措施的协调：

- First, the precise environmental objectives for the different types of water bodies in a river basin are established, as described earlier.  
第一，制定流域内不同类型水体的确切环境目标，如前面所描述的。
- Second, an analysis of human impact is conducted so as to determine how far from the objective each water body within the river basin is. At this point, the effect of the existing (non-WFD) legislation is considered. If it has ensured fulfillment of WFD standards, then the objective of the WFD may be considered attained without further measures.

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<sup>16</sup> A detailed guidance to monitoring under the WFD can be found in *Guidance Document No 7, Monitoring under the Water Framework Directive* (EC 2003b), as well as in the WFD, annex V (EC 2000).

根据 WFD 进行监测的详细指导可在 7 号指导文件：根据水框架指令进行监测（EC 2003b）和 WFD 附录 V（EC 2000）中找到。

第二，分析人为影响，以确定流域内每个水体离目标有多远。在这一点上，要考虑现有立法（非 WFD）的影响。如果确定 WFD 标准已满足，即可认为 WFD 目标已实现，无需采取进一步措施。

- Third, when the WFD standards have not been attained for a water body, the Member State must identify exactly why, and design whatever additional measures are needed to satisfy the WFD objectives. These might include stricter controls on polluting emissions from industry and agriculture, on urban wastewater sources and/or other measures.

第三，如果某水体未达到 WFD 标准，成员国必须找出原因，并制定其他必要措施，以实现 WFD 目标。这些措施可能包括严格控制工农业污染排放、严格控制废水源和/或其他措施。

This approach ensures co-ordination of relevant measures and that necessary additional measures are identified.

这种方法确保相关措施的协调及找出必要的额外措施。

The main framework of WFD implementation is the **river basin management plan**. The river basin management plan is a detailed account of how the objectives set for the river basin (ecological status, quantitative status, chemical status and protected area objectives) are to be reached within the timescale required. The plan will include all the results of the above analysis: the river basin's characteristics, a review of the impact of human activity on the status of waters in the basin, estimation of the effect of existing legislation and the remaining gap to meeting these objectives, and a set of measures designed to fill the gap. One additional component is that an **economic analysis of water use** within the river basin must be carried out. This is to provide a foundation for a discussion of the cost-effectiveness of the various possible measures. It is considered essential that all interested parties are fully involved in this discussion, and indeed in the preparation of the river basin management plan as a whole.<sup>17</sup>

WFD 的主要实施框架是流域管理规划。流域管理规划详细介绍如何在要求的时段内达到为流域设定的目标（生态状况、量化状况、化学状况和保护区目标）。规划将包括以上分析的全部结果：流域特征、评论人类活动对流域内水体的影响、预估现有立法的影响以及实现这些目标还有多大差距、以及旨在弥补差距的一系列措施。还有一项内容是必须对流域的用水情况进行经济分析，其目的是为讨论各种可能措施的成本效益提供基础。至关重要的是，所有利益相关者都充分参与这种讨论，并充分参与总体流域管理规划的编制。

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<sup>17</sup> Guidance document No 1: *Economics and the Environment* (EC 2003c) describes in more detail the role of economic in the implementation of the WFD and describes methodologies in more details. It is available here: 1 号指导文件：经济学与环境（EC 2003c）较详细的描述了经济在 WED 实施中的作用，并详细描述了各种方法。获取该文件的网址是：

[http://www.enorasis.eu/uploads/files/Water%20Governance/9.Guidancedoc01\\_Economics\\_WATECO\\_WG2-6.pdf](http://www.enorasis.eu/uploads/files/Water%20Governance/9.Guidancedoc01_Economics_WATECO_WG2-6.pdf)

**Table 2.3 The content of a river basin management plan**

**表 2.3 流域管理规划的内容**

**A River Basin Management Plans includes 流域管理规划的内容应包括**

- A general description of the characteristics of the river basin district and a summary of significant anthropogenic pressures and their impact on the status of surface water and groundwater bodies  
流域区特征综合描述，重大人为压力及其对地表水和地下水水体状况的影响概述
- A list of the environmental objectives for the water bodies in the river basin district  
流域区内水体的环境目标清单
- A map of the relevant monitoring networks that are in place  
已设立的相关监测网的示意图
- A presentation in map form of the results of the monitoring programmes  
示意图形式的监测计划成果展示
- A summary of the programmes of measures, including the ways in which the mandated objectives are thereby to be achieved  
措施规划概述，包括通过措施规划实现强制目标的方式

Source: Vista Analysis, based on WFD guidance documents.

来源：Vista Analysis，根据 WFD 指导文件。

The following is an example of how **measures** provided for in the Directive might be implemented in practice<sup>18</sup>:

下面举例说明在实践中如何实施指令中规定的措施：

A river water body is badly degraded due to nutrient enrichment from a number of different sources: (i) urban wastewater (ii) industrial wastewater and (iii) intensive agriculture. The minimum obligation under the Directive is that measures are implemented within the river basin as set out in relevant EU legislation such as the Urban WasteWater Treatment Regulations, as well as National Regulations that apply to industrial discharges including those from agriculture.

河流水体因众多不同来源造成的营养物富集而严重降级：(i)城市废水 (ii)工业废水 (iii)集约农业。指令下的最低义务是在流域内实施相关欧盟立法中规定的措施，比如《城市废水处理条例》，以及适用于工业排放、包括农业造成的排放的国家法规。

If it is considered that these measures alone will not be enough to restore the river water bodies to ‘good status’ by 2015, then additional measures will have to be identified and considered. These might include, for example, setting more stringent emission controls than is required by the above-mentioned legislation for point source discharges, or require (e.g. by way of local bye-law) stricter controls on agricultural activities within the catchment. Other measures that could be considered might include the re-creation and restoration of wetland areas, educational projects, etc. It is likely that the final approach adopted will consist of a combination of some, if not all of these

<sup>18</sup> The example is taken from the report by ESB International (2008): *Draft River Basin Management Plans. National Summary of National Summary of Programme of Measures*. The report provides a detailed list of measures applied in Ireland, which may be a useful reference. It is available here:

<http://www.wfdireland.ie/docs/National%20Summary%20Programme%20of%20Measures.pdf>

本例取自 ESB 国际（2008）的报告：编制流域管理规划，国家措施计划汇总。该报告详细列出了爱尔兰采用的措施，可作为有益参考。获取该报告的网址是：

supplementary measures; the final combination chosen will most likely be the most cost-effective combination of the technically feasible measures identified.

如果认为光是这些措施不足以使水体到 2015 年恢复到“良好状况”，还要发现并考虑其他措施。举例来说，这些措施可能包括：对点源排放设置比上述立法所要求的更严格的排放控制，或者要求（例如通过地方法则的方式）对流域内的农业活动进行更严格的控制。其他可考虑的措施还包括重建和恢复湿地地区、教育项目等。最后采用的方法可能会由这些补充措施中的一部分（即使不是全部）组合而成；所选用的最后组合也许是已确定的技术上可行措施的最具成本效益的组合。

Basic principles of water pricing and the polluter pays principle are applied when working out how to **share the burden** of implementing the measures necessary. A transparent process with sharing of data and public consultations often make sit clear where main responsibilities for the situation lie, and makes it difficult for parties responsible for pollution to “hide” from their responsibility. In cases where reduction of pollution is difficult to achieve, as responsible parties lack means to reduce pollution and/or it will collide with other concerns such as economic development or employment, a negotiated solution must be worked out between the politicians and the involved parties. This may include government support for necessary adaptations, a delay in implementation of measures due to special considerations, to the extent this is reasonable. In Europe, experience since the 1970s has shown that transparency about the basic facts of the situation and public pressure in many cases have made industry take steps to reduce pollution, which they previously considered “impossible”.

在确定如何**分担**实施必要措施的**负担**时，采用水定价基本原则和污染者付费原则。数据共享和征询民意的透明过程可以明确污染情况的主要责任所在，并且使得污染责任方很难逃避其责任。因为责任方缺乏减污手段，并且/或者减污会与经济发展或就业等其他问题发生冲突，因此减污难以实现，则此时必须制定政客和责任方之间的协商方案。协商方案可包括：政府支持必要的适应过程，在合理情况下出于特别考虑而推迟实施。欧洲 20 世纪 70 年代以来的经验表明，很多情况下，污染情况的基本事实透明，再加上公众的压力，使得企业采取措施来减少污染，而以前他们认为减少污染是“不可能的”。

### 2.2.5 Results 结果

The WFD has enabled the EU to address regional environmental risk, especially accumulated risk to aquatic ecology and drinking water sources in a consistent and ambitious manner. Environmental standards have been raised and tailored more directly to different types of water bodies.

WFD 使得欧盟以一致和雄心勃勃的方式特别解决了对水生生态和饮用水水源造成的累积性风险。环境标准提高了，而且更加直接地为不同类型的水体量身而定。

Compared with the situation before the WFD, there has been a significant improvement of the knowledge base and increased transparency by bringing together information on characteristics, ecological status, pressures and impacts on European water bodies at basin level. Altogether, 23 Member States reported information from more than 13,000 ground water bodies and 127,000 surface water bodies (82% rivers, 15% lakes, 3% coastal and transitional waters) in 2009. The data is collected in the Water Information System for Europe (WISE) database. The data makes detailed and differentiated analysis

of status and pressures related to the environmental status of water bodies across the EU, showing the distribution of problems and pressures allowing for targeted and effective action.<sup>19</sup>

与 WFD 之前的情况相比，通过整合特征、生态状况、对流域层面的欧洲水体的压力和影响方面的信息，知识库得到了显著改善，透明度得以增强。2009 年，共有 23 个成员国报告了 13000 多个地下水体和 127000 个地表水体（河流占 82%，湖泊占 15%，沿海和过渡性水域占 3%）的信息。数据收集在欧洲水信息系统数据库里。数据对整个欧盟范围内的水体状况以及水体环境状况方面的压力进行了详细而差异化的分析，说明了问题和压力的分布情况允许采取有针对性的有效行动。

The 2009 WFD reporting on surface water bodies showed that (EEA, 2012):

2009 年 WFD 地表水水体报告表明（EEA, 2012）：

- 42% of all surface water bodies held good or high ecological status, meaning that 58% of all surface water bodies need mitigation and/or restoration measures.  
在全部地表水水体中，42%处于良好或优等生态状况，意味着在全部地表水水体中，58%需要缓解和/或恢复措施。
- River water bodies and transitional waters have worse ecological status or potential and more pressures and impacts, than water bodies in lakes and coastal waters.  
与湖泊和沿海水域中的水体相比，河流水体和过渡性水体的生态状况或潜力较差，承受的压力和影响较大。
- The most common pressures are pollution from diffuse sources (in particular from agriculture) causing nutrient enrichment, and hydromorphological pressures (hydropower, flood protection, urban development etc.) resulting in altered habitats.  
最常见的压力是造成营养物富集、来自分散源（特别是来自农业）的污染，以及造成栖息地改变的水形态学压力（水力发电、防洪、城市发展等）。
- Diffuse pollution from agriculture is a significant pressure in more than 40% of Europe's water bodies in rivers and coastal waters, and in 33% of the water bodies in lakes and transitional waters. Discharges from wastewater treatment plants, industries and the overflow of wastewater from sewage systems still cause pollution: 22% of surface water bodies still have point sources as a significant pressure.  
在欧洲河流和沿海水域 40%的水体中，以及湖泊和过渡性水域 33%的水体中，来自农业的分散污染是巨大压力。废水处理厂、工业企业的排放以及下水道系统溢出的污水仍造成污染：22%的地表水水体仍承受着点源污染的巨大压力。

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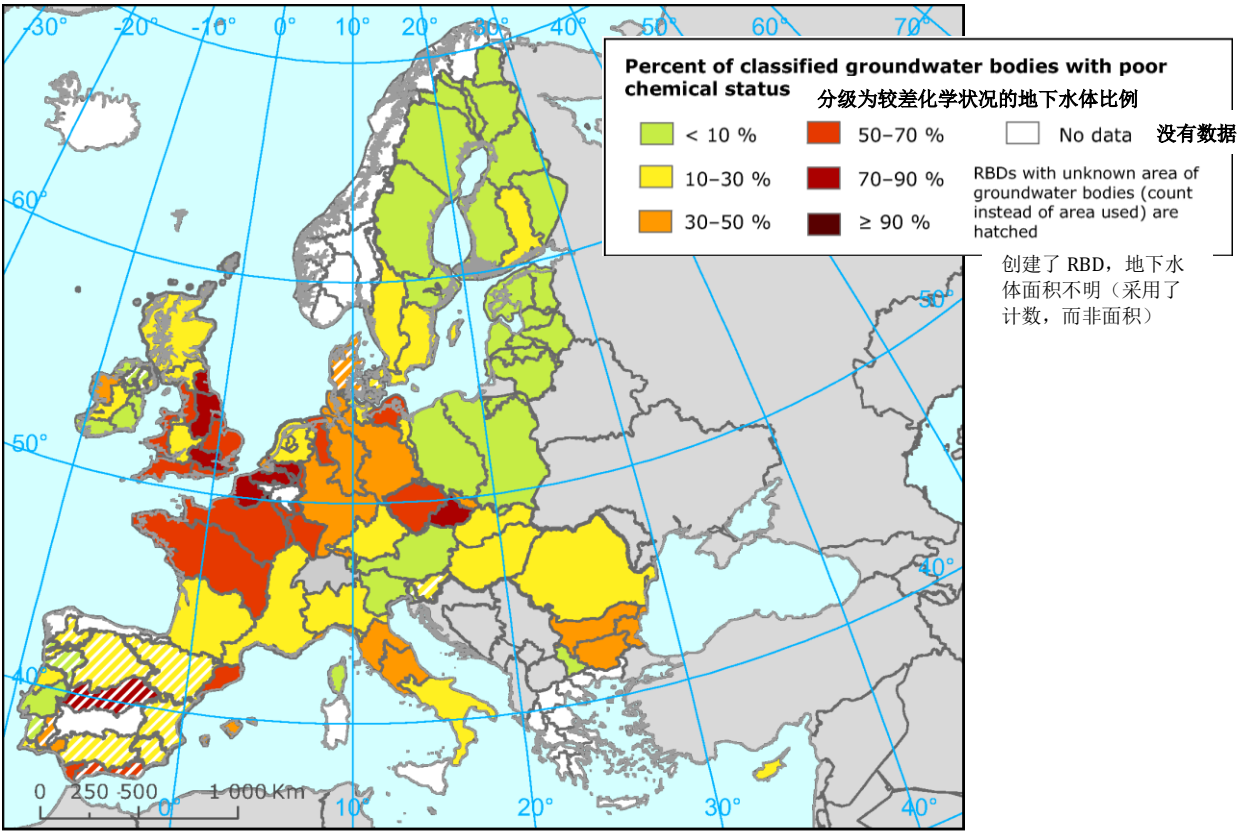
<sup>19</sup> The Water Information System for Europe (WISE) database is available at: <http://water.europa.eu/>  
获取欧洲水信息系统（WISE）数据库的网址是：<http://water.europa.eu/>

While the data from the WFD reporting does not contain time series before the second reporting in 2015, more fragmented data indicates a clear trend of improvement in many European surface water bodies since the 1980s. This exemplified by the developments in the Rhine river basin (see chapter 3).

虽然 WFD 报告的数据不包含 2015 年第二次报告之前的时间序列，但较分散的数据显示，20 世纪 80 年代以来，欧洲地表水体有了明显改善。莱茵河流域的发展动态证明了这一点（见第 3 章）。

Figure 2.5 Percentage of groundwater bodies with poor chemical status

图 2.5 化学状况较差的地下水体比例



Source: EEA (2012)

The reporting on chemical status and groundwater bodies showed that monitoring was still not extensive and/or detailed enough, as a large number of water bodies had no chemical monitoring and/or not proper monitoring of all the priority substances in the directive. Still, the numbers provided an indication of chemical status for European water bodies per 2009:

化学状况和地下水水体报告表明，监测还不够广泛和/或详细，因为很多水体没有进行指令中全部重点控制物质的化学监测和/或适当监测。尽管如此，数字仍显示了 2009 年欧洲水体的化学状况。



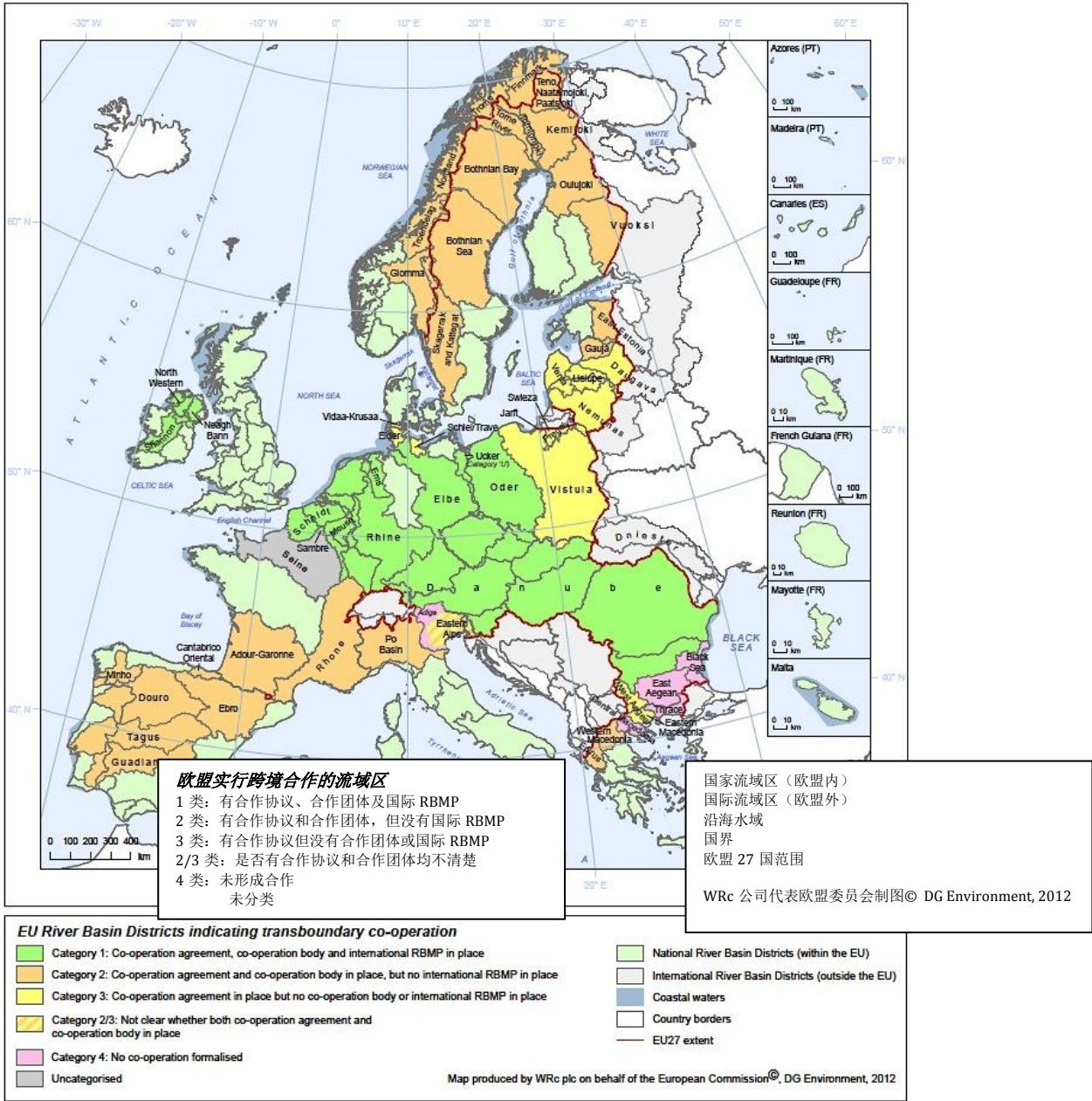
- For groundwater, 80% of water bodies across Europe were reported to have good chemical status (usually due to excessive levels of nitrate) and 87% held good quantitative status. In four Member States, more than 50% of groundwater bodies had poor chemical status.  
对于地下水，整个欧洲 80%的水体为良好化学状况（通常由于硝酸盐水平过高），87%为良好量化状况。在四个成员国，50%以上的地下水体为较差化学状况。
- For surface water, more than 90% of water bodies were reported to have poor chemical status. In five Member States, above 40% of surface waters had poor chemical status.  
对于地表水，90%以上的水体为较差化学状况。在五个成员国，40%以上的地表水体为较差化学状况。
- Six Member States reported poor chemical status for a majority of the transitional water bodies (>50%) and/or coastal water bodies (>90%) for which they have data. PAHs, the antifouling biocide tributyltin (TBT) and heavy metals are among the most common culprits.  
六个成员国报告称他们有数据的大多数过渡性水体（>50%）和/或沿海水体（>90%）为较差化学状况。PAH（多环芳氢）、驱虫杀虫剂三丁基锡（TBT）和重金属是最常见的罪魁祸首。

The status assessment of the European Commission of 2012 also showed that transboundary cooperation at river basin level is well under way in most of the river basins. In the most advanced river basins (marked with green in the map in figure 2.6 below) have a bilateral cooperation agreement, an institutional framework in the form of a cooperation body is in place (such as the international river basin commissions in the Rhine river basin or the Danube river basin, see chapter 3.3 below), and an international river basin management plan.

欧盟委员会 2012 年的状况评定也表明，流域层面的跨境合作正在多数流域顺利推进。在多数发达的流域（下面图 2.6 中标为绿色的）都有双边合作协议、合作团体形式的机构框架（比如莱茵河流域或多瑙河流域的国际流域委员会，见下文第 3.3 节）和国际流域管理规划。

**Figure 2.6 EU River Basin Districts with transboundary cooperation, per 2012.**

**图 2.6 2012 年实行跨境合作的欧盟流域区**



Source: European Commission (2014b)来源：欧盟委员会（2014b）

Assessing the 2009 reporting of measures, the European Environment Agency estimates that the status for European water bodies by 2015 (end of the first cycle of implementation) will have improved somewhat: The percentage of surface water bodies with good or high ecological status is expected to go up from 42% in 2009 to 52% in 2015, the percentage of groundwater bodies with good chemical status is expected to go up from 80% in 2009 to 89% in 2015, and the percentage of groundwater bodies with good quantitative status is expected to go up from 87% in 2009 to 96% in 2015. With regards to chemical status for surface water bodies, the data from 2009 was not adequate enough to serve as a baseline.

通过评价 2009 年的措施报告，欧洲环境署估计到 2015 年（第一实施周期末）欧洲水体的状况会有所改善：良好或优等生态状况的地表水体的比例预计会从 2009 年的 42% 上升到 2015 年的 52%，良好化学状况的地下水体的比例预计会从 2009 年的 80%



上升到 2015 年的 89%，良好量化状况的地下水比例会从 2009 年 87% 上升到 2015 年的 96%。至于地表水体的化学状况，2009 年的数据不足以作为基线。

There is still a long way to go to fully reach the goals of the WFD in all European water bodies and reduce regional environmental risks to desired levels, and it seems unlikely that the goals can be fully met by the deadline 2027 (Hering et al., 2010). This is not surprising. It would seem overly optimistic to expect European aquatic ecosystems to fully recover in 15-20 years from more than a century of degradation. Recovery of biotic communities requires the implementation of measures and the response of the ecosystem, and both steps need many years, sometimes decades. Where restoration measures and land use changes can be implemented rapidly there will in many cases be improvements in ecological status by 2027, although not necessarily all the way to ecological good status. The WFD framework and methodology with revolving six-year implementation cycles is a dynamic system, which it should be feasible to extend beyond 2027 in accordance with a future assessment of a realistic timescale for fully reaching the objectives of the directive.

所有的欧洲水体要完全达到 WFD 的目标以及将区域环境风险降至所期望的水平仍有很长的路要走，而且到截止时间 2027 年完全实现目标似乎是不可能的，欧盟水生生态系统在 15-20 年内从一百年的退化中完全恢复过来这一想法过于乐观。生物群落的恢复需要措施的落实和生态系统的响应，这两步都需要很多年，有时需要几十年。很多情况下，如果恢复措施和土地利用方式变更能够快速落实，生态系统到 2027 年就会改善，但未必会达到良好生态状况。WFD 框架和方法有循环的六年实施周期，是一个动态系统，根据对未来完全实现指令目标的现实时间表的评估，延长到 2027 年以后应该是可行的。

## 2.2.6 Lessons and suggestions for China 对中国的建议

It is difficult to provide precise suggestions for China without first having studied the current system for protection of aquatic ecology and water management in China. At a general level, however, the WFD would seem to contain a number of features that are relevant in China.

如果不首先研究中国当前的水生生态保护和管理体系，就很难为中国提供准确的建议。但一般来说，WFD 似乎有很多可以在中国发挥作用的特点。

Since the beginning of the 11<sup>th</sup> Five-Year Plan (2006-2010) the Chinese Government has greatly increased its efforts to improve water management and reduce water pollution, but the situation is still very serious in much of the country (Economist 2013).<sup>20</sup> Water is a limited and unevenly distributed resource in China. Four-fifths of China's water is in the south (notably in the Yangzi river basin), while half the people and two-thirds of the farmland is in the north, including the Yellow River basin. Due to over-use, the water table under Beijing has dropped by 300 meters since the 1970s. Overuse of water leads

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<sup>20</sup> The data in this paragraph are mainly taken from a recent overview article in the Economist (Economist 2013), if other sources are not referred to. 如果未提及其他资料来源，本段中的数据主要摘自《经济学家》(Economist 2013) 最近一篇综述文章。

to rivers disappearing and the number of rivers with significant catchment areas has fallen from more than 50,000 in the 1950s to 23,000 in 2013. The surface water that is left is often heavily polluted. In 2007 the Yellow River Conservancy Commission, a government agency, surveyed 13,000 kilometers of the river and its tributaries and concluded that a third of the water was unfit even for agriculture. Agricultural and industrial pollution are among the main sources of water pollution. In 2007, the Yellow River Conservancy Commission registered 4,000 petrochemical plants along the river stretch surveyed. Also groundwater resources are heavily polluted. In 2012, statistics from the Ministry of Environmental Protection showed that underground water in 57% of monitoring sites across Chinese cities were polluted or extremely polluted. The numbers suggest that almost 300 million rural residents in China do not have access to safe drinking water (Xinhua, 2012; Gong & Liu, 2013). In 2009, the World Bank put the overall cost of China's water crisis at 2.3% of GDP (Xie, 2009), mostly reflecting damage to health. Modifications of water bodies due to development of hydropower and urban developments also have large-scale negative impacts on freshwater environments in China.

自“十一五”以来，中国政府加大了改善水管理和减少水污染的力度，但全国许多地方的情况仍十分严重（经济学家，2013）。在中国，水是一种有限的、分布不均衡的资源。中国五分之四的水集中在南方（尤其是长江流域），而一半的人口和三分之二的农田分布在北方，包括黄河流域。由于过度使用，北京的地下水位自 20 世纪 70 年代以来下降了 300 米。过度用水导致河流消失，有重要蓄水区的河流数量从 20 世纪 50 年代的 5 万多条减少到 2013 年的 23000 条。遗留下来的地表水常常受到严重污染。2007 年，黄河水利委员会调查了 13000 公里的黄河及其支流。调查结论是，约三分之一的黄河水已不适用于农业生产。农业和工业污染是主要的水污染来源。2007 年，被调查河段沿岸有 4000 家石油化工厂在黄河水利委员会注册。地下水资源污染也很严重。2012 年，环保部的统计资料表明，57% 的中国城市地下水监测点的地下水受到了污染或者严重污染。数字表明，中国近 3 亿农村居民无法获得安全的饮用水（Xinhua, 2012; Gong & Liu, 2013）。2009 年，世界银行估计中国的水危机总成本占 GDP 的 2.3%（Xie, 2009），主要反映健康损害。水电站开发和城市发展对水体造成的干扰也对中国的淡水环境产生了大范围的负面影响。

China's challenges related to sustainable use and management of water resources are huge. Similar to in the EU, the first steps are to put in place necessary sector regulation and investments to address specific issues such as nitrates and other pollution from agriculture, industrial pollution, urban wastewater treatment and other measures to reduce obvious pollution pressure. This is happening, one example being the Ministry of Housing and Urban Rural Development's announcement in 2013, that they will be spending RMB 410 billion on improving water quality in urban areas by 2016 (Gong & Liu 2013). Another type of first steps is the measures to protect water bodies and aquatic ecology, under the Ministry of Environment, and the use of environmental impact assessments.

在水资源的可持续利用和管理方面，中国面临巨大挑战。和欧盟的情况相似，中国的基本措施是：制定行业法规，投入资金来解决特定问题，比如农业带来的硝酸盐和其他污染、工业污染、城市废水处理，并采取其他措施来减轻明显的污染压力。这些工作正在开展，例如 2013 年住房和城乡建设部发布公告，宣布将投入 4100 亿元人

民币，到 2016 年改善城市地区的水质（Gong & Liu 2013）。另一类基本措施是环保部保护水体和水生生态的措施，以及开展环境影响评价。

One could argue that until such instruments and measures are fully implemented, there is no use for framework legislation such as the framework directive. We would disagree. While these instruments and measures are extremely important and fundamental, the experience from Europe is that they when implemented in a fragmented manner will not ensure sufficient protection and a sustainable and economically optimal use of water resources. A holistic and river basin management approach to water management and reduction of regional environmental risks is crucial to ensure coordination of efforts and that the benefits of different types of use are balanced within the scope of pressure that is compatible with upholding the natural capital and ecosystem services of the river basin. This has been documented also outside of the EU (Mostert, 2003).<sup>21</sup>

诸如框架指令之类的框架性立法是各项措施充分发挥作用的基础和保障。虽然这些工具和措施是极为重要和基本的，但欧洲的经验表明，分散地实施各项工具和措施无法保证水资源得到充分的保护和可持续的、最经济划算的使用。采取整体的流域管理方法进行水管理并降低区域环境风险对于确保各项努力的协调以及不同类型利用方式的效益在适于支撑流域的自然资本和生态系统服务的压力范围内达到平衡是至关重要的。这一点在欧盟以外的一些地方也得到了证明（Mostert, 2003）。

The approaches (ref. 2.2.3) and tools (ref. 2.2.4) of the WFD would need to be used and applied by China in accordance with local circumstances, institutional capacities and other factors. While the WFD generally speaking is a success, it has also been criticized for being unnecessarily complicated and to set in motion administrative and scientific coordination processes that are time-consuming and where the outcome is uncertain. A general point of advice would be to learn from the best practices exemplified by the WFD, but try to at the same time keep things as simple and practical as possible to reduce transaction costs.

中国需要根据自己的国情、机构能力和其他因素来借鉴 WFD 的方法和工具（ref. 2.2.4）。虽然一般来说 WFD 是成功的，但它也因以下问题而受到指责：过于复杂，而且需要启动非常耗时的行政和科学协调过程，但未必有成效。一般的建议是，学习 WFD 给出的最佳实践经验，但同时又要努力尽可能地把事情简单化、实用化，以降低交易成本。

The following more specific points should merely be seen as suggestions and ideas, that would require more study and detail for potential follow-up. We also refer to the ongoing China-Europe Water Platform (CEWP) project, which promotes European and Chinese cooperation on water issues. The China-Europe Water Platform project (CEWP,

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<sup>21</sup> A global review of conflict and co-operation in 35 international river basins, concluded that the old water management paradigm (national resources water development) is gradually being replaced by a new paradigm: integrated river basin management across all levels, national, international and sub-national (Mostert 2003).

一项对 35 个国际流域的冲突与合作的全球回顾得出的结论是：旧的水管理范式（国家资源水开发）正逐渐被新的范式取代：国家、国际和地方所有层面的一体化流域管理（Mostert 2003）。

2014) facilitates cooperation and is also a dynamic resource hub for relevant information about EU experiences, the outcome of EU-Chinese joint fact-finding assessments and missions, as well as relevant events and news.<sup>22</sup>

以下比较具体的看法只可当做建议和观点，落实起来则需要更多的研究和细节。我们还要谈到正在实施的中国-欧洲水资源交流平台项目（CEWP）。该项目促进欧洲和中国在水问题上的合作，同时也是一个关于欧盟经验的相关信息、欧盟-中国联合实地调查评估和任务成果以及相关事件和新闻的动态资源枢纽。

The Communist Party of China has in 2013 stressed the need for an “ecological red line” to ensure basic ecological protection necessary. With the goals of Good Ecological Status and Maximum Ecological Potential, the WFD shows how ecology can be put at the base of management decisions related to water management and the directive provides a methodology for how ecological red lines may be established for different types of water bodies (in co-operation with the Habitats Directive, see chapter 2.4.1 below).

2013 年，中国共产党强调需要用一条“生态红线”来确保必要的基本生态保护。WFD 用良好生态状况和最大生态潜力目标说明了如何将生态作为与水管理有关的管理决策的基础，该指令还提供了为不同类型的水体建立生态红线的方法（结合《栖息地指令》，见下文第 2.4.1 节）。

In the WFD, the inventory and river basin management plan provides the opportunity to assess the extent to which measures triggered by other legislation are in fact enough to preserve aquatic ecology and drinking water sources from accumulated and acute risk. If it is shown that that is not the case, the directive obligates the country and river basin authority to close this gap with additional measures. By such an approach it is checked whether the accumulated effect of environmental legislation related to water actually delivers the desired environmental state in the water bodies, The WFD requirements thereby supplement other environmental and sector legislation and ensure that gaps are filled. Such an assessment of the combined effects of environmental and sector legislation related to water in China, would likely also reveal gaps and be helpful in work to improve the environmental quality of water.

在 WFD 中，借助清单和流域管理规划可以评价其他立法规定的措施对于保护水生生态和饮用水源免遭累积性和突发性风险威胁的程度。如果事实表明情况并非如此，指令就会强制要求国家和流域管理局用其他措施来缩小这一差距。这种方法可以检验与水有关的环境立法的累积效果是否可以实现预期的水体环境状况目标。因此，WFD 的要求是对其他环境立法和行业立法的一个有益补充，是为了确保上述差距的消除。在中国，此类对与水有关的环境立法和行业立法的综合效果的评估还能揭示差距，有利于开展水的环境质量改善工作。

Baseline data and monitoring is essential when trying to ensure more sustainable and effective water management. The monitoring and reporting requirements of the WFD

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<sup>22</sup> The CEWP website including resources and news is available here: [www.cewp.org](http://www.cewp.org)

收录资源和新闻的 CEWP 网址是: [www.cewp.org](http://www.cewp.org)

shows the depth, scope and institutional arrangement necessary to be able to establish a baseline and to monitor effects of measures, when striving to attain a more sustainable use of water resources. It also shows how such a mainstreamed system provides the possibility for detailed and differentiated analysis of status and pressures across provinces, showing the distribution of problems and pressures allowing for targeted and effective action.

在试图确保更加持续有效的水管理时，基线数据和监测是必不可少的。WFD 的监测和报告要求说明了在努力实现更加可持续的水资源利用时，建立基线和监测措施效果所必需的深度、范围和制度安排。还说明了一个如此主流化的系统是如何为详细而差异化地分析各省情形和压力提供可能的，说明了问题和压力的分布情况允许采取有针对性的有效行动。

It has been noted (Mateo-Sagasta et al., 2013) that water pollution in China tends to be more narrowly defined than in other countries, and the main targets for water pollution control continue to be chemical oxygen demand (COD) and ammonia ( $\text{NH}_3$  – a form of nitrogen). Limit values for other pollutants are, however, also used in different contexts. With its list of 33 Priority Substances and 8 Certain Other Pollutants, the WFD shows a more extensive and refined system for the mandatory assessment of chemical status of all water bodies.

有人曾指出 (Mateo-Sagasta et al., 2013)，相比其他国家，中国的水污染定义更加狭义，中国水污染控制的主要对象一直是化学需氧量 (COD) 和氨氮 ( $\text{NH}_3$  ——一种氮)。其他污染物的限值却用于不同的环境中。WFD 利用 33 种重点控制物质和 8 种其他污染物清单，展示了一个比较广泛而精确的用于强制评定所有水体化学状况的系统。

In China responsibilities for dealing with water is split between several agencies within government: Water pollution and aquatic ecology is the responsibility of the Ministry of Environmental Protection, water supply is the responsibility of the Ministry of Water Resources, sewage treatment is under the Ministry of Construction, and groundwater management is under the Ministry of Land and resources. The framework of integrated river basin management plans provides a platform for coordination of efforts between different agencies at central and provincial levels, as well as between provinces sharing river basins. The strategy of Integrated River Basin Management (IRBM) is not new to China. It was incorporated into China's 2002 Water Law and development cooperation programs, such as the EU-China river basin management programme (2006-2012) and CEWP, have also supported application of IRBM in China. As the application of IRBM is not mainstreamed, however, there is likely still substantial room for learning from EU experiences with regards to assessment and management of regional environmental risks related to water.

在中国，水管理职责由几个不同的政府机构分担：水污染和水生生态由环境保护部负责，供水由水利部负责，污水处理由建设部负责，地下水管理由国土资源部负责。综合流域管理规划框架为中央和省级不同机构之间以及流域共享各省之间的工作协调提供了平台。综合流域管理 (IRBM) 战略对于中国来说不是件新鲜事。它被纳入中国 2002 年的《水法》，而且诸如欧盟-中国流域管理计划 (2006-2012) 和 CEWP (中国-欧洲水资源交流平台) 之类的发展合作计划也支持了 IRBM 在中国的实施。然而，由

于 IRBM 的应用并非主流化的，因此中国可能还有很大的空间可以吸取欧盟在与水有关的区域环境风险评估和管理方面的经验。

## 2.3 Release of heavy metals and other hazardous substances

### 重金属和其他危险物质的排放

In this section we present the OSPAR Convention, EU REACH Directive and the EU Seveso Directive as examples on how release of heavy metals and other hazardous substances have been regulated in Europe.

本节我们以《OSPAR 公约》（奥斯陆-巴黎公约）、《欧盟 REACH 指令》和《欧盟 Seveso 指令》为例，说明欧洲如何监管重金属和其他危险物质的释放。

### 2.3.1 OSPAR Convention OSPAR 公约（奥斯陆-巴黎公约）

#### 2.3.1.1 Introduction 引言

The North Sea is an area of intense human activity. Approximately 184 million people live within the catchment area and the population density puts great pressure on the marine environment. Land-based discharges (river input and direct discharge), ocean-based discharges (dumping and incineration at sea) and atmospheric deposition have been among the major sources of contaminant inputs to the North Sea. The intense human activity on- and off-shore is the result of increasing economic activity following the Second World War, which led to a rapid growth in waste production. As a response, **a set of international regulations directed at waste dumping at sea and land based sources have been put in place in order to combat marine pollution risk** (long-term accumulative pollution as well as acute incidences, including both types in specific Marine Protected Areas) in the North Sea and the wider North-East Atlantic, most notably being the Convention for the Protection of the marine Environment of the North-East Atlantic (the 'OSPAR Convention') (Skjærseth, 2000).

北海是一个人类活动密集的地方。大约 1.84 亿人住在排水区内，人口密度给海洋环境造成了巨大压力。陆源排放（河流输入和直接排放）、海上排放（海上倾倒和焚烧）和大气沉降是其中输入北海的污染物的主要来源。陆上和海上密集的人类活动是第二次世界大战之后日益增加的经济活动带来的结果，导致垃圾排放量快速增长。为应对这些环境问题，针对海上和陆源垃圾倾倒出台了一系列国际法规，以降低北海及更广泛的东北大西洋海洋污染带来的环境风险（包括特定海洋保护区中长期累积污染以及突发环境事件）。其中最有效的当属《保护东北大西洋海洋环境公约》（简称‘OSPAR 公约’）（Skjærseth, 2000）。

The OSPAR Convention was adopted at the Ministerial Meeting of the Oslo and Paris Commissions in Paris in 1992, merging the previous Oslo Convention (1972) and the Paris Convention (1974) which, respectively, addressed dumping and incineration of waste and land-based pollution the North East Atlantic region. The Convention has been signed and ratified by all the Contracting Parties to the original Oslo or Paris Conventions, which it replaces (Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland) and by Luxembourg and Switzerland. The Convention entered into force on 25 March 1998.

《OSPAR 公约》是 1992 年在巴黎的奥斯陆-巴黎部长级会议上通过的，将以前的《奥斯陆公约》（1972 年）和《巴黎公约》（1974 年）合并在一起，它们分别论及

东北大西洋地区的垃圾倾倒和焚烧以及陆源污染。该公约由它所取代的《奥斯陆公约》或《巴黎公约》的所有原缔约各方签署和批准（比利时、丹麦、欧盟、芬兰、法国、德国、冰岛、爱尔兰、荷兰、挪威、葡萄牙、西班牙、瑞典及大不列颠联合和北爱尔兰联合王国），也经过了卢森堡和瑞士的签署和批准。该公约于 1998 年 3 月 25 日生效。

OSPAR's sister convention HELCOM (Helsinki convention) for protection of the Baltic Sea targets much of the same problems as the OSPAR Convention, and there is considerable overlap in guidelines, target setting, monitoring, etc. The contracting parties of HELCOM are also overlapping with OSPAR (HELCOM partners: Denmark, Estonia, European Union, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden).

OSPAR 的姊妹公约 HELCOM（赫尔辛基公约）是保护波罗的海的，所涉及的问题大多与 OSPAR 相同，并且在指导原则、目标设定和监测等方面有很多重叠部分。HELCOM 的缔约各方与 OSPAR 也有重叠（HELCOM 缔约各方：丹麦、欧盟、芬兰、德国、拉脱维亚、立陶宛、波兰、俄罗斯和瑞典）。

OSPAR maintain close collaboration with other international bodies dealing with protection of the marine environment, as for instance the International Maritime Organization (IMO) and the EU through EU's Marine Strategy Framework Directive (MSFD, Directive 2008/56/EC). For instance, OSPAR Parties aim to ensure that their marine monitoring and assessment work result in dual use for OSPAR and for MSFD requirements (OSPAR Commission, 2013).

OSPAR 与其他从事海洋环境保护的国际机构保持紧密协作，例如国际海事组织（IMO）和欧盟。它是通过欧盟的《海洋战略框架指令》（简称 MSFD，指令 2008/56/EC）与欧盟协作的。例如，OSPAR 缔约各方的目的是保证其海洋监测和评估工作能够服务于 OSPAR 和 MSFD。

**The significance of OSPAR lay in decisions that are binding under international law.** However, like all international conventions OSPAR lacks enforcement mechanisms<sup>23</sup>. The overlap of member countries in OSPAR and the EU is of vital importance to enforcement of OSPAR decisions and regulations since EU Directives are directly binding to member states. Thus, the EU has more powerful tools to ensure compliance and also has its own court which can issue penalties in the case of non-compliance (Skjærseth 2012). Whereas there are many overlaps between the OSPAR and EU regimes on marine pollution, including on environmental quality objectives, on some matters (e.g. hazardous substances and eutrophication) OSPAR measures appear to be stronger. **Due to the lack of enforcement power, however, the role of OSPAR is more to obtain the information, identify the problems and the possible solutions**

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<sup>23</sup> Because there is no overarching authority to enforce international law, some contend that international law is not really law at all. Others maintain that the sources of enforcement simply reside elsewhere – in domestic institutions, reputation, reciprocity etc. See a discussion of these matters in von Stein (2010). 由于没有一个总管机构来执行国际法律，有人认为国际法律根本就算不上是法律。其他人则认为执法源就在别处——国内机构、声誉、互惠等。这些问题的讨论见 von Stein（2010）。



**and then ask the EU Commission to take legislative action.** As in other matters, the individual Member States are responsible for developing, implementing and enforcing the appropriate legislation. It has become common practice for the OSPAR Commission to draft background documents and send them to the responsible European Commission Directorate-General (DG). As EU already has its own legal instruments the DG may, however, not always take the action recommended by OSPAR Commission (Frank, 2007).

**OSPAR** 的意义在于它是国际法律下有约束力的决议。然而，像所有的国际公约一样，OSPAR 也缺乏强制执行机制。OSPAR 与欧盟成员国的重叠对于执行 OSPAR 决议和法规是至关重要的，因为欧盟指令对成员国具有直接约束力。因而，欧盟有更强大的工具来确保公约的遵守，同时它也有自己的法庭，在出现违反公约的情况时可以做出处罚（Skjærseth 2012）。鉴于在海洋污染问题上、包括在环境质量目标上，OSPAR 和欧盟制度有很多重叠的地方，在有些问题上（例如危险物质和富营养化）OSPAR 的措施显得更有力。然而由于缺乏强制执行力，OSPAR 的作用更多的是获取信息、找出问题和可能的解决方案然后让欧盟委员会采取立法行动。和在其他问题上一样，欧盟各成员国负责制定、实施和执行适当的立法。OSPAR 委员会起草背景文件，然后发送给欧盟委员会负责总司（简称 DG），这已成为惯例。欧盟有自己的法律文件，但总司并不总会采取 OSPAR 委员会所建议的行动（Frank, 2007）。

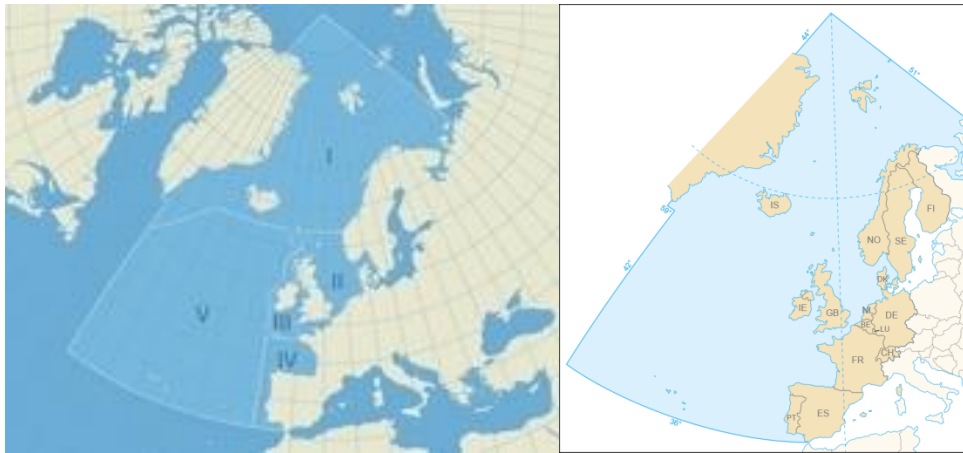
The OSPAR Convention covers most of the North-East Atlantic and its adjacent seas. This is a vast area of about 13.5 million square km which includes a diverse range of environmental conditions and different ecosystems. The marine waters are divided into five biogeographic regions, which are subject to separate priority actions, monitoring, reporting etc. (see figure 2.7):

《OSPAR 公约》涉及东北大西洋及其邻海大部分地区。这是一片辽阔的区域，约有 1350 万平方公里，区域内有各种各样的环境条件和不同的生态系统。海洋水域分为五个生物地理区，可开展单独的重点行动、监测报告等（见图 2.7）。

- Region I Arctic Waters 一区北极水域
- Region II Greater North Sea 二区大北海
- Region III Celtic Seas 三区凯尔特海
- Region IV Bay of Biscay and Iberian Coast 四区比斯开湾和伊比利亚海岸
- Region V Wider Atlantic 五区广泛大西洋

**Figure 2.7 Marine areas and countries covered by OSPAR.**

图 2.7 OSPAR 所涉及的海域和国家



Source: 来源:

The ecology of the OSPAR regions includes a wide range of species and habitats, from the ice-bound and fjord coastlines of Region I, to the estuaries, sea lochs, areas and open bays of Regions II, III and IV, and to the deep-ocean ecosystems of Region V. Long-range air transport of persistent organic pollutants (POPs) to the vulnerable arctic waters are of particular concern.

OSPAR 区域的生态有各种各样的物种和栖息地，从一区的冰封峡湾海岸到二区、三区 and 四区的入海口、海湾、地区和外湾，到五区的深海生态系统。远距离航空运输将持久性有机污染物（POP）运到脆弱的北极水域，这值得人们特别关注。

Contained within the OSPAR Convention are a series of Annexes which deal with the following specific areas and state the means for reaching the targets for each area:

《OSPAR 公约》包含一系列针对以下特定领域的附录，并规定了达到每个领域的目标的手段：

- Annex I: Prevention and elimination of pollution from land-based sources. States, inter alia, that point source discharges to the maritime area, and releases into water or air which reach and may affect the maritime area, shall be strictly subject to authorization or regulation by the competent authorities of the Contracting Parties.  
附录 I：防止并消除陆源的污染。尤其规定了向海域的点源排放以及向到达并且可能影响海域的水或空气的排放须严格接受缔约各方主管部门的授权和监管。
- Annex II: Prevention and elimination of pollution by dumping or incineration. States, inter alia, that dumping of all wastes or other matter is prohibited, except for those wastes or other matter listed in separate paragraphs.  
附录 II：防止并消除倾倒和焚烧造成的污染。尤其规定了禁止倾倒一切废弃物或其他物质，单独条款里列出的废弃物或其他物质除外。
- Annex III: Prevention and elimination of pollution from offshore sources. States, inter alia, that any dumping of wastes or other matter from offshore installations is prohibited.  
附录 III：防止并消除海上来源的污染。尤其规定了禁止从海上设备倾倒废弃物或其他物质。

- Annex IV: Assessment of the quality of the marine environment. States, inter alia, that the Contracting Parties shall cooperate in carrying out monitoring programmes and submit the resulting data to the Commission

附录 IV：评估海洋环境质量。尤其规定了缔约各方应合作执行监测计划，并向委员会提交监测产生的数据。

In addition, Annex V covers all human activities in general that might adversely affect the marine environment of the North-East Atlantic. In spite of this Annex, the OSPAR Convention explicitly does not cover questions relating to fisheries management. Also there is a preference for issues related to shipping to be dealt with by the International Maritime Organisation (IMO). Annex V states, inter alia, that Contracting Parties shall take the necessary measures to protect and conserve the ecosystems and the biological diversity of the maritime area, and to restore, where practicable, marine areas which have been adversely affected; and cooperate in adopting programmes and measures for those purposes.

另外，附录 V 涉及可能对东北大西洋海洋环境有不良影响的绝大多数人类活动。虽然有本附录的规定，但《OSPAR 公约》明确不涉及与渔业管理有关的问题。同时与航运业有关的问题优先由国际海事组织（IMO）处理。附录 V 尤其规定了缔约各方应采取必要措施来保护该海域的生态系统和生物多样性，并在可行情况下修复受到不良影响的海域；并为了这些目的合作执行计划和措施。

### **Box 2.3 The OSPAR and HELCOM Conventions and Regional Risk Assessment and Management**

The sister Conventions OSPAR and HELCOM deals with the protection of marine environment in the North East Atlantic region and the Baltic Sea, respectively. Intense economic activity in these regions has led to a multitude of long-term accumulative and acute environmental risks to marine habitats caused by sources at sea as well as by land-based activities. The Conventions take an ecosystem approach, which implies that comprehensive regional monitoring of status and management of risks are carried out to identify and mitigate environmental risks. So-called Marine Protected Areas are identified and are subject to special attention for the purpose of protecting and conserving sensitive species, habitats, ecosystems or ecological processes of the marine environment.

Long-term monitoring is carried out by the Parties of the Conventions. Monitoring includes atmospheric inputs, riverine inputs and direct discharges and dumping, as well as effects in a broad range of biogeochemical end-points in the marine environment. Periodic assessment of progress towards targets is carried out and potential knowledge gaps identified.

### **框 2.3 OSPAR 公约和 HELCOM 公约以及区域风险评估和管理**

姊妹公约 OSPAR 和 HELCOM 分别负责东北大西洋区域和波罗的海的海洋环境保护。这些区域密集的经济活动，比如海上和陆地活动，已为海洋栖息地带来多种长期的累积性和突发性环境风险。这两个公约从生态系统的角度出发，这就意味着要开展对风险现状和管理的全面的区域监测，以发现并减缓环境风险。为了保护和保存海洋

环境中的敏感类物种、栖息地、生态系统或生态过程，确定了所谓的海洋保护区，使之得到特殊关注。

公约各方开展长期监测，包括大气输入、河流输入、直接排放和倾倒以及海洋环境中生物地球终端广泛的范围内的效果。各方还将就目标实现进展进行定期评估，并确认潜在的知识差距。

### 2.3.1.2 Principles 原则

The following are the main principles guiding the OSPAR Convention (OSPAR, 2014):

下面是指导 OSPAR 公约的主要原则（OSPAR，2014）：

**Precautionary Principle:** By virtue of the precautionary principle, preventive measures are to be taken when there are reasonable grounds for concern that human activities may bring about hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea, even when there is no conclusive evidence of a causal relationship. A lack of full scientific evidence must not postpone action to protect the marine environment. The principle anticipates that delaying action would in the longer term prove more costly to society and nature and would compromise the needs of future generations.

**风险预防原则：**借助风险预防原则，在有合理的理由担心人类活动会给人类健康带来危害、危害生物资源和海洋生态系统、损坏康乐设施或者妨碍海洋的其他合法用途时，要采取预防措施，即使没有证明因果关系的决定性证据。不得因缺乏充分的科学证据而推迟保护海洋环境的行动。该原则预示着，从长期来看，延迟海洋环境保护的行动势必会让社会和自然付出更大的代价，并且会危害子孙后代的需求。

**Polluter Pays Principle:** The polluter pays principle requires that the costs of pollution prevention, control and reduction measures must be borne by the polluter. The polluter pays principle is mainly implemented by means of command-and-control approaches but also via market-based mechanisms, e.g. for the development and introduction of environmentally sound technologies and products.

**污染者付费原则：**污染者付费原则要求污染防治措施和减污措施的费用须由污染者承担。污染者付费原则主要通过指挥控制方法来执行，但也通过市场机制来执行，例如开发和引入环保型技术和产品。

**Best Available Techniques (BAT) and Best Environmental Practices (BEP):** The OSPAR Convention requires Contracting Parties to apply Best Available Techniques (BAT) and Best Environmental Practice (BEP) including, where appropriate, clean technology, in their efforts to prevent and eliminate marine pollution. OSPAR has pioneered this concept internationally and adopted a large number of Recommendations and Decisions on BAT and BEP for various industrial technologies and sources of land-based pollution. In OSPAR BAT means “the latest stage of development (state of the art) of processes, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste”. BEP is defined as “the application of the most appropriate combination of environmental control measures and strategies”. It follows that BAT and BEP for a particular source will change with time in the light of technological advances, economic and social factors, as well as changes in

scientific knowledge and understanding. Discharges from point sources, such as manufacturing plants, are regulated mainly by means of requiring the use of BAT and by setting emission standards. Discharges from diffuse sources, such as a cultivated land, are controlled by means of BEP, marketing and use of products.

最佳可行技术（BAT）和最佳环境实践（BEP）：《OSPAR 公约》要求缔约各方在其防止并消除海洋污染的工作中采用最佳可行技术和最佳环境实践，适当情况下包括清洁技术。OSPAR 在国际上开创了这一概念，对各种工业技术和陆地污染源通过了大量 BAT 和 BEP 建议和决议。在 OSPAR 里，BAT 是指“最新发展阶段（最新水平）的工艺、设施或操作方法，其表明限制排放和废物的特殊措施具有实际适用性”。BEP 被定义为“应用最恰当的环境治理措施和战略组合”。结果是，由于技术进步、经济社会因素以及科学知识和认识的变化，特殊来源的 BAT 和 BEP 会随着时间而变。对制造工厂等点源排放的监管手段是：要求采用 BAT，并制定排放标准。对耕地等分散源的排放则是通过 BEP、产品销售和使用来控制。

Regarding hazardous substances, the substitution principle, i.e. the substitution of hazardous substances by less hazardous substances or preferably non-hazardous substances where such alternatives are available applies.

至于危险物质，则适用替代原则，即：如果有该等替代品的话，用危害较小的物质或者最好用无害物质代替危险物质。

### 2.3.1.3 Approach 方法

OSPAR is implementing five thematic strategies to address the main threats that are identified: 1) The Biodiversity and Ecosystem Strategy, 2) the Eutrophication Strategy, 3) the Hazardous Substances Strategy, 4) the Offshore Industry Strategy, and 5) the Radioactive Substances Strategy. A sixth strategy is the overarching Strategy for the Joint Assessment and Monitoring Programme, which assesses the status of the marine environment and follows up implementation of the strategies. These six strategies fit together to underpin the ecosystem approach (see above). Although not a separate Strategy, the OSPAR Commission also considers climate change issues.

OSPAR 实施五项专题战略来应对已确定的主要威胁：1）生物多样性和生态系统战略，2）富营养化战略，3）危险物质战略，4）海上工业战略，和 5）放射性物质战略。第六项战略是统筹全局的联合评估与监测计划战略，评估海洋环境的状况并跟踪战略的实施情况。这六项战略组合在一起，共同支撑生态系统方法（见上文）。OSPAR 委员还考虑气候变化问题，虽然不把它作为一项独立的战略。

**The overarching approach in OSPAR is the ecosystem approach** which enables the OSPAR Commission to work coherently towards a holistic approach to the problems addressed by the different OSPAR Strategies. An ecosystem is a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit at different spatial scales. **For the purpose of the OSPAR Convention, the ecosystem approach is defined as “the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of**

**ecosystem integrity". The application of the ecosystem approach integrates conservation and management approaches, such as marine protected areas or measures targeted on single species and habitats.**

OSPAR 中统筹全局的方法是生态系统法，它可以使 OSPAR 委员会始终致力于用全盘方法来解决 OSPAR 不同战略所涉及的问题。生态系统就是植物、动物和微生物群落的一个动态综合体，它们的非生物环境作为不同空间范围的功能单位相互影响。就《OSPAR 公约》而言，生态系统法被定义为“根据生态系统及其动力学系统方面的最佳可用科学知识对人类活动进行全面综合管理，以便确定对海洋生态系统的健康至关重要的影响并采取行动，进而实现生态系统商品和服务的可持续利用并维持生态系统的完整性。”生态系统法的应用综合了保护法和管理法，比如海洋保护区或者针对单一物种和栖息地的措施。

The OSPAR Commission promotes the implementation of the ecosystem approach in the North-East Atlantic within the framework of the Convention on Biological Biodiversity by means of programmes and measures developed under its Strategies, such as the Ecological Quality Objectives (EcoQOs). OSPAR's work focusses on four elements in particular<sup>24</sup>:

OSPAR 委员会促进生态系统方法在《生物多样性公约》的框架内、通过根据 OSPAR 战略制定的计划和措施、比如生态质量目标（EcoQO），在东北大西洋实施。OSPAR 的工作以下面四个元素为重点：

1. Promoting understanding and acceptance by all stakeholders of the ecosystem approach to the management of human activities, and collaboration among the various management authorities in the North-East Atlantic in implementing that approach;  
促进所有的利益相关者了解和接受管理人类活动的生态系统法，并促进东北大西洋各管理机构合作实施该方法；
2. Monitoring the ecosystems of the marine environment in order to understand and assess the interactions between and among the different species and populations of biota, the non-living environment and humans;  
监测海洋环境的生态系统，以便了解并评估不同物种和生物种群、非生物环境和人类之间的相互影响。
3. Setting objectives for environmental quality, underpinned by monitoring, in support both of the formulation of policy and of assessments;  
设定环境质量目标，通过监测来巩固，以便支持政策的制定，并支持评估。
4. Assessing the impact of human activities upon biota and humans, both directly and indirectly through impacts on the non-living environment, together with the effects on the non-living environment itself.

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<sup>24</sup>[http://www.ospar.org/content/content.asp?menu=00430109150000\\_000000\\_000000](http://www.ospar.org/content/content.asp?menu=00430109150000_000000_000000)



评估人类活动通过对非生物环境的影响直接和间接对生物群和人类造成的影响，以及对非生活环境本身的影响。

#### 2.3.1.4 Tools 工具

Work to implement the OSPAR Convention and its strategies is taken forward through the adoption of *decisions*, which are legally binding to the Contracting Parties, *recommendations* and other *agreements*. **Decisions and recommendations set out actions to be taken by the Contracting Parties**, for instance there are several Decisions on programmes and measures on limit values and quality objectives for pollutants such as cadmium, mercury, and chlorinated organic substances, as well as Decisions on the establishment of marine protected areas. As of 2013 there were 158 Decisions and Recommendations. **Agreements include, inter alia, issues of importance; programmes of monitoring, information collection or other work which the Contracting Parties commit to carry out; guidelines or guidance clarifying how programmes and measures should be implemented; and other actions to be taken by the OSPAR Commission on behalf of the Contracting Parties**<sup>25</sup>. Although the Parties to the Convention are empowered to withhold assent, that is not always the case, and **several countries have made reservations**. While the reservation right promotes decision-making effectiveness because one avoids having individual countries impeding progress, it is on the other hand the countries with the highest activity in a particular area that tend to make reservations, making it difficult to achieve an effective solution to the problem. More recently, the EU is playing an increasingly more important role in the North Sea cooperation. Following the change in EU decision making procedures in the environmental sphere – from unanimity to qualified majority – a more comprehensive, ambitious regulatory regime to combat marine pollution has been developed (Skjærseth, 2012).

《OSPAR 公约》及其战略的实施工作通过采用对缔约各方有法律约束力的决议、建议和其他协议来推进。决议和建议提出缔约各方应采取的行动，例如，有几项关于镉、汞和有机氯化物等污染物限值和目标的计划和措施的决议，以及关于建立海洋保护区的决议。截止到 2013，已有 158 项决议和建议。协议内容包括：具有重要意义的问题；监测计划、信息收集计划、以及缔约各方要开展的其他工作的计划；澄清如何落实计划和措施的导则或指导；以及 OSPAR 委员会要代表缔约各方采取的其他行动。虽然公约的缔约各方有权拒绝，但情况并非总是如此，有几个国家已提出了保留。虽然保留权可促进决策的有效性，因为一方面可以避免个别国家妨碍进展，另一方面提出保留的往往是在某个特殊区域最活跃的国家，给有效解决问题带来困难。最近，欧盟正在北海合作中扮演着日益重要的角色。欧盟在环境领域的决议程序发生了改变，一项决议获得通过的表决由全体一致同意改为有效多数同意。这种改变之后，出台了一项更加综合宏大的治理海洋污染的监管制度（Skjærseth, 2012）。

One of the tools applied to ensure the sustainable use and protection and conservation of marine biological diversity and its ecosystems **is the implementation of Marine**

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<sup>25</sup> See list of Decisions, Recommendations and Other Agreements Applicable within the Framework of the OSPAR Convention (last updated 28/10/13): 见 OSPAR 公约框架内适用决议、建议和其他协议的清单：  
[http://www.ospar.org/html\\_documents/ospar/html/ospar\\_decrecs\\_2013.pdf](http://www.ospar.org/html_documents/ospar/html/ospar_decrecs_2013.pdf)

**Protected Areas (MPAs).** The use of protected zones is a long established practice for the protection of resources and livelihoods. Within OSPAR, **MPAs are understood as areas for which protective, conservation, restorative or precautionary measures have been instituted for the purpose of protecting and conserving species, habitats, ecosystems or ecological processes of the marine environment.** The OSPAR Guidelines for the Identification and Selection of Marine Protected Areas<sup>26</sup> provide lists of ecological and practical criteria for selection of MPAs, as, e.g., for the first type the area's importance for threatened or declining species and habitats or high proportion of sensitive species and habitats, and for the second type, e.g., the size of the area should be suitable for the particular aim of designating the area and a high level of support from stakeholders and political acceptability. The Guidelines state that the OSPAR network should take into account the linkages between marine ecosystems and the dependence of some species and habitats on processes that occur outside the MPA concerned, and that the OSPAR network should form an ecologically coherent network of well-managed MPAs. **This is particularly important for highly mobile species, such as certain birds, mammals and fish, to safeguard the critical stages and areas of their life cycle (such as breeding, nursery and feeding areas).** By 31 December 2012, the OSPAR Network of MPAs comprised a total of 333 MPAs, covering 5.2% of the OSPAR maritime area in the North-East Atlantic. The distribution of MPAs across the five OSPAR regions is, however, imbalanced. Especially, **only 1.6% of the Arctic Waters is protected by OSPAR MPAs.** Also, **it was in 2012 not possible to conclude whether MPAs were well-managed, as no evidence on their effectiveness in achieving established goals had been provided and management plans and measures for many sites were still being prepared** (OSPAR Commission, 2013c).

用来确保可持续利用和保护海洋生物多样性及其生态系统的手段之一就是**设立海洋保护区（MPA）**。设立保护区是一种确立已久的保护资源和生计的作法。在**OSPAR**里，海洋保护区被理解为为了保护海洋环境的物种、栖息地、生态系统或生态过程而制定了保护性、恢复性或预防性措施的区域。《OSPAR 海洋保护区识别与选择导则》列出了选择海洋保护区的生态标准和实用标准。第一类保护区的标准包括：区域对于濒危或衰退物种或大部分敏感物种的栖息地具有重要性等。第二类保护区的标准包括：区域的大小应适合将该区域指定为保护区，并且利益相关者高度支持，获得政界认可等。《导则》提出，在处理发生在所涉保护区以外的问题时，OSPAR 网络应考虑海洋生态系统与有些物种和栖息地之间的联系，并且提出 OSPAR 网络应形成一个管理良好的海洋保护区的生态协调的网络。这对于**流动性很强的物种、比如某些鸟类、哺乳动物和鱼类保护其生命期的关键阶段和区域（比如繁殖、哺育和摄食区）是特别重要的**。截止 2012 年 12 月 31 日，OSPAR 海洋保护区网共有 333 个海洋保护区，覆盖东北大西洋 5.2% 的 OSPAR 海域。然而，海洋保护区在五个 OSPAR 区的分布是不均衡的。特别值得一提的是，仅 **1.6% 的北极水域在 OSPAR 海洋保护区的保护之下**。还有，在**2012 年是无法对海洋保护区是否管理良好得出结论的，因为没有人提供证据证明海洋保护区对于实现既定目标是有效的，并且很多地方的管理规划和措施仍在编制之中**（OSPAR 委员会，2013c）。

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<sup>26</sup> [http://jncc.defra.gov.uk/pdf/OSPAR\\_03-17e\\_GuidelinesIdentificationMPA.pdf](http://jncc.defra.gov.uk/pdf/OSPAR_03-17e_GuidelinesIdentificationMPA.pdf)



*Targets and objectives* for the various environmental contaminants and threats are defined within each strategy. The Biodiversity and Ecosystem Strategy seeks to halt and prevent by 2020 further loss of biodiversity in the OSPAR maritime area, to protect and conserve ecosystems and to restore, where practicable, marine areas which have been adversely affected. Management of marine litter also takes place under the objective of the Biodiversity and Ecosystems Strategy. **Ecological Quality Objectives in the North Sea (EcoQO) are being developed to help assess the progress within various fields.** For instance, the burden of plastic particles in the stomachs of northern fulmar is established as an indicator for the abundance of litter encountered at sea, and an EcoQO of OSPAR is that there should be less than 10% of northern fulmars having more than 0,1g plastic particles in the stomach samples of 50 to 100 beach-washed fulmars found from each of the 4 to 5 areas of the North Sea over a period of at least five years.

每项战略里都确定了各种环境污染物和风险的 *目标*。《生物多样性和生态系统战略》以期到 2020 年停止和防止 OSPAR 海域生物多样性的进一步丧失，保护和恢复已被影响的生态系统。海洋垃圾管理也在《生物多样性和生态系统战略》的目标下进行。北海生态质量目标（**EcoQO**）正在制定之中，以帮助评价各领域的进展情况。例如，暴雪鹱胃里的塑料颗粒的量被确定为在海上垃圾量的指标。OSPAR 的 EcoQO 目标就是，在至少五年时间里，在北海 4 到 5 个地区分别采集的 50 到 100 只经过海滩冲刷的暴雪鹱样本里，胃里塑料颗粒量超过 0.1 克的暴雪鹱应占样品总量的 10% 以下。

The Eutrophication Strategy sets the objective to combat eutrophication in the OSPAR maritime area, in order to achieve and maintain by 2010 a healthy marine environment where eutrophication does not occur. **The Strategy seeks to achieve a substantial reduction at source, in the order of 50% compared to 1985, in inputs of phosphorus and nitrogen into areas where these inputs are likely to cause pollution.**

富营养化战略设定了消除 OSPAR 海域富营养化的目标，以便到 2010 年实现并保持不发生富营养化的健康海洋环境。该战略将从源头上削减可能造成污染的氮磷等营养物质向污染海域的排放，营养物质的排放量将在 1985 年的基础上大幅削减 50%。

With respect to the Hazardous Substances Strategy, its targets are to 1) achieve concentrations of contaminants at levels not giving rise to pollution effects, and contaminants in fish and other seafood for human consumption not exceeding levels established by EU legislation or other relevant standards, and 2) to move towards the targets of the cessation of discharges, emissions and losses of hazardous substances by the year 2020.

危险物质战略的目标是：1) 污染物浓度达到不引起污染的水平，鱼类和其他供人食用的海产品中的污染物不超过欧盟立法和其他相关标准规定的水平，以及 2) 到 2020 年，实现停止危险物质排放和流失的目标。

The targets of the Offshore Oil and Gas Industry Strategy are 1) to achieve, by 2020, a reduction of oil in produced water discharged into the sea to a level which will adequately ensure that each of those discharges will present no harm to the marine environment; and 2) to have phased out, by 1 January 2017, the discharge of offshore chemicals that are, or which contain substances, identified as candidates for

substitution, except for those chemicals where, despite considerable efforts, it can be demonstrated that this is not feasible due to technical or safety reasons.

海上石油和天然气工业战略的目标是：1) 到 2020 年，排放到海里的废水中的石油减少到每次排放不会对海洋环境造成危害的水平；以及 2) 到 2017 年 1 月 1 日，逐步消除那些已有可替代物质的海上化学品的排放，由于技术原因或安全原因而无法消除的化学品除外。

Finally, the the Radioactive Substances Strategy seeks to prevent pollution of the OSPAR maritime area from ionising radiation through reductions of discharges, emissions and losses of radioactive substances, with the ultimate aim of concentrations in the environment near background values for naturally occurring radioactive substances and close to zero for artificial radioactive substances.

最后，放射性物质战略寻求通过减少放射性物质的排放和流失，防止电离辐射污染 OSPAR 海域，最终目的是：自然存在的放射性物质在环境中的浓度接近背景值，人造放射性物质在环境中的浓度接近零。

The OSPAR Convention contains a general obligation to collaborate in **regular monitoring and assessment** of the state of the marine environment in the maritime area. Annex IV to the Convention provides for cooperation in monitoring programmes, joint quality assurance arrangements, the development of scientific assessment tools, such as modelling, remote sensing and risk assessment strategies, and the preparation of assessments. Environmental assessment and monitoring related work is implemented by each of OSPAR's thematic committees.

《OSPAR 公约》规定了一项一般义务：合作开展对公约海域海洋环境状况的**定期监测和评估**。公约附录 IV 规定就监测计划、联合质量保证安排、开发诸如建模、遥感和风险评估战略之类的科学评估工具、评估准备开展合作。环境评估和监测相关工作由 OSPAR 每个专题委员会实施。

Assessment of the progress is carried out on a regular basis in OSPAR. **OSPAR collects a number of data streams annually (such as offshore discharges, dumping, radioactive discharges). The data are made available on the website as publications. With regular intervals (every 2 or 3 years) these data are assessed for trends and the assessments are published.** The holistic and thematic assessments undertaken over several decades are based upon the monitoring data collected. The assessment practice is an essential part of the feedback loop that connects monitoring with marine environmental management and back again. This periodic practice is also the time to take stock of the quality of the data and the gaps in knowledge that affect the information outcomes. **Monitoring and assessment are thus inextricably linked, and the quality of the assessment is strongly determined by the quality of the underlying monitoring data.** Long-term monitoring is carried out for atmospheric inputs, riverine inputs and direct discharges, as well as concentrations and effects in the marine environment. Data are made available and published together with a broader set

of marine monitoring programs (see UNEP's GRAMED page<sup>27</sup>). OSPAR also collaborate with the non-governmental organization WWF regarding a media outreach website<sup>28</sup>. The principles of OSPAR Data Release Arrangements are as follows (OSPAR data policy<sup>29</sup>):

《OSPAR 公约》定期进行进展情况的评估。**OSPAR 每年收集大量的数据流（比如海上排放、倾倒、放射性物品排放等）。数据在网站上公开。定期（每 2 年或 3 年）评估这些数据的趋势，并公布评估结果。**几十年来进行的整体评估和专题评估是以所收集的监测数据为基础的。评估工作是反馈环节的一个基本组成部分，它把监测与环境管理连接在一起，然后又回到原点。这种定期工作也是衡量数据质量以及影响信息成果的知识缺口的过程。**这样，监测与评估紧密连在一起，而评估质量很大程度上由基本监测数据的质量决定。**对大气输入、河流输入和直接排放以及其对海洋环境质量的影响进行长期监测。提供并公布监测数据与一系列海洋监测计划（见联合国环境规划署的 GRAMED 网页）。OSPAR 还就一个媒体宣传网站与非政府组织 WWF 合作。  
《OSPAR 数据发布安排》的原则如下（OSPAR 数据政策：

1. OSPAR is committed to making as much information as possible publicly available, consistent with achieving other similarly important goals of public policy.  
OSPAR 致力于公开尽可能多的信息，与实现其他同样重要的公共政策目标相一致。
2. OSPAR and its Contracting Parties wish to collaborate to the greatest possible extent with other agencies working in the field of monitoring and observing the marine environment. Such agencies include the International Council for the Exploration of the Sea, the European Environment Agency, the Barcelona, Helsinki and Black Sea Commissions, the Arctic Monitoring and Assessment Programme and the European Air Pollution Monitoring Programme.  
OSPAR 及其缔约各方希望最大程度地与从事海洋环境监测与观察领域工作的其他机构合作。该等机构包括国际海洋考察理事会、欧洲环境署、巴塞罗那、赫尔辛基与黑海委员会、北极监测与评估计划署和欧洲空气污染监测计划署。
3. Data-handling arrangements should ensure that properly documented, quality-controlled and comparable data sets are available for use both by those who need them for their work and by the public, safeguard the interests of the scientists who collect and interpret data, encourage scientific research, and assist the maintenance of sound, comprehensive, high-quality, accessible data banks, which can be relied on for their accuracy and integrity.  
数据处理安排应保证得到妥善记录、质量控制和可比的数据集，供那些其工作需要这些数据集的人使用及公众使用，保障收集和解释数据的科学家的利益，鼓励科学研究，并帮助维护合理、综合、优质、易使用的数据库，该等数据库因其准确性和完整性而值得信赖。

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<sup>27</sup> <http://www.unep-wcmc-apps.org/GRAMED/DataPortalLinks.cfm>

<sup>28</sup> <http://www.charlie-gibbs.org/>

<sup>29</sup> [http://www.ospar.org/content/content.asp?menu=01511400000000\\_000000\\_000000](http://www.ospar.org/content/content.asp?menu=01511400000000_000000_000000)

4. Data-handling arrangements should also make efficient use of resources and be clear and transparent, while protecting the privacy and confidentiality of individuals and commercial interests.

数据处理安排还应有效利用资源，并且清晰透明，同时保护个人的隐私和机密及商业利益。

#### 2.3.1.5 Results 结果

The OSPAR Convention is one of many regimes aiming at protecting the North Sea environment. For instance, dumping at sea and land-based discharges of nutrients and hazardous substances are regulated by three international institutions, i.e., the North Sea Conferences, the EU, and OSPAR. **Instead of resulting in duplication and inefficiency, the three institutions have acted to complement each other by fulfilling different function, facilitating overall effectiveness** (Skjærseth, 2012). Thus, so far, synergy rather than conflict has characterized the work of the different international institutions, **resulting in significant reductions of the input of hazardous pollutants such as pesticides and heavy metals, and nutrients. Dumping and incineration at sea of toxic waste are now things of the past. Eutrophication is still a problem in many areas of the North Sea, however, and only one third of OSPAR's 26 priority (groups of) chemicals which pose a risk to the marine environment are expected to have been phased out by 2020 if current efforts continue. For the remaining two thirds, additional action is needed to progress toward the OSPAR 2020 target of cessation of their releases to the environment** (OSPAR Commission, 2013d). Time trends based on monitoring undertaken by OSPAR Contracting Parties for the Comprehensive Atmospheric Monitoring Programme (CAMP) show **decrease in nitrogen, heavy metals and selected POPs** in accordance to the general emission reductions done in Europe the last decades (OSPAR Commission, 2009). **Environmental concentrations of some radionuclides from the nuclear sector have decreased and there is some evidence to suggest that the effect of discharges and concentrations of radioactive substances on the overall quality status of the OSPAR maritime area is low.** There are, however, limitations in the data basis impeding robust conclusions. Some monitoring areas in Region I and II still have elevated concentrations of radionuclides due to out-flowing Baltic Sea water contaminated with radionuclides from the 1986 Chernobyl accident. Regarding marine litter, the EcoQO related to northern fulmars are far from being achieved. In monitored regions about 60-90% of fulmars exceeded the objective.

《OSPAR 公约》是众多旨在保护北海环境的政体之一。例如，海上倾倒及营养物和有害物质的陆上排放由三家国际机构监管，即北海会议、欧盟和 OSPAR。这三家机构通过履行不同的职能、促进总体效能，实现了彼此互补，而没有造成工作重复和低效（Skjærseth, 2012）。因而迄今为止，不同国际机构的工作产生了协同效应，而不是互相冲突，结果是农药和重金属等危险污染物以及营养物的海洋输入大幅减少。海上倾倒和焚烧有毒废物现已成为过去式。然而，富营养化在北海很多地方仍是一个问题，而且如果目前的工作持续开展下去，预计到 2020 年，在 OSPAR 的 26 种（组）对海洋环境造成风险的重点控制化学品中，仅三分之一会被逐步消除。对于剩下的三分之二，需要采取其他行动来实现 OSPAR 设定的到 2020 年停止其向环境排放的目标（OSPAR 委员会，2013d）。在 OSPAR 缔约各方开展的监测基础上，《综合大气监测计划》（CAMP）的时间趋势表明，由于最近几十年欧洲开展的综合减排工作，氮、重

金属和选定的 POP（持久性有机污染物）减少了（OSPAR 委员会，2009）。来自核电站的一些放射性核素的环境浓度下降了，并且有证据表明，放射性物质的排放和浓度对 OSPAR 海域总体质量的影响较小。然而，数据库也存在着局限性，有碍于得出有力的结论。1986 年切尔诺贝利核电站事故释放的放射性核素污染了波罗的海海水，海水流出导致一区和二区的一些监测区出现了放射性核素浓度升高的情况。至于海洋垃圾，保护暴雪鸕的 EcoQO 目标远未实现。监测区约 60-90%的暴雪鸕超标。

#### 2.3.1.6 Lessons and suggestions for China 对中国的启示和建议

China is a coastal State with long coastlines. Bordering on the mainland of China are the Bohai Sea, the Yellow Sea, the East China Sea and the South China Sea, all marginal seas in the west Pacific. China's coastal waters are experiencing severe pollution, with the pollution of the worst affected areas up 50% from 2011 to 2012 according to The State Oceanic Administration (SOA). In Bohai Bay, for instance, factories and construction projects take up more than 80 percent of the shoreline<sup>30</sup>. The State Oceanic Administration (SOA) is the leading agency responsible for China's ocean policymaking and overall management of ocean and coastal affairs. SOA found that 68,000 square kilometers had the worst official pollution rating, up 24,000 square kilometers on 2011. Affected waters are deemed unsuitable for swimming, fish-farming, port use and are not even fit for some industrial purposes under this classification<sup>31</sup>.

中国是一个沿海国家，有很长的海岸线。中国大陆的陆缘海有渤海、黄海、东海和南海，全部为太平洋西部的边缘海。中国的沿海水域正遭受严重污染。根据国家海洋局（SOA）的数据，2012 年受影响最严重区域的污染物比 2011 年增加了 50%。例如，在渤海湾，工厂和建设项目占据了 80%的海岸线。国家海洋局（SOA）是负责中国海洋政策制定及海洋和沿海事务总体管理的主要机构。SOA 发现，68,000 平方公里得到了最差的官方污染评级，比 2011 年增加了 24,000 平方公里。在这种级别下，受影响水域被认为不适于游泳、养鱼、港口用途，甚至不适于一些工业用途。

An eight year survey of China's marine resources (2004-2012), also by the Chinese SOA, showed that the past decade has seen a continuous rise in pollution discharged into estuaries, and that three-quarters of those discharges failed to meet regulatory limits. Some 48 estuaries are contaminated with heavy metals, the insecticide dichlorodiphenyltrichloroethane (DDT) and petroleum hydrocarbons. These pollutants, together with run-off of chemical fertilizers and animal manure from farmland, have resulted in the build-up of excessive nutrients and harmful algal blooms in coastal waters. The survey showed that over the past 20 years, China's coastal waters have seen an average of 83 'red tides' a year — harmful algal blooms characterized by the red pigment of the dominant phytoplankton species — mostly in the East China Sea. 'Green tides', dominated by green plankton, occur mostly in the Yellow Sea and hit the economy harder. In 2008, the direct economic loss was 1.3 billion Chinese yuan (USD 208 million). In 2009, China was hit by 'brown tides', which kill shellfish (Qiu 2012)<sup>32</sup>. In a

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<sup>30</sup> [http://www.chinadaily.com.cn/cndy/2013-04/12/content\\_16394921.htm](http://www.chinadaily.com.cn/cndy/2013-04/12/content_16394921.htm)

<sup>31</sup> <http://rt.com/news/china-coastal-water-pollution-614/>

<sup>32</sup> See Also Cao and Wong (2007) for a review of coastal zone status and management in China.

中国海岸带状况和管理回顾见 Cao 和 Wong (2007)。

review of heavy metal pollution in coastal areas in South China, Wang et al (2013) report that Hong Kong and the Pearl River Estuary were severely contaminated by heavy metals. Human health risk assessments suggested that levels of heavy metals in some seafood (particularly mollusks and shellfish) exceeded the safety limit. According to the Ministry of Environmental Protection, in 2011, **“the overall quality of coastal marine waters of China was not bad”** (SOE, 2011).

中国国家海洋局开展的一项为期 8 年（2004-2012 年）的中国海洋资源调查表明，过去十年，排入河口的污染物持续增加，而且四分之三的污染物不符合排放标准。大约 48 个河口被重金属、杀虫剂二氯二苯三氯乙烷（DDT）和石油烃污染。这些污染物，再加上农田流失的化肥和畜肥，共同导致沿海水域氮磷等营养物质浓度高，易发生赤潮。调查表明，过去 20 年来，中国的沿海水域平均每年有 83 次‘赤潮’，由于藻华爆发后红色浮游植物快速生长，海面呈现红色，因此命名为赤潮，赤潮主要发生在东海海域。以绿色浮游生物为主的‘绿潮’主要发生在黄海，对经济的冲击更大。2008 年，直接经济损失为人民币 13 亿元（合 2.08 亿美元）。2009 年，中国遭‘褐潮’袭击，导致贝类死亡（Qiu 2012）。在对华南沿海地区重金属污染的回顾中，Wang 等人（2013）报告香港和珠江口受到了严重的重金属污染。人类健康风险评估表明，某些海产品（特别是软体动物和贝类）中的重金属水平超过了安全限值。根据环保部的数据，2011 年“中国沿海水域的总体质量不错”（SOE, 2011）。

China is Party to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972, commonly called the "London Convention". The Convention is an agreement to control pollution of the sea by dumping and to encourage regional agreements supplementary to the Convention. In 2006, "Guideline for marine debris monitoring and assessment" was drafted and since 2007 the Marine Debris Monitoring and Assessment Program has been carried out in China. In March 2010 the Regulation of the People's Republic of China on the Prevention and Control of Marine Pollution from Ships (the Regulation) was implemented. The Regulation is considered to be the cornerstone of the Chinese marine pollution law system. The Regulation is constituted pursuant to the Marine Environment Protection Law of the People's Republic of China (MEPL) and sets out the principles and outline of the Chinese marine pollution legal system. The Regulation imposes a series of requirements on ships. It covers any ship-sourced pollution and any ship-related operation that may cause pollution damage in waters and sea areas under the jurisdiction of China (Huang, 2010).

中国是《1972 防止因倾倒废弃物及其他物质而引起海洋污染的公约》、即“伦敦公约”的缔约国。该公约是一项控制倾倒所致海洋污染的协议，并鼓励签署区域协议来补充该公约。2006 年起草了“海洋垃圾监测与评估导则”，并且《海洋垃圾监测与评估计划》自 2007 年起在中国实施。2010 年 3 月，《中华人民共和国防治船舶污染海洋环境管理条例》（简称“条例”）开始施行。《条例》被认为是中国海洋污染法律体系的基石。《条例》是根据《中华人民共和国海洋环境保护法》（MEPL）制定的，阐明了中国海洋污染法律体系的原则和大纲。《条例》对船舶运输提出了一系列要求。它涉及可能在中国管辖水域和海域引起污染损害的任何船舶来源的污染和任何船舶相关的作业（Huang, 2010）。

In a review study, Cao and Wong (2007) conclude that **the Chinese government has made a significant effort in developing legislation for the coastal zone, including establishment of jurisdictional and zoning boundaries, and allocating use rights**

**for coastal and marine resources.** A demonstrated project for integrated coastal management in Xiamen has been implemented. Marine protected areas are also established over the last years, e.g. in Liaoning province, adjacent to North Korea, however the coverage is still low, 1.3% in 2009 (World Bank, 2014).

在一项回顾研究中，Cao 和 Wong（2007）得出结论：中国政府在制定海岸带法律方面做出了巨大努力，包括建立管辖权边界和区域边界，以及分配沿海和海洋资源使用权。厦门实施了一项海岸带综合管理示范项目。近年来还建立了海洋保护区，例如在毗邻朝鲜的辽宁省，但覆盖率仍很低，2009 年为 1.3%（世界银行，2014）。

Whereas China itself is a major contributor to pollution in its marine waters, some areas are affected by other nations as well. China and the two Koreas have massive populations living in the Yellow Sea drainage basin. Many environmental problems in this shallow sea (the average depth is 44m) are of a transboundary nature: industrial wastewater containing major pollutants from port cities; non-point source contaminants of agricultural origin (pesticides); oil discharged from vessels and ports; and oil and oily mixtures from oil exploration. Various initiatives have been taken to enhance collaboration in the region. For instance, as part of the UNEP/GEF Strategic Action Plan for the Yellow Sea Large Marine Ecosystem (LME), China and Korea will be augmenting pollution assessment and control activities in coastal waters around the margins of the LME (UNEP/GEF, 2009).

虽然中国本身是其海域污染的主要“元凶”，但有些地方也受到了其他国家的影 响。中国与朝鲜和韩国有大量人口居住在黄海流域。黄海是一个浅海（平均深度 44 米），它的很多环境问题具有跨境性：来自港口城市含有主要污染物的工业废水；来自农业的非点源污染物（农药）；来自船舶与港口的石油；石油勘探带来的石油和油性配制品。采取了各种举措来加强这一地区的协作。例如，作为联合国环境规划署/全球环境基金（UNEP/GEF）《黄海大海洋生态系统（LME）战略行动计划》的一部分，中国和韩国将扩大在 LME 边缘周围沿海水域的污染评估和控制活动（UNEP/GEF，2009）。

China is member of the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), a regional partnership programme implemented by the United Nations Development Programme (UNDP). PEMSEA Network of Local Government (PNLG) serves as a network of local governments in the region, which, along with their stakeholders, shall be committed to promote the application of Integrated Coastal Management (ICM) as a management framework to achieve sustainable coastal development. China has established ICM programs along substantive parts of some coastal areas, especially in the Bohai Sea (EAS, 2010). **Together with other countries in the region, China identified the main challenges to sustainable coastal and ocean management. The top 2 constraints identified were lack of enforcement of existing laws and regulations, and disparate views and priorities among government agencies. The next 3 challenges identified concerned functional institutional mechanisms and human resource capacity as the main challenges. Thus, while there has been significant progress among countries in developing policy and legislation, the feedback suggests that the focus needs to shift from developing such instruments to improving competencies and capacities in enforcement and implementation (EAS, 2010).**



中国是东亚海洋环境管理伙伴关系（PEMSEA）计划的成员。这是联合国开发计划署（UNDP）实施的一项区域合作计划。PEMSEA 地区政府网络（PNLG）作为一个东亚地区政府网，应和利益相关者共同致力于促进海岸带综合管理（ICM）的实施。ICM 是一个实现沿海可持续发展的管理框架。中国制定了大部分沿海地区、特别是渤海的 ICM 计划（EAS, 2010）。和东亚其他国家一起，中国确定了沿海和海洋可持续管理面临的主要挑战。已确定的前两大制约因素是：现行法律法规执行不力，以及各政府部门的观点和工作重点不同。其余三项挑战主要是有关职能机制和制度机制以及人力资源。因而，虽然各国在制定政策和立法方面取得了巨大进展，但反馈表明，工作重点需要从管理研究转移到提高执行能力和实施能力上（EAS, 2010）。

**In summary, it appears that legislation to prevent marine pollution has been established in China and that China is taking part in international regional efforts within the field. Moreover, a range of programmes and projects are carried out, including monitoring programs and ecosystem oriented integrated coastal management initiatives. Due to intense economic activities along the coastline and lack of pollution control at the entity level and of enforcement of current environmental regulations, the situation is however still severe and seems to be worsening in many coastal and marine waters.**

In line with the diagnosis by PEMSEA, a main priority for China should be to **enhance enforcement of current regulations, particularly for land-based activities**. The finding by the Chinese SOA for 2004-2012 that three-quarters of pollution discharges failed to meet regulatory standards, clearly shows a need for a massive upgrade of control and enforcement mechanisms. **Technical measures to reduce run-off from agricultural land, as well as avoiding over-use of fertilizers**, is needed to stop pollution from agricultural sector reaching marine waters. Such measures align with measures to reduce pollution of freshwater (surface water and groundwater) in the country, and collaboration between relevant authorities is needed.

**Implementation of Marine protected areas (MPA)** has been an effective tool in the protection of marine waters in the North Sea region, and should be further developed in China as the current coverage seems to be fairly low (1.3% in 2009). While the coverage of MPA is still low in the arctic regions within the OSPAR domain, the coverage in the other regions is 3-11%, while there is a coverage of 22% within territorial waters of the OSPAR countries<sup>33</sup>. A broader coverage of MPAs with appropriate monitoring and management systems, together with nationally coordinated actions against land-based polluters, may contribute to turning the negative trend with respect to pollution of the Chinese marine waters.

总之，中国已制定了防止海洋污染的立法，并且中国正在参与国际上在这一领域的区域努力。此外还实施了包括监测计划和面向生态系统的综合海岸管理计划等一系

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<sup>33</sup>[http://www.ospar.org/html\\_documents/ospar/html/data/assessment\\_fact\\_sheets/ospar\\_assessment\\_sheet\\_mpa\\_status\\_in\\_2012.pdf](http://www.ospar.org/html_documents/ospar/html/data/assessment_fact_sheets/ospar_assessment_sheet_mpa_status_in_2012.pdf)



列计划和项目。由于沿海地区经济活动密集、缺乏企业层面的污染控制、现行环境法规执行不力，很多沿海水域和海洋水域的形势仍十分严峻，甚至可能变得更糟。

根据 PEMSEA 的诊断，中国的首要任务应是**加强现行法规的执行力度，尤其是加强与陆源活动相关的法规的执行力度**。中国 SOA 发现，在 2004 至 2012 年间，3/4 的污染排放未能达到监管标准，这清楚地表明控制和执行机制需要大规模提升。需要采取**技术措施降低农田中化肥和畜肥的流失，还要避免化肥的过度使用**，以便防止农田领域的污染影响海洋水域。需要采取这样的措施，连同减少中国淡水（地表水和地下水）污染的措施及相关部门间的协作。

海洋保护区（MPA）的开展是保护北海区域海洋水域的一个有效手段，中国应将其进一步发展，因为目前它涵盖的范围还比较有限（在 2009 年是 1.3%）。虽然 MPA 在 OSPAR 领域的北极地区涵盖范围比较有限，但是它在其他区域的涵盖范围达到 3%至 11%，而在 OSPAR 国家的领海中，其涵盖范围达 22%。更广泛的 MPA 范围以其恰当的监测和管理系统，以及针对陆源污染者的全国范围的协作行动，可能有利于转变中国海洋水域污染的消极局势。

### 2.3.2 EU REACH Directive 欧盟 REACH 指令

#### 2.3.2.1 Introduction 引言

The production, use and disposal of chemicals and of products containing hazardous substances were up till the early 2000s regulated through a wide range of different legislation in the EU countries, introducing a considerable number of risk reduction measures providing extensive control over the classification, labelling, marketing and use of substances and preparations(EC, 2003).

欧盟各国直到 21 世纪初才通过各种不同的立法来监管化学品以及含有危险物质的产品的生产、使用和处置，出台了一系列的风险降低措施，对物质和配制品的分类、标签、销售和使用实行广泛控制（EC, 2003）。

The need for a new strategy arose from wide acceptance that the existing legislation was not capable of responding adequately to public concern in Europe about the potential impact of chemicals on health and the environment, and would be increasingly unable to meet expectations in the future. The existing legislation, for certain dangerous substances, was seen as unsuited to the requirements of the new century for the following reasons:

现有立法无法充分应对欧洲公众对化学品健康和环境的潜在不良影响的担心，并且公众已经意识到目前的监管将会与期望相差越来越远，由此需要制定新的化学品风险防控战略。出于以下原因，某些危险物质的现有立法被认为不适合新时代的要求：

- it did not make sufficient information available about the properties of "existing" chemicals (first marketed before 1981), which dominate the EU market, 无法提供关于欧盟市场广泛使用的“现存”化学品（最早于1981年以前销售的）特性的充分信息，
- it was failing to deliver risk assessments within a reasonable timeframe, 不能使风险评估在合理时间段内完成，
- it placed too much burden on public authorities to provide proof of risk, 使公共机构承担了太多提供风险证据的举证责任，
- the requirements for putting new chemicals on the market were much stricter than those applied to "existing" chemicals. 对新化学品投放市场的要求比对“现存”化学品的要求严格。

This resulted in the establishing of REACH (Regulation on Registration, Evaluation, Authorization and Restriction of Chemicals) that entered into force on 1. June 2007. It replaces 40 then existing Directives, and streamlines and improves the former legislative framework on chemicals of the EU. It was adopted to improve the protection of human health and the environment from the risks that can be posed by chemicals, while enhancing the competitiveness of the EU chemicals industry.

这促生了 REACH 法规（《化学品注册、评估、许可和限制法规》）。该法规于 2007 年 6 月 1 日生效，取代了当时已有的 40 项指令，简化并完善了欧盟原先关于化学品的立法框架。它旨在加强对人类健康和环境的保护，使其免遭化学品造成的风险，并提高欧盟化学工业的竞争力。

The EU worked over seven years to agree on the principles and legislation behind REACH. **It is considered by the EU itself as the most groundbreaking piece of legislation on safer chemicals in the world, and the most complex legislation in the Union's history** ([www.wikipedia.com](http://www.wikipedia.com)).

欧盟用了七年时间努力就 REACH 法规背后的原则和立法达成一致。欧盟自认为 REACH 法规是一部全球最具开创性的关于安全化学品的立法，并且是欧盟历史上最复杂的立法。

### 2.3.2.2 Principles 原则

**REACH places the responsibility for the safe management of the risks of chemical substances on the industry**, and ensures that appropriate safety information is provided to their users. This should **encourage enterprises to apply risk reduction measures from an early point in the life cycle of the substance concerned, and thereby to avoid any negative impact on downstream users and customers**. It will also **permit EU Member State competent authorities to re-orient their resources towards evaluating the quality of the information submitted by industry rather than doing risk assessments themselves**. Furthermore, the EU can take additional measures on highly dangerous substances, where there is a need for complementing action at EU level ([www.ec.europa.eu](http://www.ec.europa.eu)).

**REACH** 规定由企业承担化学物质的安全管理责任，还保证向化学品使用者提供适当的安全信息。这会促使企业从有关物质的生命周期的早期开始采取风险降低措施，从而避免对下游用户和客户造成负面影响。该法规还允许欧盟成员国主管部门调整资源使用方向，将其用于评价企业所提交信息的质量，而不是自己进行风险评估。此外，在欧盟层面需要补充行动时，欧盟还可以采取其他关于高危物质的措施（[www.ec.europa.eu](http://www.ec.europa.eu)）。

**REACH places the burden of proof on companies**. This is in accordance with the polluter pays principle. To comply with the regulation, **companies must identify and manage the risks linked to the substances they manufacture and market in the EU**. They have to demonstrate to EUs chemical body ECHA(see below) how the substance can be safely used, and they must communicate the risk management measures to the users.

根据污染者付费原则，REACH 规定由企业承担举证责任。为了遵守该法规，企业必须识别并管理在欧盟生产和销售化学品的健康和环境风险。他们要向欧盟化学品机构 ECHA（欧洲化学品管理局）（见下文）演示如何安全使用物质，而且必须将风险管理措施传达给用户。

In principle, **REACH applies to all chemical substances**, not only those used in industrial processes but also in the day-to-day lives, for example in cleaning products, paints as well as in articles such as clothes, furniture and electrical appliances. Therefore, the regulation has an impact on most products and companies across the EU.

原则上，**REACH** 适用于所有的化学物质，不仅适用于工业过程中使用的化学物质，而且适用于日常生活中使用的化学物质，例如清洁用品、涂料以及衣服、家具和电器之类的物品。因此，该法规对整个欧盟范围内的多数产品和企业都有影响。

Another crucial principle behind REACH is the substitution principle. This requires that a dangerous substance is replaced by less dangerous substance or technology where technically and economically feasible alternatives are available. If no safer alternative exists, the company must work to find one.

REACH 背后的另一个关键原则是替代原则。该原则要求，在有技术和经济上可行的替代品的情况下，用危险较小的物质或技术代替危险物质。如果没有较安全的替代品，企业必须努力找到一个。

Companies throughout the EU who make, import or use chemicals in their products and manufacturing processes have since 2007 been working to comply with this challenging legislation. REACH is contributing to:

自 2007 年以来，整个欧盟范围内制造、进口或在其产品和生产过程中使用化学品的企业一直在努力遵守这部具有挑战性的立法。REACH 有助于：

- Making companies who manufacture or import chemicals explain clearly and give information on the properties of their chemicals  
让制造或进口化学品的企业清楚地解释其化学品的特性，并提供关于其化学品特性的信息
- Making those same companies explain how that substance is used (it may be used in many different products or industrial processes) and who is likely to be exposed to it  
让那些生产相同物质的企业解释如何使用该物质（可能会被用于很多不同的产品或工业生产过程中）以及谁会接触该物质
- Controlling the risks presented to human beings and the environment by the most hazardous chemicals, by reducing the amount that they are exposed to  
通过减少其暴露量，控制危险（易燃易爆剧毒）化学品给人类和环境带来的风险
- Making sure that hazardous substances are classified and included in a public inventory, and that any product containing them is labelled and packaged so that consumers and workers are well informed and can use them safely  
确保对危险物质进行分类并将其列入公开清单，并且确保给任何含有危险物质的产品贴上标签并进行包装，以使消费者和工人充分知情并安全使用
- Ensuring that, over time, the most dangerous of these chemicals are phased out.  
确保最危险（易燃易爆剧毒）的化学品会随着时间的推移被逐步淘汰。

### 2.3.2.3 Approach 方法

REACH establishes procedures for collecting and assessing information on the properties and hazards of substances. Companies need to register their substances and to do this they need to work together with other companies who are registering the same substance.

REACH 建立了收集并评估物质特性和危害信息的程序。企业需要注册其物质，为此需要与其他注册了相同物质的企业合作。

ECHA receives and evaluates individual registrations for their compliance, and the EU Member States evaluate selected substances to clarify initial concerns for human health

or for the environment. In this respect REACH promotes alternative methods for the hazard assessment of substances in order to reduce the number of tests on animals. Authorities and ECHA's scientific committees assess whether the risks of substances can be managed.

欧洲化学品管理局接收注册，并评价其是否符合规定，然后由欧盟成员国评估选定的物质，以说明该物质对人类健康或环境的影响，并消除公众对该物质造成健康或环境影响的担心。在这方面，REACH 促进用其他方法代替对物质危害进行评估，以减少动物试验次数。由有关部门和欧洲化学品管理局的科学委员会评估物质的风险是否可管理。

**If the risks cannot be managed properly, authorities can restrict the use of substances in different ways.** Authorities can **ban** hazardous substances if their risks are unmanageable. They can also **decide to restrict a use or make it subject to a prior authorisation.** In the long run, the most hazardous substances should be substituted with less dangerous ones.

如果风险不能被妥善管理，有关部门可通过不同方式限制使用物质。如果危险物质的风险难以管理，有关部门可禁止生产、销售、使用该危险物质。有关部门也可以决定限制使用或者规定其事先获得授权。从长远来看，危害最大的物质应当由危害较小的物质取代。

As shown above, REACH impacts on a wide range of companies across many sectors, even those who may not think of themselves as being involved with chemicals. In general, under REACH companies may have one of these roles:

如以上所示，REACH 对很多行业的各种不同企业有影响，包括那些认为自己与化学品无关的企业。一般而言，企业在 REACH 下可能扮演以下角色之一：

- **Manufacturer:** Makers of chemicals, either to use within the company or to supply to others (even if it is for export), will probably have some important responsibilities under REACH.  
*制造商：*在企业内部使用或供应给他人（即使是用于出口的）的化学品的制造者可能负有 REACH 下的某些重大责任。
- **Importer:** Buyers of chemicals from outside the EU/EEA are likely to have some responsibilities under REACH. It may be for individual chemicals, mixtures for onwards sale or finished products, like clothes, furniture or plastic goods.  
*进口商：*从欧盟/欧洲经济区外面购买化学品的买主可能要负有 REACH 下的某些责任。进口的商品包括个别化学品、对外销售的混合物或者像衣服、家具或塑料商品这样的成品。
- **Downstream users:** Most companies use chemicals, sometimes even without realizing it, therefore they need to check their obligations if they handle any chemicals in their industrial or professional activity. Such companies might have some responsibilities under REACH.  
*下游用户：*多数企业都使用化学品，有时甚至没有意识到这一点，该等公司可能负有 REACH 下的某些责任。因此，如果他们在其工业活动或专业活动中处理任何化学品，则需要检查自己在 REACH 法案下的义务。

- *Companies established outside the EU:* Such companies are not bound by the obligations of REACH, even if exporting products into the customs territory of the EU. The responsibility for fulfilling the requirements of REACH, such as pre-registration or registration lies with the importers established in the EU, or with the only representative of a non-EU manufacturer established in the EU.

在欧盟以外成立的企业：该等企业不受 REACH 义务的约束，即使它们将产品出口到欧盟的关税领土。满足 REACH 要求、比如预注册或注册的责任由成立于欧盟的进口商承担，或者由这些欧盟以外的制造商成立在欧盟的唯一代表承担。

**For substances manufactured or imported in quantities of 1 ton or more per year per company, manufacturers and importers need to demonstrate that they have appropriately done so by means of a *registration dossier*, which must be submitted to the European Chemicals Agency (ECHA).** ECHA is an agency established to manage the technical, scientific and administrative aspects of the REACH system. ECHA helps companies to comply with the legislation, advances the safe use of chemicals, provides information on chemicals and addresses chemicals of concern.

对于年产量或进口量在 1 吨或以上的化学物质，制造商和进口商需要用注册档案来证明他们在化学品管理方面做得很好。注册档案须提交给欧洲化学品管理局（ECHA）。ECHA 是为了管理 REACH 系统的技术、科学和行政方面工作而成立的机构。ECHA 帮助企业遵守立法，促使其安全使用化学品，提供化学品信息，并处理 REACH 重点关注化学品的问题。

**ECHA may then check that the registration dossier complies with the regulation and must *evaluate* testing proposals** to ensure that the assessment of the chemical substances will not result in unnecessary testing, especially on animals, but also that adequate information is provided (more about this below). Where appropriate, ECHA may also select substances for a broader evaluation to further investigate substances of concern.

欧洲化学品管理局可检查注册档案是否符合法规，而且必须评估试验建议，以确保化学物质的评估不会重复做不必要的试验，尤其是动物试验，而且还应确保注册档案提供充分的信息（详见下文）。适当情况下，欧洲化学品管理局还可选出一些物质进行更广泛的评估，以进一步调查关注物质。

**REACH also foresees an *authorization* system aiming to ensure that the risks from Substances of Very High Concern (SVHC) are properly controlled, and that those substances are progressively replaced by suitable, less harmful alternative substances or technologies where these are economically and technically viable.** Where risks cannot be adequately controlled, the use of SVHC may only be authorized where there is an overall benefit for society of using the substance and there are no suitable alternatives (see more about the authorization system below).

**REACH 还规定了授权系统，旨在确保高度关注物质（SVHC）带来的风险得到妥善控制，并且那些物质会逐渐被合适的、危害较小的、在经济和技术上可行的替代物质取代。**如果风险不能被适当控制，仅当使用物质对全社会有益并且没有合适的替代品时，高度关注物质的使用才会得到授权（详见下文的许可系统）。

In addition, EU authorities may impose **restrictions** on the manufacture, use or placing on the market of substances causing an unacceptable risk to human health or the environment. The Member States authorities are responsible for **enforcing** REACH through inspections as well as penalties in case of non-compliance.

另外，欧盟当局可**限制**生产、使用或销售对人类健康或环境造成不可接受风险的物质。欧盟成员国当局负责通过检查以及违规处罚来**执行** REACH。

#### 2.3.2.4 Tools 工具

As described above, the REACH approach is based on the tools Registration, Evaluation, Authorization, Restriction and Enforcing. Below is a description on how these work.

如上所述，REACH 方法建立在注册、评估、授权、限制和执行的基础之上。下面说明这些方式是实现对化学品监管的。

#### Registration 注册

Manufacturers and importers of substances have a general obligation to submit a registration to ECHA for each substance manufactured or imported in quantities of 1 ton or more per year per company (legal entity). This obligation applies to substances as such and in mixtures. A special registration regime applies for substances in articles (e.g. manufactured goods such as cars, textiles, electronic chips). However, certain substances are exempted from registration under REACH. **Failure to register means that the substance cannot be manufactured or imported.**

物质制造商和进口商有义务向欧洲化学品管理局注册每一种生产量或进口量在 1 吨/年（法人实体）或以上的物质。对于生产或进口这种物质或者包含这种物质的混合物都需要注册。专项注册制度适用于制成品中的物质（例如汽车、纺织品和电子芯片之类的制成品）。然而，某些物质由于欧盟规定不可以生产或进口，在 REACH 下禁止注册。

Registration applies to substances on their own, substances in mixtures and certain cases of substances in articles. Chemical substances that are already regulated by other legislations, such as medicines or radioactive substances, are partially or completely exempted from REACH requirements.

注册适用于物质本身、混合物中的物质以及一定情况下制成品中的物质。已由其他立法监管的化学物质，比如药品或放射性物质，部分或完全豁免于 REACH 要求。

Manufacturers and importers of the same substance have the obligation to submit their registration jointly. The analytical and spectral information provided should be consistent and sufficient to confirm the substance identity.

相同物质的制造商和进口商必须共同提交注册。所提供的分析信息和光谱信息应当是一致的，并且足以确认物质的特性。

For substance registration a fee is usually charged.

物质注册一般是收费的。

## Evaluation 评估

There are three types of evaluation under REACH:

在 REACH 下有三种类型的评估：

- Dossier evaluation performed by ECHA  
由欧洲化学品管理局开展的档案评估
- Substance evaluation performed by a Member State: to clarify any grounds for considering that a substance constitutes a risk to human health or the environment  
由成员国开展的物质评估：以说明某物质的人体健康或环境风险
- Member States can also evaluate registered intermediates.  
成员国还可以评估已注册的中间体。

**ECHA and the Member States evaluate the information submitted by companies to examine the quality of the registration dossiers and the testing proposals, and to clarify if a given substance constitutes a risk to human health or the environment.**

Evaluation under REACH focuses on three different areas:

欧洲化学品管理局和欧盟成员国评估企业所提交的信息，以检查注册档案的质量并提出试验建议，并说明特定物质是否存在人体健康或环境风险。REACH 下的评估侧重于三个不同方面：

- Examination of testing proposals submitted by registrants  
审查注册人提交的试验建议
- Compliance check of the dossiers submitted by registrants  
检查注册人提交的档案是否符合规定
- Substance evaluation  
物质评估

Once the evaluation is done, registrants may be required to submit further information on the substance.

一旦进行评估，注册人可能会被要求提交更多的物质信息。

ECHA has to publish a report each year on the progress it has made over the previous calendar year on its obligations in relation to evaluation. ECHA is in these reports specifically required to include recommendations to potential registrants to foster improvement in the quality of future registrations.

欧洲化学品管理局每年要公布一份报告，说明与上一年相比其在评估工作方面取得的进展。欧洲化学品管理局需要将潜在注册人的建议列入这些报告，以促进提高今后的注册质量。

## Authorization 授权

The authorization procedure aims to assure that the risks from SVHCs are properly controlled and replaced by less dangerous substances or technologies where technically



and economically feasible alternatives are available. If no safer alternative exists, the company must work to find one. These substances cannot be placed on the market or used after a given date, unless an authorization is granted for their specific use, or the use is exempted from authorization. Interested parties have 45 days from the date of publication to provide comments to the Agency on the identification of the substance as SVHC as well as further information related to use, exposure, alternatives and risks.

授权程序旨在确保高度关注物质引起的风险得到适当控制，并且如果有技术上和经济上可行的替代品，用危险性较小的物质或技术代替高度关注物质。如果没有较安全的替代品，企业必须努力找到一个。这些物质在其特定用途得到授权之后，方可在某个给定日期以后投放市场或使用，否则不准予使用。自授权公布之日起 45 天内，有关各方可以向欧洲化学品管理局提供该高度关注物质的意见，并提供物质使用、暴露、替代品和风险有关的进一步信息。

The authorization process involves three steps: i) identification of SVHC; ii) recommendation for inclusion in the Authorization List; and iii) applications for authorization. ECHA consults the public during all three steps and encourages all interested parties to get involved and give their views.

授权程序包含三个步骤：i) 确认高度关注物质；ii) 建议列入授权清单；iii) 申请授权。欧洲化学品管理局在三个步骤中都要征询公众意见，并鼓励所有有关各方参与并提出自己的看法。

i) Substances with the following hazard properties may be identified as SVHCs:

具有以下危害特性的物质可被认定为高度关注物质：

- Substances meeting the criteria for classification as carcinogenic, mutagenic or toxic for reproduction category 1A or 1B in accordance with other EU regulations of CMR substances  
按照欧盟其他 CMR 物质法规被分类为 1A 或 1B 类的致癌物质、致畸变物质和生殖毒性物质
- Substances which are persistent, bioaccumulative and toxic or very persistent and very bioaccumulative according to REACH  
按照 REACH 法规确定的持久性、生物累积性、有毒物质（PBT）和强持久强生物累积物质（vPvB）
- Substances identified on a case-by-case basis, for which there is scientific evidence of probable serious effects that cause an equivalent level of concern as with those mentioned above  
按实际案例确定的物质，并且有科学证据表明这些物质有可能造成与上述物质同等风险水平的

ii) ECHA regularly assesses the substances from a Candidate List to determine which ones should be included in the Authorization List as a priority. The prioritization is primarily based on information in the registration dossiers on uses and volumes of the substances on the EU market that fall within the scope of the authorization requirement.

Any information submitted during the previous step (i.e. the identification of SVHC) will also be taken into consideration.

欧洲化学品管理局定期评估候选清单上的物质，以确定哪些物质应被优先列入授权清单。根据欧盟范围内这些物质的使用量及用途来确定物质在授权清单中的优先次序。在优先序确定过程中，认定高度关注物质时递交的信息也会被纳入考虑。

During the public consultation on the draft recommendation for including substances in the Authorization List, information on the complexity of the supply chain is particularly welcome. ECHA also welcomes comments on the review periods, the transitional arrangements and on those uses which could possibly be exempted from the authorization requirement. When proposing such exemptions it should be considered if specific EU (not only national) legislation is in place that ensures the risk resulting from the specific use of the substance for human health or the environment is properly controlled and if this legislation imposes minimum requirements relating to the protection of human health or the environment for the use of the substance.

在就将物质列入授权清单的建议草案征询民意期间，公众和相关部门高度关注物质供应链复杂性方面的信息。欧洲化学品管理局还欢迎对审核期、过渡期以及对豁免于授权要求的用途发布意见。提出这种豁免时，应考虑是否有特别的欧盟立法可保证物质的特定使用方式能够控制物质的人体健康或环境风险，以及该立法是否为保护人体健康和环境对物质提出了使用建议。

ECHA takes the comments received into account when updating the draft recommendation. This updated draft recommendation will help the Member State Committee to draft its opinion. Taking this opinion into account, ECHA will finalize its recommendation which is then submitted to the EU Commission who makes the final decision on which substances to include in the Authorization List.

在更新物质授权的初步建议时，欧洲化学品管理局将收到的公众意见纳入考虑。更新后的初步建议会帮助成员国委员会提出初步意见。在充分考虑成员国委员会的意见之后，欧洲化学品管理局将确定最终建议，然后提交给欧盟委员会，由欧盟委员会最终决定将哪些物质列入授权清单。

SVHCs will be gradually identified in the 'Candidate List' and eventually included in Annex XIV of the REACH Regulation. Once included in that Annex, they cannot be placed on the market or used after a date to be set (the so-called "sunset date") unless the company is granted an authorization.

高度关注物质会逐渐在‘候选清单’中确认，并最终列入 REACH 法规附录 XIV。一旦被列入该附录，在某个设定日期（所谓的“日落之日”）之后就不能投放市场或者使用，除非企业得到授权。

For substances placed on the Authorization List; manufacturers, importers and downstream users of the substance need to submit an application to ECHA if they wish to continue their use after the sunset date. The application for authorization step includes an eight-week public consultation on alternative substances or technologies for the uses of the substances subject to authorization for which an authorization application has been submitted.

对于被列入授权清单的物质，如果想要在“设定日期”以后继续使用，物质的生产商、进口商和下游用户需要向欧洲化学品管理局递交申请。申请授权步骤包括 8 周的征询民意期，就已递交授权申请、须经授权的物质使用的替代物质或技术向公众征求意见。

iii) Manufacturers, importers or downstream users of a substance on the Authorization List can apply for authorization. Annex XIV of the REACH Regulation sets the list of substances subject to authorization obligations. Taking into account the first recommendation of priority substances for inclusion in Annex XIV adopted by ECHA on 1 June 2009, **the Commission adopted on 17 February 2011 a Commission Regulation including the first six substances of very high concern in the list of substances subject to authorization.**

授权清单上的某物质的生产商、进口商和下游用户可申请授权。REACH 法规附录十四列出了须履行授权义务的物质清单。在考虑欧洲化学品管理局 2009 年 6 月 1 日通过的列入附录 XIV 的优先物质初步建议之后，**欧盟委员会于 2011 年 2 月 17 日通过了委员会条例，将首批六种物质列入需授权的高度关注物质清单。**

### ***The authorization process 授权过程***

From 1 June 2011 ECHA must be notified of the presence of SVHCs in products if the total quantity used is more than one ton per year and the SVHC is present at more than 0.1% of the mass of the object. Some uses of SVHCs may be subject to prior authorization from ECHA, and applicants for authorization will have to include plans to replace the use of the SVHC with a safer alternative.

自 2011 年 6 月 1 日起，若产品中所用高度关注物质总量每年超过 1 吨，并且高度关注物质含量超过 0.1%，则必须告知欧洲化学品管理局，该产品中含有高度关注物质。有些高度关注物质用户需事先获得欧洲首批管理局的授权，授权申请人要提出用较安全的替代品取代使用高度关注物质的计划。

### ***Restrictions 限制***

Restrictions are a tool to protect human health and the environment from unacceptable risks posed by chemicals. Restrictions may limit or ban the manufacture, placing on the market or use of a substance. A restriction applies to any substance on its own, in a mixture or in an article, including those that do not require registration. It can also apply to imports.

限制是一种手段，用来保护人体健康和环境免受化学品引起的不可接受的风险。限制措施可限制或禁止某物质的生产、投放市场或使用。限制措施适用于任何物质本身、混合物中的物质或物品中的物质，包括不需要注册的物质，还适用于进口商品。

A Member State or ECHA on request of the European Commission can propose restrictions if they find that the risks need to be addressed on a Community wide basis. Anyone can comment on a proposal to restrict a substance. Those most likely to be interested are companies, organizations representing industry or civil society, individual citizens, as well as public authorities. Comments are welcomed from the EU or beyond.

应欧盟委员会的要求，欧盟成员国或欧洲化学品管理局如果认为需要在整个欧共体范围内应对该物质的健康和环境风险，可以建议实行限制。任何人都可以评议限制某物质的建议。最有可能参与“限制”评议的是公司、代表业界或民间团体的组织、个人公民以及公共机构。欢迎欧盟或欧盟以外其他国家和地区提出意见。

ECHA works with experts from the Member States to provide scientific opinions on any proposed restriction that will help the European Commission, together with the Member States, to take the final decision.

欧洲化学品管理局与欧盟成员国专家合作，共同对所提议的限制提出科学意见，帮助欧盟委员会以及欧盟成员国做出最后决定。

### *Enforcing 执行*

**The Member States authorities are responsible for enforcing REACH through inspections as well as penalties in case of non-compliance.** In this framework, several issues are of interest:

欧盟成员国当局通过检查以及违规处罚等方式执行 **REACH**。在此框架内，几个问题值得关注：

- *REACH enforcement authorities.* Member States authorities are responsible for enforcing REACH. Thus, each Member State has already designated a competent authority dealing with REACH enforcement.  
*REACH 执行部门。* 欧盟成员国当局负责执行 REACH。因此，每个成员国都指定了负责执行 REACH 的主管部门。
- *Forum for the Exchange of Information on Enforcement ("the Forum").* REACH creates a Forum within ECHA which brings together Member States enforcement authorities in a formal framework. The Forum coordinates enforcement activities and is required to establish a good cooperation, coordination and exchange of information between the Member States, ECHA and the Commission regarding enforcement. Among other activities, the Forum develops coordinated enforcement projects and reports the results of them. The first of these enforcement projects was finalized in May 2010.  
*执行信息交流论坛（简称“论坛”）。* REACH 在欧洲化学品管理局内创建了论坛，建立了成员国执行部门的交流框架。论坛协调执行活动，并且需要建立成员国、欧洲化学品管理局和欧盟委员会之间在执行方面的良好合作、协调和交流机制。论坛主要负责开展协调的执行项目交流、项目结果报告、其他活动沟通等。2010 年 5 月确定了第一批执行项目。
- *Penalties applicable for infringement of the provisions of REACH.* Under REACH Regulation each Member State must determine inter alia the penalties that would apply to the infringement of REACH provisions, and must take all measures necessary to ensure that they are implemented. The penalties must be "effective, proportionate and dissuasive". The Member States have to notify their provisions to the European Commission and must also notify any subsequent amendment.

处罚适用于违反 REACH 规定的情况。根据 REACH 法规，每个成员国均必须确定适用于 REACH 违规的处罚措施，而且必须采取必要措施来保证处罚得到执行。处罚必须是“有效的、相称的和劝诫性的”。成员国须将其处罚规定通知欧盟委员会，今后若对处罚进行修订也需向欧盟委员会报备。

## Other tools under REACH REACH 下的其他工具

### *Communication of Information* 信息交流

One of the major elements of the REACH regulation is the requirement to **communicate information on chemicals up and down the supply chain**. This ensures that manufacturers, importers and also their customers are aware of information relating to health and safety of the products supplied. For many retailers the obligation to provide information about substances in their products within 45 days of receipt of a request from a consumer is particularly challenging. Having detailed information on the substances present in their products will allow retailers to work with the manufacturing base to substitute or remove potentially harmful substances from products. The list of harmful substances is continuously growing and requires organizations to constantly monitor any announcements and additions to the REACH scope. This can be done on ECHA's website.

REACH 法规的主要内容之一就是要求交流供应链各个环节的化学产品信息。这可以确保生产商、进口商及其客户了解产品健康安全方面的信息。对于许多零售商来说，在收到客户请求 45 天内提供关于其产品中所含物质的信息是一项很有挑战性的义务。提供其产品中所含物质的详细信息使零售商可以与生产商合作，共同替换或消除产品中有潜在危害的物质。有害物质名单不断更新，因此各组织要时常留意任何欧洲化学品管理局网站的公告，以知晓 REACH 范围的有害物质名单的更改。

### *Substance Information Exchange Forums (SIEFs)* 物质信息交流论坛

To somewhat simplify the registration and to limit vertebrate animal testing as far as possible, so-called Substance Information Exchange Forums (SIEFs) are formed amongst legal entities (such as manufacturers, importers and data holders) who are dealing with the same substance. **This allows them to join forces and finances to create just one registration dossier**. However, this creates a series of new problems as a SIEF is the cooperation between sometimes a thousand legal entities, which did not know each other at all before. But in order to complete a several thousand end points dossier in a limited time, they must:

为了简化注册并尽可能限制脊椎动物试验，在注册同一种物质的法人实体（比如生产商、进口商和数据持有人等）当中成立物质信息交流论坛（SIEF）。这可以让它们汇合力量和资金，针对某一种物质只建立一个注册档案。然而，这也产生了一系列新的问题，因为一个 SEIF 有时是上千个法人实体的合作，他们以前彼此毫不认识。但为了在规定时间内完成一个有几千个终点的档案，他们必须：

- find each other and start communicating openly and honestly  
找到对方并开始坦率真诚地沟通
- start sharing data

开始共享数据

- start sharing costs in a fair and transparent way  
开始公平透明地分担费用
- democratically and in full consensus take the most complex decisions  
民主并且完全一致地做出最复杂的决定

The EU Commission supports businesses affected by REACH by handing out (free of charge) a software application (IUCLID), which simplifies capturing, managing and submitting of data on chemical properties and effects. Such submission is a mandatory part of the registration process. Under certain circumstances the performance of a Chemical Safety Assessment (CSA) is mandatory and a Chemical Safety Report (CSR) assuring the safe use of the substance has to be submitted with the dossier. Dossier submission is done using the web-based software REACH-IT.

欧盟委员会向 REACH 相关企业免费分发一款软件应用（IUCLID，该应用的功能是简化收集、管理和提交关于化学特性和效用的数据。提交这种数据是物质注册过程的强制要求。在某些情况下，必须进行化学安全评估（CSA），并随档案一起提交化学安全报告（CSR），档案的提交可以在网站上利用软件 REACH-IT 完成。

### ***Harmonized classification and labelling*** 统一分类与标签

The classification and labelling of certain hazardous chemicals must be harmonized to ensure adequate risk management throughout the EU. EU Member States, manufacturers, importers and downstream users may propose a harmonized classification and labelling of a substance. EU Member States can also propose a revision of an existing harmonization.

必须统一某些有害物质的分类与标签，以确保整个欧盟范围内开展针对性的风险管理。欧盟成员国、生产商、进口商和下游用户可提出对某物质进行统一分类和标签的要求。欧盟成员国还可以就统一分类和标签提出修订意见。

Harmonized classifications and labelling are mandatory for the suppliers of respective substances so that users are better informed about their potential hazardous effects and how best to make use of them safely.

各物质的供应商必须进行统一分类和标签，这样能够帮助使用者更好地了解物质的潜在有害影响，更安全地使用这类物质。

### ***Registry of Intentions*** 意向注册

EU Member States Competent Authorities (MSCAs)/ECHA on request by the EU Commission may prepare so-called Annex XV dossiers for identification of SVHC, Annex XV dossiers for proposing a harmonized Classification and Labelling (C&L) or Annex XV dossiers proposing restrictions. These are placed in a public Registry of Intentions. The aim of this registry is to allow interested parties to be aware of the substances for which the authorities intend to submit Annex XV dossiers and therefore facilitates timely preparation of the interested parties for commenting later in the process.

应欧盟委员会的要求，成员国主管部门（MSDCAs）/ 欧洲化学品管理局（ECHA）可准备附录 XV SVHC 申请、附录 XV 统一分类标签提议（C&I）或者附录 XV 限制物质提议（附件 XV）。这些附录的草案放在一个公开的意向栏里。将附录草案公开的目的在于让利益相关者知道主管部门即将提交附录 XV 的物质有哪些，从而促进利益相关者及时准备在这一过程中进行评议。

It is also to avoid duplication of work and encourage co-operation between EU Member States when preparing Annex XV dossiers. The registry allows MSCAs/ECHA to check if another Authority has in the past worked on an Annex XV dossier for a specific substance or is currently preparing an Annex XV dossier on the substance. It should be noted that for the restrictions process there is a legal requirement for the Member State to notify to the ECHA its intention to prepare an Annex XV restriction dossier.

此栏目还能够避免重复工作，并鼓励各成员国在准备附录 XV 时通力合作。该栏目能够帮助各成员国主管部门（MSCAs）/ 欧洲化学品管理局（ECHA）了解哪些特殊物质已经由另一个机构提交了附录 XV 或正在准备附录 XV。需要指出的是，法律要求在限制程序中，如果成员国准备提交附录 XV 限制，必须先通知欧洲化学品管理局。

The registry of intentions is divided into three separate sections: i) a section listing the current, active intentions of EU Member States, ii) the Annex XV dossiers submitted that are still under one of the three decision-making processes (identification as SVHC, Harmonized C&L, restrictions) and iii) a list of the intentions that have been withdrawn after evaluation by a Member State or ECHA is provided.

意向注册栏目分为三个独立的部分：i）展示欧盟成员国当前的主动意向，ii）已提交但仍处于决策阶段的附录 XV（三个决策步骤为：确定高度关注物质、统一分类标签、限制），iii）展示经过成员国或欧洲化学品管理局评估后被撤销的高关注度物质意向；

## ***Socio-economic analysis in REACH***

### ***REACH 中的社会经济分析***

Socio-economic analysis plays a vital role in the restrictions and authorization processes under REACH. Restrictions proposals need to contain a description of the risks as well as information on the health and environmental benefits, the associated costs and other socio-economic impacts. Companies that apply for an authorization to use substances in the Authorization List may include a socio-economic analysis as part of their application.

社会经济分析在 REACH 法规下的限制和授权程序中起着关键作用。限制提议里需要包含对风险的描述以及根据 REACH 实施后带来的健康和环境效益、相关费用和其他社会经济影响的信息。申请授权使用授权清单中的物质的公司可将社会效益分析列入申请书。

ECHA is active in developing and promoting the application of socio-economic analysis in the field of regulating chemicals. It organizes workshops, seminars and other events to build the capacity of Member States and stakeholders to perform socio-economic

analysis to increase the understanding of the role of socio-economic analysis as part of chemicals risk management,

欧洲化学品管理局积极开展并促进开展化学品监管领域的社会经济分析，组织专题讨论会、研讨会和其他活动，以培养成员国和利益相关者开展社会经济分析的能力，从而使得相关方了解社会经济分析在化学品风险管理中的作用。

ECHA is working to examine the economic value of benefits of avoiding selected adverse human health outcomes due to exposure to chemicals. This information can be used as a part of the socio-economic analysis in the evaluation of health and environmental impacts of chemicals. ECHA also maintains a website with a number of sources of information that may be of use to those preparing a socio-economic analysis under REACH.

欧洲化学品管理局致力于分析通过减少化学品接触降低化学品对人体某方面健康风险所实现效益的经济价值。在评价化学品的健康和环境影响时，这种信息可作为社会经济分析的一部分。欧洲化学品管理局还建立了一个网站，大量信息可服务于按照 REACH 规定开展的社会经济分析。

#### **2.3.2.5 Results 结果**

Since the implementation of REACH is at an early stage, there are few experiences to draw lessons from.

由于 REACH 的实施处于初级阶段，可借鉴的经验还不多。

ECHA has set three major deadlines for registration of chemicals. In general these are determined by tonnage manufactured or imported, with 1000 ton/year being required to be registered by 1 December 2010, 100 ton/year by 1 June 2013 and 1 ton/year by 1 June 2018. In addition, chemicals of higher concern or toxicity also have to meet the 2010 deadline.

欧洲化学品管理局为化学品注册设定了三个重要的限期。这些限期通常根据生产量或进口量确定，年产量或进口量为 1000 吨的化学品需要在 2010 年 12 月 1 日前完成注册，年产量或进口量为 100 吨的在 2013 年 6 月 1 日前完成注册，年产量或进口量为 1 吨的在 2018 年 6 月 1 日前完成注册。另外，高度关注化学品或高毒性化学品要在 2010 年以前完成注册。

As of 20 June 2013, there were 144 SVHCs on the candidate list for authorization.

截止到 2013 年 6 月 20 日，授权候选清单上共有 144 项高度关注物质。

About 143,000 chemical substances marketed in the EU were pre-registered by the 1 December 2008 deadline for such registration. Although pre-registering was not mandatory, it allows potential registrants much more time before they have to fully register. Supply of substances to the European market which have not been pre-registered or registered is illegal (known in REACH as "no data, no market").

到 2008 年 12 月 1 日，欧盟市场上销售的约 143,000 种化学物质都完成了预注册。虽然预注册并非强制性的，但它让潜在注册人在进行正式注册之前有更多准备时间。



向欧盟市场供应未经预注册或注册的物质是违法的（在 REACH 中称为“没有数据就没有市场”）。

### 2.3.2.6 Lessons and suggestions for China 对中国的启示和建议

China is perhaps the world's largest producer and user of chemical substances. There are also considerable environmental problems caused by the use and release of such substances. There are several regulations in place in China to handle this problem.

中国或许是世界最大的化学物质生产国和使用国，同时也存在很多由化学物质的使用和排放引起的环境问题。中国颁布了若干项法规处理这一问题。

Ministry of Environmental Protection (MEP) in 2010 released the revised version (the Order No. 7) of the Provisions on Environmental Administration of New Chemical Substances. The new regulation replaced the old regulation issued in 2003. This regulation is according to CIRS (2013) similar to EU REACH and is also known as "China REACH".

2010 年，中国环保部（MEP）发布了修订版的《新化学物质环境管理办法》（环保部 7 号令）。这部新法规取代了 2003 年发布的旧法规。根据 CIRS（2013），此法规类似于欧盟 REACH 法规，因此又被称为“中国 REACH 法规”。

Under this regulation, companies shall submit new chemical substance notification to the Chemical Registration Centre (CRC) of MEP for the new chemicals irrespective of annual tonnage, i.e. chemicals other than the approximately 45,000 substances currently listed in the Inventory of Existing Chemical Substances Produced or Imported in China (IECSC). The notification not only applies to new substance on its own, in preparation or articles intended to be released, but also applies to new substances used as ingredients or intermediates for pharmaceuticals, pesticides, veterinary drugs, cosmetics, food additives and feed additives, etc.

根据此法规，所有涉及《中国现有化学物质名录》的 45,000 种物质之外的化学品的生产、使用及销售的企业应当向环境保护部化学品登记中心（CRC）提交新化学物质申报报告（对新化学物质的生产、使用及销售量没有限制，不论数量多少均需要提交申报报告）。申报不仅适用于新化学物质本身、配置品中的化学物质或在物品中挥发释放的化学物质，而且适用于用作药物、农药、兽药、化妆品、食品添加剂和饲料添加剂等的配料的新化学物质。

A revised version of Regulations on Safe Management of Hazardous Chemicals in China (Decree 591) was published by the State Council in 2011 came into force on 1. December 2013, replacing an old version issued in 2002. The regulation has clauses for the production, storage, import, use, sales and transporting of hazardous chemicals. This regulation is according to CIRS (2013) no doubt the most complex chemical legislation in China. There are 102 articles, dozens of supporting measures and numerous national standards for this law. More than 8 government bodies are involved in the implementation of this law. It is the main law regulating existing chemicals in China.

2011 年，国务院公布了修订版的《危险化学品安全管理条例》，自 2013 年 12 月 1 日起施行，取代了 2002 年发布的旧版条例。条例对危险化学品的生产、储存、

进口、使用、销售和运输做出了规定。根据 CIRS（2013），该条例无疑是中国最复杂的化学品立法。这部法律有 102 条条款、几十项辅助措施和大量国家标准予以支持。8 个以上的政府机构参与了本法律的实施。它是中国监管现有化学品的主要法律。

There are also restrictions on some toxic chemicals to be imported or exported. By January 2014 some 162 chemicals are on the import/export prohibition list. There are also several other regulations imposed towards chemical substances. According to CIRS (2013) compliance with chemical regulations in China is not easy because information is not always transparent and available, and sometimes the regulations could be ambiguous.

中国对进口或出口有毒化学品也有限制。到 2014 年 1 月，进出口禁止清单上有约 162 项化学品。同时还有几部针对化学物质的其他法规。根据 CIRS（2013），因为化学品信息并不是完全透明和可获得的，加之一些法律法规的规定并不十分明确，因此，化学品法规也存在着操作性不强，落实不到位等问题。

**The REACH framework is very comprehensive and requires a lot of knowledge, analytical capacity etc. from the industry side. We see from Europe that implementing REACH takes a lot of time and efforts, and it will take many years before it is fully implemented. Accordingly, the benefits from the framework will not be fully seen before long into the future.**

REACH 框架非常综合全面，而且要求企业有大量的知识和分析能力等。我们从欧盟经验可以看出，实施 REACH 需要耗费大量时间和精力，而且要得到充分实施会需要很多年。因此，框架带来的好处要在未来很久以后才能显现。

**Thus, it would eventually be demanding for Chinese authorities and companies to fully implement a scheme similar to REACH. If interested, China should consider carefully if and how the authorities are or could eventually be prepared for such an introduction as a supplement to existing Chinese regulations.**

由于全球都非常重视化学品管理，由此看来，中国也将开展严格的化学品监管。这就要求中国有关部门和企业充分实施一项与 REACH 类似的计划。如果有兴趣的话，中国应仔细考虑有关部门是否及如何准备出台这样的计划作为对中国现有法规的补充。

**However, Chinese companies exporting goods into the EU are already affected by REACH requirements, and will eventually alone or together with companies in other countries have to follow the procedures and comply with the requirements if they have products that contain potentially harmful substances that have previously not been assessed or authorized by the REACH bodies. Thus, many Chinese companies could over time gain experience with the REACH framework, which could eventually make it easier for China to implement a similar domestic scheme.**

然而，向欧盟出口货物的中国公司已经受到了 REACH 法规要求的影响。如果他们的产品含有以前未经过 REACH 机构评估或授权的潜在有害物质，他们最终必须单独或者与其他国家的公司一起履行程序并遵守要求。这样，许多中国公司就可以逐渐积累 REACH 框架的经验，最终使中国更容易实施一项类似的国内计划。

**An option for China could be to adopt the outcome from the REACH processes in the EU.** This would mean that Chinese authorities would allow the use of all substances that are authorized through the REACH process. This should in the long run ensure high environmental standards in the chemicals policy, but would on the other hand make China rely fully on REACH considerations and make it unable to consider the damages from a local Chinese perspective.

建议当前中国可以充分学习和完全借鉴欧盟 REACH 法案提出的清单物质、操作程序。这意味着中国当局会允许使用所有通过 REACH 程序获得授权的物质。从长远来看，这可以确保化学品政策中的高环境标准，控制和减少化学品带来的健康和环境风险，但另一方面也会让中国完全依赖 REACH 的考虑事项，而无法根据中国本国特点来考虑控制使用的化学品及产品。

### 2.3.3 EU: Seveso Directives: reducing risks of major accidents

欧盟：Seveso 指令：降低重大事故风险

#### 2.3.3.1 Introduction 引言

Industrial accidents involving dangerous substances often have very serious consequences. Some well-known major accidents like Seveso, Bhopal, Schweizerhalle, Enschede, Toulouse and Buncefield have taken many lives and/or damaged the environment and cost up to billions of euro. In the wake of these accidents, political awareness has sharpened towards recognising the risks and taking appropriate precautionary action to protect citizens and communities.

涉及危险物质的工业事故常常有非常严重的后果。一些重大事故，比如塞韦索、博帕尔、史威查豪尔、恩斯赫德、图卢兹和邦斯菲尔德，夺走了很多生命，破坏了环境，财产损失达数十亿欧元。这些事故带来的结果是：认识、了解风险并采取适当防范行动控制风险并保护公民和社区的环境安全的政治意识显著增强。

The 1976 Seveso accident in Italy spurred EU legislation aimed at prevention and control of the risks of major accidents in chemical industry. The resulting “Seveso” directives now apply to around 10 000 industrial establishments. These establishments have in common that they use or store dangerous substances in large quantities and are mainly a part of the chemicals, petrochemicals, storage and metal refining industries. The Seveso directives aim **to reduce the risks of major accidents and also limit the consequences if such accidents happen**. More specifically the legislation seeks to minimize consequences for the environment and at the same time regulates the protection of employees of a company as well as people in close proximity to, for example, a chemical plant.

意大利 1976 年发生的塞韦索事故促使欧盟制定了防止和控制化学工业重大事故风险的立法。事故之后制定的“Seveso”指令目前适用于约 10,000 家工业企业。这些企业的共同之处在于，他们都大量使用或储存危险物质，而且主要属于化学品、石油化学品、仓储和金属精炼行业。塞韦索指令的目的是**降低重大事故风险，并且限制事故的影响后果**。更具体地说，该立法寻求把事故对环境造成的后果减至最小，同时保护公司员工以及靠近化工厂的人员的人身健康和安全。

The directives **oblige member states to facilitate that industry operators have policies in place to prevent major accidents**. Operators that handle dangerous substances above certain thresholds are obliged to regularly inform the public likely to be affected by an accident. The **operators should provide safety reports, a safety management system and an internal emergency plan**. Member states must ensure that **emergency plans are established for the surrounding areas and that mitigation actions are planned**. These objectives should also be taken into account in land-use planning. The legislation constitutes a tiered approach to the level of controls. **The larger the quantities of dangerous substances present within an establishment, the stricter the rules**. The so-called upper-tier establishments have

larger quantities than lower-tier establishments and are therefore subject to more control.<sup>34</sup>

该指令要求成员国必须帮助业界经营者制定预防重大事故的政策。买卖超过一定临界量的危险物质的经营者必须定期向可能受事故影响的公众报告。经营者应提供安全报告、安全管理体系和内部应急预案。成员国必须保证为周围地区制定应急预案，并制定缓解行动方案。在土地使用规划中，这些风险控制目标也应被纳入考虑。该立法对控制水平建立了分层的双轨制管理。企业内存在的危险物质数量越大，控制就越严格。上层企业危险物质数量比下层企业多，因此要受到更大的控制。

The legislation on prevention and limitation of major accidents is threefold and consists of the Seveso I, II and III directives. The Seveso I directive on the major-accident hazards of certain industrial activities was adopted in 1982. In 1996 it was replaced by the Seveso II directive on the control of risk of major-accidents hazards involving dangerous substances. The second directive is a revision of the first directive. The revision was prompted by a change in focus to more general management systems (Versluis, 2004). The new focus stemmed from “the recognition that approximately 85% of over 300 accidents reported under Seveso I have shown some deficiencies in the management system” (Porter and Wettig, 1999: 3). To account for this, **Seveso II introduced a change from focusing on individual technical installations to focusing on entire establishments.**

这部关于重大事故预防与限制的立法由 SevesoI 指令、SevesoII 指令和 SevesoIII 指令三个部分组成。1982 年通过的 SevesoI 指令是关于某些工业活动的重大事故灾害的。1996 年，它被 Seveso II 指令取代，后者是关于涉及危险物质的重大事故灾害风险控制的。修订塞维索指令 I 的原因是欧盟将工业活动风险管理的重点转移到了更加综合的管理制度 (Versluis, 2004)。这一管理重点的改变是由于“认识到了 Seveso I 报告的 300 多次事故中，约 85% 表明管理体系存在缺陷” (Porter and Wettig, 1999: 3)。因此，**Seveso II 做了修改，将管理主体从个别技术设备改为整个企业。**

The Seveso III directive was adopted in 2012 and presents further adaptation of the provisions related to the risks of major accidents as well as harmonizing this legislation with other recently adopted EU policies. In particular, **the directive broadens the scope for citizen protection and information in relation to risks resulting from activities of nearby companies.** The member states are obliged to transpose and implement this directive within 1<sup>st</sup> June 2015. A broad overview of the three Seveso directives is presented in table 2.4.

Seveso III 指令于 2012 年通过，对重大事故风险有关的规定做了进一步调整，并使这部立法与最近通过的其他欧盟政策相协调。特别是，**该指令拓宽了与附近企业活**

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<sup>34</sup> For the detailed classification system with regard to lower- and upper-tier establishments see Annex 1, Part 1 in the official legislation: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0001:0037:EN:PDF>

关于下层企业和上层企业的详细分类系统，见正式立法第一部分附录 1: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:197:0001:0037:EN:PDF>

动所致风险有关的市民保护和信息公开范围。成员国必须在 2015 年 6 月 1 日之前转换并实施本指令。表 2.4 提供了对 Seveso 系列指令的概述。

**Table 2.4 The Seveso directives: A brief summary**

**表 2.4 Seveso 指令：小结**

	Specifics 全称	Date of adoption 通过日期	Content/change from previous legislation 内容/与上一部立法的不同
Seveso I	<p>Directive 82/501/EEC on the major-accident hazards of certain industrial activities</p> <p>关于某些工业活动引起的重大事故灾害的指令 82/501/EEC</p>	<p>June 24<sup>th</sup>, 1982. Amended twice, in 1987 and 1988</p> <p>1982 年 6 月 24 日。1987 年和 1988 年两次修改</p>	<ul style="list-style-type: none"> <li>• Main objective: To prevent major accidents and to limit their consequences for man and the environment</li> </ul> <p>主要目的：预防重大事故并降低事故的健康和环境影响</p> <ul style="list-style-type: none"> <li>• Member states must assure that operators have a policy in place to prevent major accidents and that this policy is reported to and monitored by competent authorities within each member state</li> </ul> <p>成员国必须确保经营者制定预防重大事故的政策，该政策须报告给每个成员国内的主管部门，并由主管部门监控。</p>
Seveso II	<p>Directive 96/82/EC on the control of major-accident hazards involving dangerous substances</p> <p>关于控制涉及危险物质的重大事故灾害的指令 96/82/EC</p>	<p>December 9<sup>th</sup>, 1996. Amended in 2003</p> <p>1996 年 12 月 9 日。2003 年修改</p>	<ul style="list-style-type: none"> <li>• Introduction of new requirements relating to safety management planning, emergency planning and land-use planning</li> </ul> <p>执行关于安全管理规划、应急预案和土地使用规划的新要求</p> <ul style="list-style-type: none"> <li>• Reinforcement of the provisions on inspections to be carried out by the member states</li> </ul> <p>强化关于由成员国进行检查的规定</p>
Seveso III	<p>Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC</p> <p>关于控制涉及危险物质的重大事故灾害的指令 2012/18/EU，修改并随后取代了欧盟委员会指令 96/82/EC</p>	<p>July 4<sup>th</sup> 2012</p> <p>2012 年 7 月 4 日</p>	<ul style="list-style-type: none"> <li>• Technical updates to take account of changes in EU chemicals classification</li> </ul> <p>技术更新，将欧盟化学品分类的调整考虑在内</p> <ul style="list-style-type: none"> <li>• Better access for citizens to information about risks and more effective rules on public participation in land-use planning projects related to Seveso plants. Access to justice for citizens who have not been granted access to information and participation</li> </ul>

			<p>让市民更好地获取关于风险的信息，强调了公众参与和 Seveso 工厂有关的土地使用规划，使得相关规定更具操作性和有效性。由于企业和政府原因致使信息公开和公众参与不到位的，公众可以诉诸司法。</p> <ul style="list-style-type: none"><li>• Stricter standards for inspections of establishments to ensure more effective enforcement of safety rules</li></ul> <p>企业排查标准更加严格，以保证更有效地执行安全规程。</p>
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Source: The European Commission 来源：欧盟委员会

2.3.3.2 Principles 原则

The Seveso directives are **concerned with the prevention of major accidents, which may result from certain industrial activities, and with the limitation of their consequences for both the environment and the public.** It is the responsibility of each member state to facilitate the manufacturer to undertake all measures necessary to prevent major-accidents and to limit consequences if any accident happens. **The member states are also obliged to ensure that competent authorities are set up,** and that the manufacturers report back to these authorities.

Seveso 指令旨在预防某些工业活动引起的重大事故，以及减轻事故对环境和公众造成的后果。每个成员国都有责任帮助生产商采取一切必要措施预防重大事故，并在发生重大事故时降低其健康、环境影响。

The underlying principle of the legislation is **precautious action** (in line with the **precautionary principle**). The desire is to reduce the risk of major accidents and to limit their consequences. In order to accomplish these objectives **information serves as a key instrument** to achieve the main objectives of these directives. First, **staff working at the different plants (establishments) needs sufficient and correct information to be able to prevent and limit accidents.** Second, **people living nearby plants have a right to information of the possible hazards and how to behave in an emergency situation.**

该立法的基本原则是**防范行动**（根据**风险预防原则**）。立法的目的是降低重大事故引起的风险，并减轻重大事故造成的后果。要完成这些目标，需要掌握大量的风险防控有效信息。首先，在不同工厂（企业机构）工作的员工需要掌握充分和正确的信息才能够预防并降低事故频率。其次，住在工厂附近的公众有权知道他们可能遭受的危害以及在紧急情况下该采取何种措施。

The Seveso legislation was updated (by Seveso II and III) to ensure high levels of protection throughout the EU in a consistent and efficient manner. This is equivalent to **fairness and equity** in the sense that existing and new establishments are subjected to the same rules and approaches across the member states. Since the consequences of major-hazard accidents can travel across member state borders, the directive objectives can, in some circumstances, be better achieved at the EU level. The legislation thus

allows the EU to adopt measures in accordance to the **principle of subsidiarity** and the **principle of proportionality** (see chapter 1 for definitions).

Seveso 立法根据风险形势的变化在不断更新（通过 Seveso II 和 III），以便一致有效地确保整个欧盟范围内对于工业风险的高水平保护。现有企业和新企业须遵守所有成员国内相同的管理规定和方法，这也就是公平公正原则。由于重大灾害事故可能造成跨界影响，因此某些情况下，指令在整个欧盟层面实施将有助于立法目标的实现。因此，该立法允许欧盟根据替代原则和相称性原则（定义见第 1 章）采取风险防范措施。

### 2.3.3.3 Approach 方法

The Seveso directives apply to establishments where dangerous substances are present in large quantities.<sup>35</sup> The Seveso directives establish **how a policy regime to prevent and limit major accidents should be set up within the EU member states**. This implies that each operator is inclined to draw up a **major-accident prevention policy**.<sup>36</sup> Furthermore **each establishment is required to notify competent authorities within each member state of its dangerous substances**. The operators are also required (by the member states) to **produce safety reports and emergency plans**. In the event of **an accident, the operator should supply information to the competent authorities, which again should adopt appropriate measures**.

Seveso 指令适用于存在大量危险物质的企业及机构。Seveso 指令规定了如何在欧盟成员国内建立预防和规避重大事故的政策制度。这意味着，每个经营者都要制定重大事故预防政策。此外，每家企业机构都要向成员国的主管部门通报危险物质的相关信息。经营者还被（成员国）要求编制安全报告和应急预案。发生事故时，经营者应向主管部门提供信息，主管部门还应再采取适当措施。

The member states are responsible for overseeing that **the public likely to be affected by an accident are informed on safety measures and how to behave in the event of an accident**. The **safety reports from the different establishments should also be publicly available**. However, the operator may ask the competent authorities to not disclose certain parts of the report to the public (for reasons of public security, national defense or industrial, commercial or personal confidentiality). Member states should also provide information to nearby member states on potential issues that can have transboundary effects.

成员国负责监督可能受事故影响的公众是否被告知了安全措施以及在事故发生时的应对措施。企业的安全报告也应向公众公开。然而，经营者可要求主管部门将涉及

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<sup>35</sup> See <http://ipsc.jrc.ec.europa.eu/?id=491> for the substances covered by the legislation and for the classification and thresholds of these substances.

该立法所涉及的物质以及这些物质的分类和临界量见 <http://ipsc.jrc.ec.europa.eu/?id=491>。

<sup>36</sup> An operator is defined as any individual or corporate body that holds an establishment or installation (within an establishment) or an individual who has been given decisive economic power.

经营者被定义为持有一个企业机构或（企业机构内）设备的个人或法人团体，或者被赋予了决定性经济权的个人。



公共安全、国防或工业机密、商业机密或个人机密等内容保密。成员国还应向相邻的成员国提供关于可产生跨境影响的潜在问题的信息。

In the event of an **accident** the Commission should receive the details on these as well as the emergency measures taken and the immediate precautions necessary to prevent such an accident from happening again. A standardized report on the accident should also be provided by the member states based on the information from the operator and the competent authorities. The Commission is in charge of a register and information system containing the details of the major accidents which have occurred. The main purpose of this system is **to provide relevant actors with information on preventive measures and the lessons learned from major accidents**.

发生**事故**时，欧盟委员会应得到事故信息以及事故的应对措施和类似事故防范措施等详细信息。成员国还应根据经营者和主管部门提供的信息提交标准化的事故报告。欧盟委员会建立了登记与信息系统，系统内记录了重大事故的详细信息。该系统的主要目的是**向相关责任人提供事故预防措施信息以及从重大事故中得到的教训**。

With respect to enforcement of establishment compliance, **establishments can face a prohibition order**. However an operator may appeal to an appropriate body (determined by national law) against such an order. The directives specify that:

在企业执行情况的检查方面，**企业可能由于存在某些问题而被要求禁止生产**。然而，经营者可针对惩罚结果向相关机构（根据国家法律确定）上诉。指令规定：

- Member states shall prohibit the use of any establishment, installation or storage facility if measures taken by the operator for the prevention and mitigation of major accidents have serious flaws  
如果经营者所采取的重大事故预防和减轻措施有严重缺陷，成员国应禁止任何企业机构、设备或储存设施的生产和使用活动。
- Member states may prohibit the use if the operator has not submitted the notification, reports or other information required within the specified time period  
如果经营者未在规定时间内提交申报书、报告或者所要求的其它信息，成员国可颁布禁令。

Member state authorities also enforce compliance with the Seveso directives through **inspections and penalties**. The Seveso legislation (Seveso I and II) has **traditionally not applied to the following types of establishments**:

成员国还通过检查和处罚强制企业遵守 Seveso 指令。Seveso 立法不适用于以下类型的企业机构：

- Military establishments, installations or storage facilities  
军事机构、设备或储存设施
- Hazards created by ionizing radiation  
电离辐射造成的危害

- The transport of dangerous substances and intermediate temporary storage by road, rail, internal waterways, sea or air, outside the establishments covered by this legislation<sup>37</sup>  
在不受本立法约束的企业机构厂界外，通过公路、轨道、国内水道、海洋或空中运输危险物质以及临时储存仓库
- The transport of dangerous substances in pipelines  
通过管道运输危险物质
- The activities of the extractive industries concerned with exploration for, and the exploitation of, minerals in mines and quarries or by means of boreholes  
采掘行业与勘探和开采矿井或采石场中的矿产品或者以钻井方式进行勘探和开采有关的活动
- Waste land-fill sites 垃圾填埋场

However, in Seveso III exclusions from the legislation are to be assessed on a case to case basis by the Commission.

然而，欧盟委员会可根据实际情况实施 Seveso III 指令。

#### 2.3.3.4 Tools 工具

As outlined above, the Seveso approach is based on several tools. **The main tools are Notification, Major-accident prevention policy (MAPP), Safety reports, Emergency plans, Land-use planning, Information to the public, Public consultation and participation in decision-making (introduced by Seveso III) and Inspections.** Below is a description of how these work. If changes occur at an establishment which could result in a lower-tier (i.e. low risk) establishment becoming an upper-tier (i.e. high risk) establishment (or vice versa), the Notification, the MAPP and the Safety report should be updated accordingly. Figure 2.8 shows how the different tools apply to the two types of establishments. Lower-tier establishments have fewer obligations than upper-tier establishments.

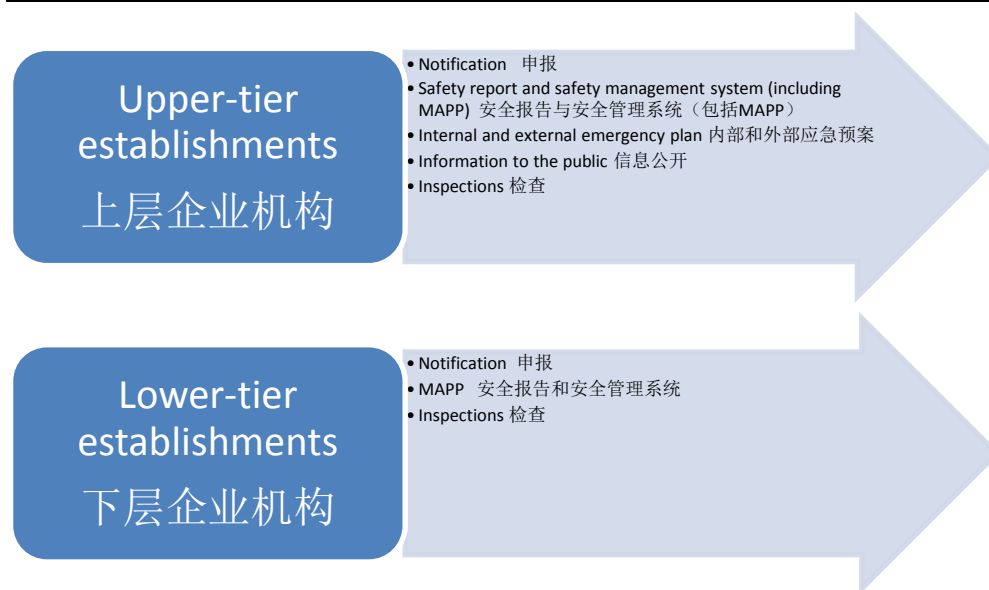
如上所述，Seveso 指令以几个工具和手段为基础。主要工具和手段有：申报、重大事故预防政策（MAPP）、安全报告、应急预案、土地使用规划、信息公开、征询民意和公众参与决策（Seveso III 引入的）以及检查。下面描述这些工具是如何实施的。如果某企业机构发生变化，导致下层（即低风险）企业机构变为上层（即高风险）企业机构（或反之亦然），申报、MAPP 和安全报告应相应进行更新。图 2.8 显示了不同工具如何适用于两种类型的企业机构。由于上层企业环境风险高，因此其开展的工作和提交的材料与报告要多于下层企业机构。

#### Figure 2.8 Reporting and monitoring requirements for upper-tier and lower-tier Seveso establishments

图 2.8 上层和下层 Seveso 企业机构的报告和监测要求

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<sup>37</sup> See <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:260:0013:0059:EN:PDF> for legislation on the carriage of dangerous goods by road, rail and inland waterway  
关于通过供公路、轨道和内陆水道运输危险货物的立法见 <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:260:0013:0059:EN:PDF>



### Notification 申报

The operator of a new or old establishment is **obliged to send a notification to member state authorities with contact details and information on dangerous substances which are present or likely to be present at the establishment.** This notification should contain name and full address, the registered place of business and the name of the person in charge of the establishment (if not the same person as the operator). Furthermore, **information sufficient to identify the dangerous substances and categories of substances involved or likely to be present should be provided.** The quantities and physical form of the substances and the activity or proposed activity of the installation/storage facility are also to be accounted for in the notification.

新企业或老企业的经营者必须向成员国当局提交申报书，注明详细联系方式以及关于企业存在或可能存在的危险物质的信息。申报书里应注明企业的名称、详细地址和注册地点以及企业负责人的姓名（如果企业负责人和经营者不是同一个人）。此外，还应提供足以识别所涉或可能存在的危险物质的量以及物质种类。申报书里还应说明物质的数量和状态以及设备/存储设施的工业生产活动。

Lastly, the notification must include a **report of the nearby environment of the establishment and factors that may cause a major accident or may increase the consequences of possible accidents.** This includes details of neighbouring establishments and of sites that fall outside the scope of the Seveso legislation. Developments that could be **the source of or increase the risk of a major accident or domino effects (i.e. an accident in one plant starting a chain of accidents in neighboring plants)** are also to be specified. The same holds for **developments that could increase the possible consequences of accidents or domino effects.** If the risks of domino effects are high, the concerned establishments are obliged to cooperate and exchange information. This is particularly relevant for industrial parks, see chapter 3. If any changes in the information provided occurs (i.e. an increase or decrease in the quantity of the dangerous substances or permanent closure), the operator of the establishment should make the responsible national authorities aware of these changes.

最后，申报书必须包括一份企业附近环境的报告以及可能引起重大事故或者可能扩大潜在事故的后果分析。这包括相邻企业以及 Seveso 立法适用范围以外场地的详细信息。此外还应详细说明企业成为重大事故或多米诺骨牌效应（即一个工厂的一例事故引发附近工厂的一连串事故）的风险及事故后果情况。如果多米诺效应风险较高，有关各企业必须开展合作并交流信息。在工业园区层面，企业间开展风险交流是非常必要的，见第 3 章。如果提交的信息有变动（即危险物质的数量增减或者停止生产），企业经营者应将这种变动告知成员国负责部门。

### **Major-accident risk prevention policy 重大事故风险预防政策**

**The operator is required to outline the major-accident risk prevention policy (MAPP) in a written document** which is to be sent, if national law stipulates it, to the responsible national authorities.<sup>38</sup> The MAPP is to be designed to ensure a high level of protection of human health and the environment, and should be proportionate to the risk of major-accidents. This **includes the operator's main goals and principles of action and the role and responsibility of management**. The MAPP should also signal the commitment towards continuously improving the control of major-accident hazards and ensuring high protection levels. The MAPP should be subject to review by the operator at least every five years.

经营者需要按照法律规定以书面文件的形式向国家负责部门发送**重大事故预防政策（MAPP）概要**。MAPP 旨在监督健康和环境风险管理措施能够高度落实，并且应当与重大事故的风险水平和后果相匹配。报告包括经营者行动的主要目标和原则以及管理人员的职责等内容。**MAPP 还应体现出对不断改进重大事故灾害控制和确保风险防控水平的承诺**。MAPP 还需由经营者每五年审核一次。

The operator is responsible for the proper implementation of the MAPP at the establishment. **The MAPP is to be implemented by appropriate means and structures, and by a safety management system**. The implementation should be **proportionate to the major-accident hazards, the complexity of the organization or the activities of the establishment**. There is granted more discretion in the implementation for lower-tier establishments than for upper-tier establishments.

经营者负责 MAPP 在企业的落实。**MAPP 要以适当的手段和组织方式、通过安全管理体系来实施**。实施应与重大事故灾害、组织的复杂度或者企业的高风险活动相称。在实施中，下层企业可以依据塞维索指令的要求，自行编写某些章节的内容，与上层企业项目相比，其 MAPP 的要求更为宽松。

### **Safety report (for upper-tier establishments only) 安全报告（仅适用于上层企业）**

The operator of an upper-tier establishment is required to produce a safety report in line with these purposes:

上层企业的经营者需按照以下目的编制安全报告：

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<sup>38</sup> For an example of a Major Accident Prevention Policy (MAPP) see the MAPP of Lansdowne Chemicals: <http://www.lansdownechemicals.com/assets/pdfs/MAPP.pdf>  
重大事故预防政策（MAPP）范例见兰斯顿化工有限公司的 MAPP

- To show that a MAPP and a safety management system for implementing it have been established  
说明已制定了 MAPP 并建立了实施 MAPP 的安全管理系统
- To show that major-accident hazards and possible major-accident scenarios have been identified and that the necessary measures have been implemented to prevent accidents and to limit their consequences  
说明已确定了重大事故灾害及可能的重大事故场景，并且采取了必要措施来预防事故及限制事故的后果
- To show that adequate safety and reliability have been accounted for in design, construction, operation and maintenance of for instance equipment, infrastructure and storage facilities  
说明在设备、基础设施和存储设施的设计、建造、操作和维护中已经考虑了安全性和可靠性。
- To show that internal emergency plans are in place and that information to facilitate an external emergency plan is provided  
说明已制定了内部应急预案并且已提供了便于制定外部应急预案的信息
- To provide sufficient information to the national authority to enable decisions to be taken with regard to the siting of new activities or development around existing establishments  
向国家有关部门提供充分信息，使其能够就现有企业周围新活动或开发项目的选址做出决策

The safety report is to be sent to the responsible national authorities. The report is subject to periodical review by the operator. If there are any new evolvments, the safety report should be updated accordingly. This is also standard procedure following a major accident at the establishment.

安全报告要发送给成员国负责部门。该报告需由经营者定期审核。如有新情况，安全报告应进行相应更新。这也是企业发生重大事故之后应遵循的标准程序。

### **Emergency plans (for upper-tier establishments only)**

应急预案（仅适用于上层企业）

In the event of an accident it is important to have high-quality emergency plans to rely on. **Emergency plans can contribute to limiting damage and minimizing the effects of an accident.** Such a plan is also a necessary tool to provide information to the public, authorities and services concerned in an efficient manner. The emergency plan also outlines the restoration and clean-up following a major accident.<sup>39</sup>

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<sup>39</sup> See <http://www.galwaycity.ie/AllServices/RoadsandTraffic/Publications/FileEnglish,5116,en.pdf> for an example of an external emergency plan (Galway Harbour Enterprise Park) and <http://www.mem.ie/guidancedocuments/a%20guide%20to%20seveso%20obligations.pdf> for EU guidance on emergency plans.外部应急预案范例（Galway 港企业园区）见 <http://www.galwaycity.ie/AllServices/RoadsandTraffic/Publications/FileEnglish,5116,en.pdf>，欧盟应急预案指导见 <http://www.mem.ie/guidancedocuments/a%20guide%20to%20seveso%20obligations.pdf>

发生事故时，可操作性强、实施性强的应急预案很重要。应急预案有助于限制事故的损害并将事故影响减至最小。预案还是信息公开和发布的必要工具。应急预案还要概述发生重大事故之后的修复清理措施。

In order to accomplish the objectives of an emergency plans, the following steps need to be taken:

为了实现应急预案的目标，需要执行以下步骤：

1. An internal emergency plan of the measures to be taken inside the establishment drawn up by the operator  
由经营者拟订企业内部应对措施的内部应急预案
2. Necessary information to draw up an external emergency plan has to be provided to the responsible authority by the operator  
经营者必须向负责部门提供拟订外部应急预案的必要信息
3. An external emergency plan for the measures to be taken outside of the establishment drawn up by the authority  
有关部门拟订企业外部应对措施的外部应急预案

Personnel working inside the establishment are to be consulted on step 1 while the public concerned should have the possibility to give its opinion regarding step 3. Both the internal and external emergency plan should be reviewed, tested and where necessary also updated.

编制外部应急预案时要征询企业内部工作人员的意见，公众应当就外部应急预案提出意见。内部和外部应急预案均应进行审核、检验，必要时进行更新。

### Land-use planning 土地使用规划

Article 12 of the Seveso II Directive requires Member States to ensure that the objectives of preventing major accidents and limiting the consequences of such accidents are taken into consideration in their land-use planning policies. The **essential necessity here is to maintain appropriate distances between establishments covered by the directives and residential areas, areas of public use and areas of particular national interest.** However, **the legislation itself does not contain any detailed suggestion on how this should be done.** In order to address this issue, a Technical Working Group (TWG 5) was set up in 1996, with the participation of representatives from the Member States nominated by their Competent Authorities, representatives from the relevant Federations of Industry and from the local authorities (e.g. associations of mayors).

《Seveso II 指令》第 12 条要求成员国确保在其他土地使用规划中考虑预防重大事故和限制该等事故后果的目标。在这一点上的基本要求是保持受指令约束的企业与居住区、公共使用区和国家划定的特殊区域之间保持的适当距离。然而，该立法本身并没有就如何做到这一点提出详细建议。为了解决这一问题，1996 年成立了技术工作组（TWG 5），工作组的成员有成员国主管部门提名的代表、相关工业联合会的代表以及地方当局（例如市长协会）的代表。



### **Box 2.4 Safety zones in the SEVESO Directive**

#### 框 2.4 Seveso 指令中的安全地带

The Seveso Directive addresses the issue of safety zoning through its Article 12(1) on land-use planning, which requires the following:

“Member States shall ensure that the objectives of preventing major accidents and limiting the consequences of such accidents are taken into account in their land-use policies and/or other relevant policies. They shall pursue those objectives through controls on:

(a) the siting of new establishments,

(b) modifications to existing establishments covered by Article 10,

(c) new developments such as transport links, locations frequented by the public and residential areas in the vicinity of existing establishments, where the siting or developments are such as to increase the risk or consequences of a major accident.

Member States shall ensure that their land-use and/or other relevant policies and the procedures for implementing those policies take account of the need, in the long term, to maintain appropriate distances between establishments covered by this Directive and residential areas, areas of public use and areas of particular natural sensitivity or interest, and, in the case of existing establishments, of the need for additional technical measures in accordance with Article 5 so as not to increase the risks to people.”

The Seveso Directive thus requires Member States to ensure that the objectives of preventing major accidents and limiting the consequences of such accidents are taken into consideration in land-use planning policies. The Directive does not contain any detailed suggestion on how this should be done. In order to address this issue, a Technical Working Group (TWG 5) was set up in 1996, with the participation of representatives from the Member States nominated by their Competent Authorities, representatives from the relevant Federations of Industry and from local authorities. In 1999 TWG 5 issued a Guidance document in support to the implementation of Article 12. The Conference on "Major Industrial Hazards in Land-use Planning", held in 2002 showed a need for enhanced convergence, in particular in the field of risk assessment. The conference emphasized that the variety of approaches was substantial. According to EU's Joint research Center<sup>40</sup>, the practices and methodologies are so varied that it is difficult to compare land-use policies throughout the European Union or to defend against claims that they do not support a minimum standard across the Member States. Article 12 in the Directive was amended in 2003 to establish a database for risk data and to develop guidance to local planners with respect to risk assessment in land-use planning.

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<sup>40</sup><http://ipsc.jrc.ec.europa.eu/index.php/Land-use-planning/694/0/>).

Seveso 指令通过第 12 (1) 条关于土地的使用规划解决安全区域划分的问题，该 12 (1) 条要求：

“成员国应确保在制定土地使用政策和（或）其他相关政策时考虑到防止重大事故和限制该类事故影响的目标。成员国应通过对以下方面的控制来争取达到这些目标：

(a) 新企业的选址，

(b) 对受第 10 条约束的现有企业的修改，

(c) 公众常去的新建设项目，例如交通枢纽、地点和现有企业附近的居住区，这些地方的选址或项目很重要，有可能会增加某重大事故的风险或影响，

成员国应确保其土地使用和（或）其他相关政策以及执行这些政策的程序从长期考虑受指令约束的企业与居住区、公共使用区和国家划定的具特殊自然敏感度或特殊利益的区域之间保持适当的距离；针对现有企业，还要考虑根据第 5 条采取其他技术措施，避免增加对人的风险。”

《Seveso 指令》因此要求成员国确保在土地使用规划中考虑预防重大事故和限制该等事故后果的目标，但指令未针对如何做到这一点给出详细建议。为解决这一问题，1996 年成立了技术工作组（TWG 5），工作组的成员有成员国主管部门提名的代表、相关工业联合会的代表以及地方当局的代表。1999 年，TWG 5 发布了一份指导文件，以支持第 12 条的实施。2002 年举行的“土地使用规划中的重大工业危害”会议表明需要加强一致性，尤其是风险评估领域的一致性。会议强调，方法的多样性是重要的。根据欧盟联合研究中心，采取的做法和方法非常多样化，以致于很难比较欧盟的所有土地使用政策或针对它们不符合成员国最低标准的指控进行辩护。指令中的第 12 条于 2003 年进行了修改，以建立风险数据库，并为地方规划者提供土地使用规划风险评估的指导。

In 1999, after three years of work, TWG 5 issued a Guidance document in support to the implementation of Article 12.<sup>41</sup> The document presents some general guidelines on how to assess the risks for accidents and how this could be reduced for new establishments, modifications to existing establishments and developments in the vicinity of existing establishments. The matters suggested as possibly relevant for consideration include the results of risk analysis and evaluation, including an evaluation of the physical characteristics of the area in which the hazardous activity is being planned, including where relevant:

1999 年，这项工作启动三年之后，TWG 5 发布了一份指导文件，以支持第 12 条的实施。文件就如何评估事故风险以及如何降低新建企业、现有企业改扩建项目和现有企业附近开发项目的事故风险提供了一些一般导则。建议可结合风险分析评估的结果、高风险活动所在区域特征对导则进行适当修订，应当考虑的因素包括：

<sup>41</sup> 土地利用规划指导见 See

[http://ipsc.jrc.ec.europa.eu/fileadmin/repository/sta/mahb/docs/LandUsePlanning/EUR18695EN\\_LandUsePlanningGuidance.pdf](http://ipsc.jrc.ec.europa.eu/fileadmin/repository/sta/mahb/docs/LandUsePlanning/EUR18695EN_LandUsePlanningGuidance.pdf) for the guidance on land-use planning.



- The quantities and properties of hazardous substances on the site;  
现场危险物质的数量和特性;
- Brief descriptive scenarios of a representative sample of industrial accidents possibly arising from the hazardous activity, including an indication of the likelihood of each;  
简要描述可能由危险活动引起的最大可信事故情景，包括指出每种情景的可能性;
- For each scenario:对于每一种情景:
  - The approximate quantity of a release;大约释放量
  - The extent and severity of the resulting consequences both for people and for the non-human environment in favourable and unfavourable conditions, including the extent of resulting hazard zones;  
在有利和不利条件下，对人以及对非人类环境所致后果的范围和严重程度，包括所致危害区的范围;
  - The time-scale within which the industrial accident could develop from the initiating event;  
从事件的发生到演化为重大事件的经历时间
  - Any action which could be taken to minimize the likelihood of escalation.  
为了将事故风险（发生可能性和事故影响）减至最小而可以采取的行动
- The size and distribution of the population in the vicinity, including any large concentrations of people potentially in the hazard zone;  
周边人口规模和分布，包括危害区可能出现的人口聚集情况;
- The age, mobility and susceptibility of that population.  
周边人口的年龄、流动性和敏感性;
- The severity of the harm inflicted on people and the environment, depending on the nature or circumstances of the release;  
人和环境的受害程度，视释放物质的性质和事故情况而定;
- The distance from the location of the hazardous activity at which harmful effects on people and the environment may reasonably occur in the event of an industrial accident;  
与危险装置设施及生产活动所在地的距离，发生工业事故时可能会对周边人和环境产生适度的有害影响;
- The same information not only for the present situation but also for planned or reasonably foreseeable future developments.  
预测工业企业未来发展的情况及风险的水平、环境影响情况等;
- The results of consultations and public participation processes;  
信息公开及公众参与过程的结果;
- The evaluation of the environmental risks, including any transboundary effects;  
环境风险评估，包括跨境（跨界）影响;

The guidance document also presents some examples on how this has been followed up in some EU countries. The essential issue in land use planning is to have enough space between the industry activity and residential areas. The Government in one EU country has issued guidelines for housing developments close to existing industry and to the consideration of proposals to modify industrial establishments as well as the location of new industry. The Government also prescribes that measures should be taken at the

source to reduce industrial discharges and noise, but in addition to such restrictions on discharges, etc. it is recognized that there is also a need for planning measures to protect the immediate surroundings and people.

指导文件还通过一些案例说明了一些欧盟国家的实施情况。土地利用规划中的基本问题是工业活动与住宅区之间要有足够的安全距离。一个欧盟成员国的政府发布了现有工业企业附近住房开发导则，并发布了改造工业设施及新工业企业选址的提案供审议。该政府还规定，应从源头上采取措施，以减少工业排放和噪音，但除了这些排放限制之外，公众认为还需要通过规划措施来保护周边环境和居民。

Safety distances are listed for 32 different activities, for example (Christou & Porter, 1999):

该成员国列出了 32 项不同活动的安全距离，例如：

- Plastic industry: 200 meters  
塑料工业：200 米
- Paper mill: 500 meters  
造纸厂：500 米
- Non-organic chemical industry: 1,000 meters  
非有机化工：1000 米
- Oil refinery: 1,500 meters  
炼油厂：1500 米

The guideline values presented are the typical initial values, more detailed assessment should be undertaken as necessary. The latter involves consideration of “reasonable” scenarios that can occur. Examples of such scenarios are: discharges, fire, smoke from fires, contaminated extinguishing water, explosions and subsequent damage. The list of distances is based on experience and studies of the permit-granting authorities as well as the findings of environment researchers. The guidelines for safety distances therefore contain the joint assessment of risks to the environment, health and safety. The recommendations can be used in overall assessments of location, safety distances, etc. in comprehensive plans as well as for the design of detailed development plans and their regulations concerning demands for safety distances and demands on the design of land and buildings.

所提供的指导值是经验判断的初始值，必要时应进行详细评估并对安全距离予以调整。后者需要考虑可出现的“合理”情景。这种情景有：泄露、火灾、火灾烟气、被污染的消防水、爆炸及后续损害。所列的距离基于经验和排污许可证颁发部门的研究以及环境研究人员的调查结果。因此，安全距离导则包含环境、健康和安全风险的综合评估。这些建议值可用于综合规划中选址、安全距离等的总体评估，也可用于详细开发方案的设计以及开发方案中关于安全距离需求和土地与建筑物设计需求的规定。

## Information to the public and public consultation and participation in decision-making

### 信息公开以及公众协商和公众参与决策

Later versions of the Seveso directives have **particularly emphasized the importance of public awareness regarding major-accidents hazard**. One tool to accomplish this goal is to **make the information of these hazards available to the public**. Another tool is to **grant the public consultative rights in the decision-making process**.

最新的 Seveso 指令特别强调了公众对重大事故灾害的认知非常重要。实现这一目标的一个手段就是向公众提供这些危害的信息（信息公开）。另一个手段是赋予决策过程中的公众商议权（公众参与）。

With regard to the first tool, sufficient communication to the public is necessary to limit the consequences of a major accident. All persons likely to be affected by a major accident should thus **regularly receive information on safety measures and how to behave in the event of a major accident in an upper-tier establishment**. The public can also request information contained in, for instance, the safety report. Potentially affected neighboring member states should also receive information on possible transboundary effects.

关于第一种手段，充分向公众传达信息对于限制重大事故的后果是必要的。因而，所有可能受重大事故影响的人员都应定期得到关于安全措施以及上层企业发生重大事故时的应对信息。公众还可以索要安全报告中包含的信息。可能受影响的邻近成员国也应得到关于可能跨境影响的信息。

With regard to the second tool, the public concerned should be given an early opportunity to give its opinion on planned new establishments or possible evolvments of existing establishments. The consultations with the public should then be taken into account in the decision-making. Information on the decision-making related to new projects and evolvments should also be provided publicly.

关于第二种手段，有关公众应尽早参与区域规划中的新企业或现有企业的可能变动的决策并发表意见。在决策过程中应考虑与公众协商。同时还应公开提供与新项目和变动项目有关的决策方面的信息。

### Inspections 检查

**A system of inspections is organized within each member state** to ensure compliance with the legislation. The purpose of inspections is to verify that:

每个成员国境内均组建了一个检查系统，以确保遵守立法。检查的目的在于查证：

1. The operator has taken the appropriate measures to prevent major accidents  
经营者已采取了适当措施来预防重大事故
2. The operator has provided the appropriate means for limiting the consequences of major accidents, both on-site and off-site  
经营者提供了限制现场和场外重大事故后果的适当手段
3. The data and information provided in the reports submitted accurately reflect the establishment

提交的报告中所提供的数据和信息准确反映企业情况

4. Information has been supplied to the public

向公众提供信息（检查结果也是信息公开的内容之一）。

All establishments are covered by an inspection plan at the national, regional or local level. While **inspections at upper-tier establishments occur at least on an annual basis, the period between site visits can be three years for lower-tier establishments**. If the inspections reveal shortcomings, the operators need to implement the proposed actions. **Non-routine inspections are carried out to investigate serious complaints, serious accidents and “near misses” incidents**.

所有的企业都参加一项国家、区域或地方级的检查计划。上层企业的检查至少每年进行一次，但下层企业的现场检查时间间隔可以是三年。如果检查发现不足之处，经营者需要根据现场检查所提出的建议措施进行整改和完善。除了这些例行的常规检查以外，还可以进行抽查，以调查重大投诉、严重事故和“险兆”事故。

### How are EU Member States and enterprises implementing the Seveso Directive? 欧盟成员国和企业是如何实施 Seveso 指令的？

Member States are free to internally organize the responsibility for the implementation and follow up of the Seveso Directive. In most EU countries this responsibility seems to be placed within a different government institution than for instance the responsible for pollution control. In Norway for instance, the responsible institution for the Seveso Directive is the Norwegian Directorate for Civil Protection, which is responsible for national, regional and local civil protection, fire and explosion protection, electrical safety, safe handling of hazardous substances (including transportation) etc. On the other hand, the responsible institution for preventing pollution of air, water and soil is the Norwegian Directorate for Pollution Prevention. In smaller EU countries with relatively few Seveso enterprises risk management issues and pollution prevention can be handled by one public institution only.

成员国可以自由安排本国该如何安排《Seveso 指令》的实施与具体落实责任。在多数欧盟国家，这种职责安排给了除污染控制机构以外的其他政府机构。例如，挪威的《Seveso 指令》责任机构是挪威民防局，它负责全国、地区和地方民防、防火防爆、用电安全、危险物质的安全搬运（包括运输）等。另一方面，预防空气、水和土壤污染的责任机构是挪威污染预防局。在较小的欧盟国家，由于受 Seveso 指令约束的企业数量较少，风险管理问题和污染预防工作只能由一家公共机构处理。

The responsibility for following up requirements from Seveso and other regulations regarding environment, health and safety (EHS) is usually an integrated part of the production chain in most companies, and a part of everyday operations of a plant. Thus, it is usually the responsibility for all employees, from the top manager to the “operator on the floor” to ensure that the various EHS regulations and company procedures are fulfilled. This is considered the best way to ensure that EHS risks are minimized. Usually there are also internal systems in place to follow up and monitor this, with some personnel (EHS executive officer) dedicated to these tasks. These systems are often based on international standards, such as ISO 14000 (environmental protection) and OHSAS 18001 (safety). Regular internal EHS audits ensure the effectiveness of these management systems.

落实 Seveso 和其他环境、健康和安全（EHS）方面法规的要求通常是很多企业生产链中不可分割的一部分，也是一个工厂日常运转的一部分。因而，确保落实各种 EHS 法规和公司规程通常是从总经理到“地面操作工”全体员工的责任。这被认为是确保 EHS 风险最小化的最佳方式。通常还有内部制度来落实和监控这项责任，指定专人（EHS 执行官）负责这些工作。这些制度常常以国际标准为基础，比如 ISO 14000（环境保护）和 OHSAS 18001（安全）。定期的 EHS 内部稽核可确保这些管理制度的有效性。

Modern companies also usually have their own EHS goals, strategies, standards, short run and long run targets etc. for EHS in the form of zero visions when it comes to accidents and deaths, emissions well below permits etc. There is also regular training of personnel where procedures related to emergency management, evacuation etc. are drilled. Risks in the various areas are usually assessed regularly, and improvements in operations and procedures are continuously sought to reduce the various risks the plant is facing. See also chapter 3.2 for a more comprehensive overview of how these issues are handled in chemical industry parks.

现代企业通常还有自己的 EHS 目标、策略、标准、短期和长远 EHS 目标等，也就是压根不希望发生事故和死亡、超标排放等事件。同时定期开展员工培训，在培训中演练应急管理、疏散等方面的程序。通常定期对各方面的风险进行评估，并不断寻求改进操作和程序，以降低工厂面临的各種风险。第 3.2 节概述了化工园区是如何处理这项问题的。

#### 2.3.3.5 Results 结果

The Seveso legislation has been reviewed and evaluated frequently since it was first introduced in 1982. The original directive established The Major Accident Reporting System (MARS and later renamed eMARS). The purpose of eMARS is to facilitate the exchange of lessons learned from accidents and near misses involving dangerous substances to improve chemical accident prevention and mitigation of potential consequences.

Seveso 立法自从 1982 年初次出台以来进行了频繁的评审。最初的指令建立了《重大事故报告系统》（简称 MARS，后来改名为 eMARS）。eMARS 的目的是促进交流从涉及危险物质的事故和险情中吸取的经验教训，以加强化学事故的预防和后果的减缓。

eMARS contains reports of chemical accidents and near misses provided to the Major Accident and Hazards Bureau (MAHB) of the European Commission's Joint Research Centre from EU, OECD and UNECE countries.<sup>42</sup> **Reporting an event into eMARS is compulsory for EU Member States** when a Seveso establishment is involved and the event meets the criteria of a “major accident” as defined by Annex VI of the Seveso III Directive (2012/18/EU). The information of the reported event is entered into eMARS directly by the official reporting authority of the country in which the accident occurred.

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<sup>42</sup> See <https://emars.jrc.ec.europa.eu/>  
见 <https://emars.jrc.ec.europa.eu/>

eMARS 收录来自欧盟、世界经济与合作组织（OECD）和联合国欧洲经济委员会（UNECE）国家、提供给欧盟委员会联合研究中心重大事故灾害管理局（MAHB）的化学事故与险情报告。当某个事件涉及受 Seveso 约束的企业，并且该事件符合《Seveso III 指令》附录 VI 定义的“重大事故”标准时，**欧盟成员国必须向 eMARS 报告该事件（2012/18/EU）**。所报告事件的信息由发生事故国家的官方报告部门直接输入 eMARS。

The eMARS statistics show that **the number of major accidents reported has remained quite stable since the introduction of the original directive in 1982**. While eMARS lists 355 accidents for the time frame between 1982 and 1998, it lists 302 accidents for the time frame between 1999 and 2013. **However, the number of Seveso establishments has increased over the years**. For instance, in early 2009 the Commission listed 8500 establishments as part of the Seveso regime.<sup>43</sup> Currently, around 10 000 establishments are covered by the legislation. These numbers combined, i.e. the stability in accident rates despite an increase in applicable establishments and the number of member states, indicate that **the Seveso legislation has contributed to preventing major accidents**. Figure 2.9 presents the sectors with more than 10 accidents over the time frame 1979-2011.

eMARS 统计资料显示，自 1982 年原始指令颁布以来，已报告重大事故次数保持很稳定。虽然 eMARS 显示 1982 和 1998 年之间有 355 次事故，但 1999 年和 2013 年之间有 302 次事故。**然而，这是由于这些年受 Seveso 约束的企业数量增多了**。例如，2009 年初，欧盟委员会将 8500 家企业列入 Seveso 体系。目前，大约 1 万家企业受该立法的约束。虽然适用企业和成员国的数量增加了，但事故率却比较稳定，这些数字结合在一起表明，**Seveso 立法对预防重大事故做出了贡献**。图 2.9 显示了在 1979-2011 年期间发生 10 次以上重大事故的行业。

**Figure 2.9 Most involved sectors 1979-2011 (total accidents >10)**

**图 2.9 1979-2011 年最相关行业（事故总次数>10）**

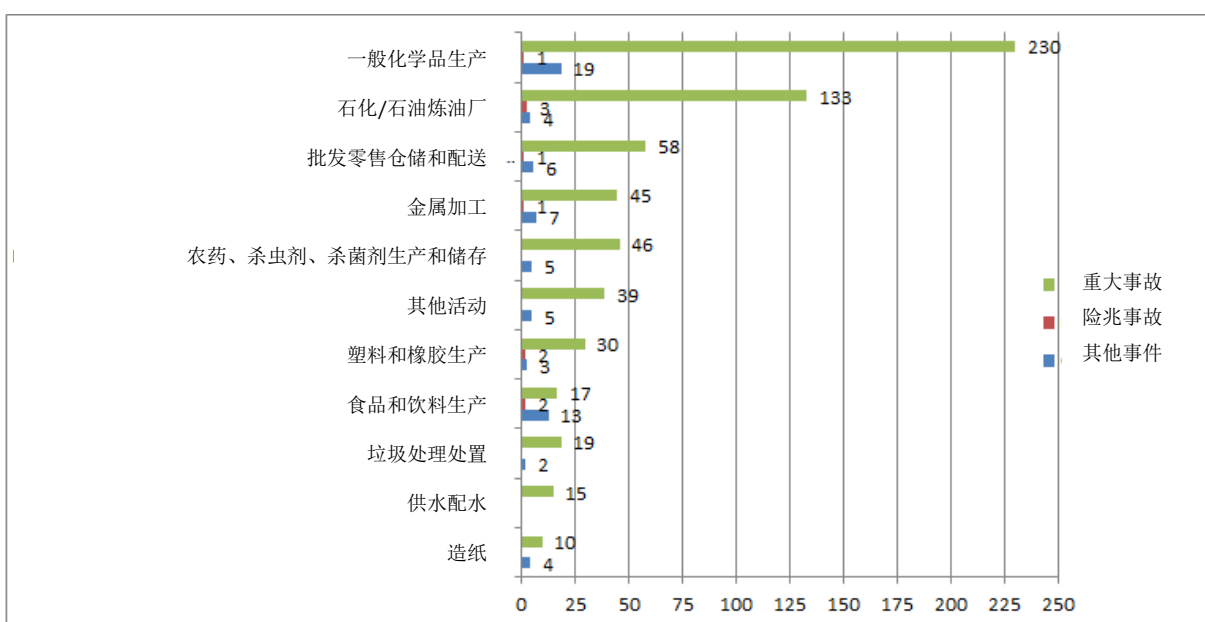
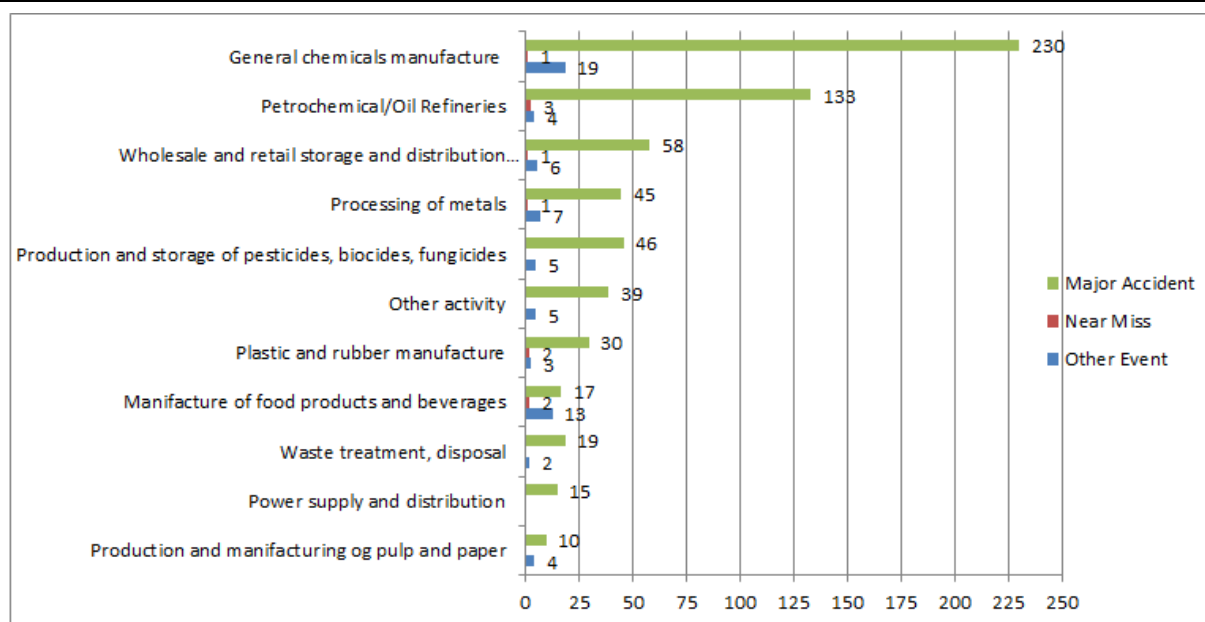
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<sup>43</sup> In December 2008, 4528 upper tier establishments were reported. This was an increase of 14 per cent (up from 3949) since 2005. The frequency of accidents, which for many years had been higher than 3 per 1000 establishments per year, thus shows a tendency of falling to under three on average.

2008 年 12 月，报告显示有 4528 上层企业，比 2005 年（3949 家）增加了 14%。多年来事故频率高于每年每千家企业 3%，有望下降到平均 3% 以下。

## Tackling environmental risks with environmental planning: international experiences

### 通过环境规划解决环境风险：国际经验



Source: European Commission/eMars ([www.jrc.ec.europa.eu](http://www.jrc.ec.europa.eu))

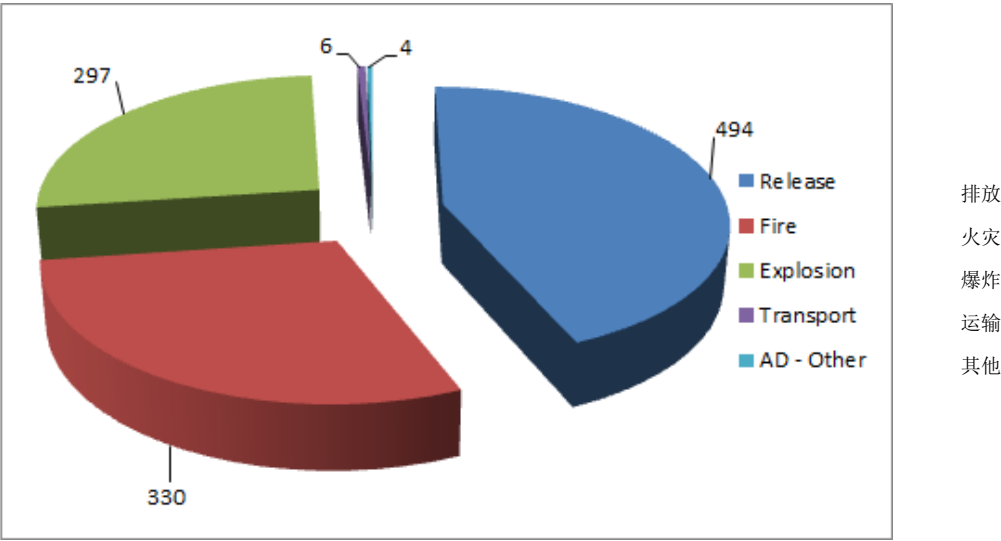
来源：欧盟委员会/eMars ([www.jrc.ec.europa.eu](http://www.jrc.ec.europa.eu))

Sectors like general chemicals manufacture and petrochemical/oil refineries have been especially prone to accidents. Figure 2.10 shows the frequency of each accident type. Release, fire and explosion are the most common accident types. Note that the low number of accidents linked to transport can be due to the Seveso directives not applying to certain transport activities.

一般化学品生产和石化/石油炼油厂行业特别容易发生重大事故。图 2.10 显示了每种事故类型的频率。排放、火灾和爆炸是最常见的事故类型。注意，与运输有关的事故次数少，这是因为 Seveso 指令不适用于某些运输活动。

Figure 2.10 Accident type (1979-2011)

图 2.10 事故类型（1979-2011 年）



Source: European Commission 来源：欧盟委员会

Several studies, workshops and reports have been conducted to exchange experiences and information throughout the time period in question. In June 2012 the Commission started to publish the Lessons Learned Bulletin.<sup>44</sup> This bulletin is published each semester and highlights lessons learned from major accidents. It also highlights accidents reported in eMARS and what could be potentially learned from these.

在以上时间范围内，欧盟开展了多次研究、专题讨论会和报告，以交流经验和信息。2012 年 6 月，欧盟委员会开始公布《经验教训公告》。该公告每半年公布一次，重点展示从重大事故中吸取的经验教训。同时还重点展示 eMARS 中报告的事故以及可能从这些事故中吸取的经验教训。

The evaluation by the Commission conducted in relation with the Seveso III draft proposal, reckons that the Seveso II legislation has been instrumental in reducing the risks and consequences of major accidents. One of the reasons for this is the strengthening of the management systems within the establishments.

欧盟委员会就 Seveso III 初步建议开展的评估表明，Seveso II 立法帮助减少了重大事故引起的风险和后果。其原因之一就是企业内管理系统得到了加强。

A study of the effectiveness of the Seveso II directive conducted a survey across 8 member states covering 83 percent of the Seveso establishments and representing 86 percent of the accidents reported during 1994-2004 (EU-VRI, 2008). The survey indicates that the **targeted groups consider that the Seveso II directive have achieved substantially higher levels of safety in comparison to non-Seveso**

<sup>44</sup> See <http://ipsc.jrc.ec.europa.eu/?id=817> for the bulletins and other useful European Commission publications on guidance and inspections.  
公告以及欧盟委员会其他关于指导和检查的有用刊物见 <http://ipsc.jrc.ec.europa.eu/?id=817>。



**establishments.** They acknowledge that **the requirements of the directive contribute to creating awareness of the hazards as well as developing measures to control risks.** However, the majority of the respondents also state that **the implementation of the Seveso II directive is not uniform within Europe or within a given country.**

Seveso II 指令效能研究项目在 8 个成员国开展了一项调查。该调查覆盖 83% 的 Seveso 监管企业，阐述了 1994-2004 年期间 86% 的报告事故（EU-VRI, 2008）。调查表明，目标群体认为实施 Seveso II 指令的企业安全水平大大高于非 Seveso 监管企业。他们承认，该指令的要求有助于树立危险意识以及制定控制风险的措施。然而，大多数被调查者还表示，Seveso II 指令在欧洲或者在某个特定国家境内的实施并不统一。

### 2.3.3.6 Lessons and suggestions for China

#### 对中国的启示和建议

The Seveso legislation seeks to ensure high levels of protection throughout the EU in a consistent and efficient manner. The existing and new establishments are subject to the same rules and approaches across the Member States. **Although the implementation of the regime is not considered to be uniform across the union, the establishments claim that the levels of safety, knowledge and awareness are substantially higher than before.** The EU and its Member States have several similarities to China and its provinces in terms of organization. Hence, the reporting system (see Figure 2.6) of establishments containing dangerous substances set out by the Seveso directives can also be applicable to China and its provinces.

Seveso 立法寻求一致有效地确保整个欧盟范围内的高水平保护。现有企业和新企业须遵守所有成员国内相同的规则和方法。虽然 Seveso 的实施被认为在整个欧盟范围内是不统一的，但各企业声称安全、认识和意识水平比以前大大提高了。欧盟及其成员国在组织上与中国和中国各省有几个相似之处。因此，包含 Seveso 指令规定危险物质的企业报告系统（见图 2.6）也适用于中国及中国各省。

If China was to implement similar policies as laid out by the Seveso directives, it can be useful to take note of some lessons learnt from the EU. For instance, the detailed guidelines for land-use planning from an EU Member Country referred to above could be implemented, including the requirements for safety distances. However, the latter should be adjusted to local Chinese conditions. These guidelines could be applied when new industry plants are considered, but could eventually also be useful in cases when existing industries are (too) close to residential areas and the moving of either the industry plant or the residents is considered.

Central authorities (for instance MEP) should establish the overall guidelines for this land-use safety planning and emergency preparedness. The implementation of these guidelines should most likely be left to local authorities. They should have the best knowledge of local conditions to ensure a smooth implementation and follow up of these important issues.

Also, the evaluation and revisions of the Seveso directives have in particular revealed the need for:

如果中国实施与 Seveso 指令所提出的类似的政策，那么从欧盟实施 Seveso 吸取的经验教训非常有用。例如，上文提及的欧盟某成员国土地使用规划详细导则可被实施，包括对安全距离的要求。然而，后者应根据中国地方情况进行调整。这些导则在考虑建立新工厂时可被使用，在现有工业与居住区距离（过）近，考虑移动工厂或居住区的情况下也十分有用。

中央机构（例如 MEP）应为土地使用安全规划和应急准备建立总体导则。这些导则的实施应尽可能留给当地部门负责。它们应对当地情况有最深的了解，以确保导则的顺利实施和这些重要事宜的后续跟进。

此外，《Seveso 指令》的审核和修订尤其反映了对以下方面的需要：

- **Focusing on safety management systems for whole establishments instead of technical units within an establishment.** Such a switch in focus by Seveso II contributed to improved management and better safety  
重视整个企业的安全管理系统，而非企业内的技术单元。Seveso II 这种侧重点的转变对加强管理和提高安全性做出了贡献。
- **Fixed time limits for most of the actions required by the legislation as well as penalties in the event of noncompliance** to ensure compliance across the Member States  
对立法所要求的多数行动规定限期，出现违规情况时给予处罚，确保所有成员国守法。
- **Exchange of information across member state borders (i.e. provinces) to avoid and minimize domino effects in the event of a major accident.**  
在欧盟层面开展信息沟通与交流，这样能够在发生重大事故时避免和尽量减小多米诺链发事件。

## 2.4 Protection of nature and soil 自然和土壤的保护

In this sub-chapter we present the EU Habitats Directive and some considerations in the EU on the development of a soil strategy.

本节我们介绍《欧盟栖息地指令》和欧盟在土壤战略制定方面的一些思路。

### 2.4.1 The EU Habitats Directive: An ecological red line for preserving biodiversity in EU 《欧盟栖息地指令》：欧盟保护生物多样性的生态红线

#### 2.4.1.1 Introduction 介绍

**In the EU, the Habitats Directive is a key policy tool to reduce and manage regional risk to ecology.** The Habitats Directive is the EU's main tool for preserving biodiversity and follow-up of its international commitments under the Convention on Biological Diversity. **The goal of the directive is to protect and ensure long-term viability for threatened species and nature types in Europe,** which are defined as approximately 1,000 species and some 220 habitats that are listed in the directive's annexes. The directive sets a common minimum standard for protection of the most important European species and habitats. It includes a legal obligation for all EU Member States to ensure their survival through a network of protected areas (called Natura 2000) and relevant measures throughout EU territory. The Habitats Directive only concerns species and habitats of common European interest. Member States are free to have additional goals, priorities and nature conservation sites according to national or local conditions.

在欧盟，《栖息地指令》是减少和管理区域生态风险的关键政策手段。《栖息地指令》是欧盟保护生物多样性及履行其在《生物多样性公约》下的承诺的主要工具。该指令的目标是保护欧洲濒危物种和自然类型，并保证其长期生存力。指令附录列出了大约 1000 个物种和大约 220 个栖息地。指令规定了保护欧洲最重要物种和栖息地的通用最低标准。它规定所有的欧盟成员国都有法律义务借助欧盟的保护区网络（称为 Natura 2000）和相关措施保证这些物种和栖息地的生存。《栖息地指令》只涉及关乎欧洲共同利益的物种和栖息地。成员国可以根据国家和地方情况自由添加目标、重点物种和栖息地及自然保护区。

#### Box 2.5. The Habitats Directive and regional Risk Assessment and Management

##### **The Habitats Directive and Regional Risk Assessment and Management.**

EU Habitats Directive to safeguard the most threatened and unique species and nature types in Europe constitutes a form of regional environmental risk assessment and management, as it involves monitoring of environmental status and risks, application of common environmental standards, and deals with a spatial scale (biogeographical regions) that includes multiple habitats with multiple sources of stressors that affect multiple endpoints.

#### 框 2.5. 栖息地指令和区域风险评估和管理

### 栖息地指令和区域风险评估和管理

欧盟栖息地指令旨在保护欧洲受威胁最严重和独特的物种和自然类型，构成一种区域环境风险评估和管理，因为该指令包括环境状况和风险监测、通用环境标准应用，并对包含多种栖息地的空间规模进行风险评估，在这些栖息地中压力源影响多个端点。

**The preservation of biodiversity is fundamental to human well-being and sustainable provisioning of natural resources.** Biodiversity protection is also closely intertwined with other environmental issues, such as adaption to climate change and protecting human health. Europeans depend heavily on the stocks of natural capital and flows of ecosystem services that lie within and also beyond Europe's borders (EEA 2010).<sup>45</sup> Over-exploitation of natural capital entails a multitude of risks, such as risks of species extinction, risks of collapse of commercial fish stocks through over-fishing, decline of pollinators (important for food production) due to intensive agriculture, and reduced water retention and increased flooding risks due to the destruction of moorland. Ecosystems and biodiversity also serves crucial functions for recreation, sense of belonging and other cultural purposes. Loss of biodiversity affects such cultural ecosystem services negatively, with impacts on health and well-being.

保护生物多样性对于人类福祉和自然资源可持续供应是必要的。生物多样性保护还与其他环境问题相互交织在一起，比如气候变化适应和人类健康保护。欧洲人非常依赖欧洲境内外的自然资本存量和生态系统服务流量（EEA，2010）。过度开发自然资本带来了众多风险，比如物种灭绝风险、过度捕鱼造成的商业鱼类衰竭风险、集约农业所致的传粉昆虫（对粮食生产很重要）减少以及由于沼泽地遭到破坏而造成的保水力下降和洪水风险增大等风险。生态系统和生物多样性对于休闲娱乐、归属感和其他文化活动也起着重要作用。生物多样性丧失对生态系统这种文化服务功能产生不利影响，对人类健康和福祉造成影响。

**Europe's biodiversity is in decline.** Quantitative data on the status and trends of European biodiversity are sparse, although the reporting under the Habitats Directive has recently increased the evidence based for selected species (see further below). For instance (EEA 2010), population of forest birds have declined around 15% since 1990. Farmland bird populations declined dramatically in the 1980s, mainly due to agricultural intensification, and have remained stable at a low level since the mid 1990s. Grassland butterfly populations, on the other hand, have declined by a further 50% since 1990. As the reporting under the Habitats Directive shows (see further below), the conservation status of the most threatened species and habitats in the EU remains worrying in spite of efforts.

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<sup>45</sup> The introduction is largely based on the European Environment Agency's report *The European Environment. State and outlook 2010* (EEA 2010).

本段介绍主要基于欧洲环境署的报告《2010 欧洲环境现状与展望》（EEA 2010）。

**欧洲的生物多样性在衰退。**关于欧洲生物多样性现状和趋势的定量数据很稀少，然而《栖息地指令》下的报告最近增加了选定物种的证据数据（见下文）。例如（EEA, 2010），1990 年以来，森林鸟类种群数量下降了 15% 左右。20 世纪 80 年代，由于农业集约化，农田鸟类种群数量急剧下降，并在 20 世纪 90 年代中期以来一直保持在低水平。另一方面，草原蝴蝶种群数量 1990 年以来又下降了 50%。正如《栖息地指令》下的报告所显示的（见下文），虽已付出努力，但欧盟受威胁最严重的物种和栖息地的保护现状仍令人担忧。

**Land conversion drives biodiversity loss and degradation of soil functions.** The main land-cover types in Europe are forests (35%), arable land (25%), pasture (17%), semi-natural vegetation (8%), water bodies (3%), wetlands (2%), and artificial/built-up areas (4%). The trend in the last decades has been that urban areas expand further at the expense of all other land-cover categories except forests and water bodies (EEA 2010). During the last decade, an additional 5% of EU territory was covered with concrete or otherwise converted into artificial areas (EC 2013a). Urbanisation and expanding transport networks are increasingly fragmenting habitats, making populations of animals and plants more vulnerable to local extinction due to hampered migration and dispersal. These land-cover changes also affect ecosystem services negatively, for instance leading to negative effects on water, nutrient and carbon cycles, compromising soil organic matter's role as a carbon sink, and reducing water retention capacity leading to increased risks for flooding and erosion as well as reduced attractiveness for outdoor recreation.

**土地流转推动了生物多样性丧失和土壤功能退化。**欧洲主要的土地覆盖类型有森林（35%）、耕地（25%）、草地（17%）、半天然植被（8%）、水体（3%）、湿地（2%）和人工/建成区（4%）。最近十年的趋势是，城市地区以除了森林和水体之外其他所有土地覆被种类为代价进一步扩张（EEA 2010）。最近十年间，又有 5% 的欧盟领土被混凝土覆盖或者以其他方式转变成了人工区（EC 2013a）。城市化和不断扩张的交通网使栖息地越来越破碎化，使动植物种群因迁徙和传播受阻而面临局部灭绝的危险。土地覆被这些变化对生态系统服务功能也产生了不利影响，例如对水、营养物和碳循环造成了不利影响，破坏了土壤有机物的碳汇作用，降低了土壤的保水能力，导致洪水和水土流失风险增大，户外游憩吸引力下降。

A recent Eurobarometer survey (EC, 2013b) covering EU's 28 Member States (EU28) found that 90% of Europeans see the decline of natural habitats and the endangering and disappearance of certain animals and plants as serious problems. 75% of respondents considered it important to protect nature because Europe will get poorer economically as a consequence of loss of biodiversity. 65% of Europeans fully agreed with the statement that the EU should increase the areas where nature is protected in Europe.

最近一项覆盖欧盟 28 个成员国（EU28）的欧洲晴雨表调查（EC, 2013b）发现，90% 的欧洲人认为自然栖息地衰退以及某些动植物的濒危和消失是严重问题。75% 的被调查者认为保护自然很重要，因为欧洲会因生物多样性丧失而在经济上变穷。65% 的欧洲人完全同意欧盟应增加欧洲自然保护区数量这种说法。

The challenge for the EU in terms of nature and biodiversity (EEA, 2010), is:

欧盟在自然与生物多样性方面面临的挑战（EEA，2010）是：

- to preserve biodiversity in line with international commitments,  
按照国际承诺保护生物多样性
- to maintain ecosystems and biodiversity at a level where sustainable use of natural resources and human well-being is ensured, and  
生态系统和生物多样性维持在一个自然资源可持续使用且保证人类福祉的水平
- to reduce the negative impact through trade on natural capital globally.  
降低全球自然资本交易带来的不利影响。

EU's key policy instruments to protect biodiversity is the Habitats Directive, defining targets and measures for protecting the most threatened species and habitats, and the Wild Birds Directive (79/409/EEC), which provides a protection scheme for all wild birds occurring in the union.

欧盟保护生物多样性的主要政策工具是《栖息地指令》，它确定了保护受威胁最严重物种和栖息地的目标和措施；此外还有《欧盟野鸟保护指令》（79/409/EEC），为欧盟境内出现的所有野生鸟类提供了一项保护方案。

#### 2.4.1.2 Principles 原则

The preamble to the Habitats Directive (92/43/EEC)<sup>46</sup> notes a number of principles underpinning the directive, and we summarize main points here:

《栖息地指令》序文（92/43/EEC）提到了支撑该指令的很多原则，这里我们总结以下几点：

- The preservation, protection and improvement of the quality of the environment, including the conservation of natural habitats and of wild fauna and flora, is an essential objective of general interest pursued by the European Community, as stated in Article 130r of the European Treaty.  
根据《欧洲条约》第 130r 条规定，保护环境并改善环境质量、包括保护野生动植物的自然栖息地是欧洲共同体所追求的关乎一般利益的基本目标。
- The main aim of the Directive is to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, thereby making a contribution to the general objective of sustainable development.  
《栖息地指令》的主要目的是促进保持生物多样性，将经济、社会、文化和区域需求纳入考虑，从而对可持续发展总目标做出贡献。
- Since natural habitats are continuing to deteriorate and an increasing number of wild species are threatened, and since the threatened habitats and species form

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<sup>46</sup> EEC (1992): Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. European Economic Community. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML>

EEC（1992）1992 年 5 月 21 日理事会关于自然栖息地和野生动物和植物保护的指令 92/43/EEC。欧洲经济共同体。获取网址：

part of the EU's natural heritage and the threats to them are often of a trans-boundary nature, it is necessary to take conservation measures at EU level.

由于自然栖息地在不断恶化，而且越来越多的野生物种受到威胁，并且由于受威胁栖息地和物种构成欧盟自然遗产的一部分，对它们的威胁常常是跨境性的，因此欧盟必须采取保护措施。

- In view of the crucial threats to certain types of natural habitat and certain species, it is necessary to prioritize in order to favour early implementation of conservation measures (ref. the listed habitats and species in the annexes to the directive).

鉴于某些类型的自然栖息地和某些物种受到了事关生存的威胁，必须确定优先次序，以有利于保护措施的早期实施（参阅指令附录里列出的栖息地和物种）。

- In order to ensure the restoration or maintenance of prioritized natural habitats and species, it is necessary to designate special areas of conservation in order to create a coherent European ecological network according to a specified timetable. In each area, necessary measures shall be implemented to reach conservation objectives.

为了确保优先级自然栖息地和物种的修复和维护，必须指定专门的保护区，以按照规定的时间表创建一个连贯一致的欧洲生态网络。每个区均应实施必要措施，以实现保护目标。

- The Habitats Directive shall be mainstreamed with other EU legislation for designation of special ecological protection areas, such as the Wild Birds Directive of 1979 (79/409/EEC).

《栖息地指令》应与欧盟指定特别生态保护区的其他立法相融合，比如《1979年野鸟保护指令》（79/409/EEC）。

- Member States shall propose sites for areas of conservation, but in exceptional cases the EU level may designate additional sites that are considered essential for the maintenance or survival of a priority natural habitat type or a priority species.

由成员国提出保护区的地点，但特殊情况下欧盟可指定可能对优先保护自然栖息地类型或优先保护物种的维持或生存至关重要的其他地点。

- Any plan or programme that is likely to have a significant effect on the conservation objectives of a site, shall be assessed so that such an effect is made clear and can be taken into consideration.

评估可能对某地点的保护目标有重大影响的任何计划，使这种影响清晰化并且被纳入考虑。

- Conservation of priority natural habitats and priority species of European interest is a common responsibility of all Member States, but may impose an excessive financial burden on certain Member States given, on the one hand, the uneven distribution of such habitats and species throughout the EU and, on the other hand, the fact that the "polluter pays" principle can have only limited application in the special case of nature conservation. It is therefore agreed that, in certain cases a contribution by means of EU co-financing shall be provided for.

关乎欧洲利益的优先自然栖息地和优先物种的保护是所有欧盟成员国的共同责任，但一方面考虑到这种栖息地和物种在整个欧盟范围内的分布不均匀，可能给某些成员国带来了过大的财政负担，另一方面，“污染者付费”原则在自然保护这个特殊情况下只能得到有限应用。因此人们一致认为，应规定某些情况下以欧盟联合融资方式出资。



- Land-use planning and development policies should encourage the management of features of the landscape, which are of major importance for wild fauna and flora.  
土地使用规划与开发政策应鼓励管理对野生动植物具有重大意义的景观功能。
- A system should be set up for surveillance of the conservation status of the natural habitats and species covered by this Directive.  
建立一个系统，用于监督受本指令约束的自然栖息地和物种的保护状况。
- With the aim of ensuring that the implementation of this Directive is monitored, the European Commission will periodically prepare a composite report based, inter alia, on the information sent to it by the Member States, about the national efforts and status for prioritized habitats and species.  
为了确保本指令的实施得到监控，欧盟委员会将根据成员国发给它的信息以及其他信息，定期编制各国相关工作和优先级栖息地及物种状况的综合报告。
- Improvement of scientific and technical knowledge is essential for the implementation and Member States shall encourage the necessary research and scientific work.  
提高科技知识水平对于实施本指令至关重要，成员国应鼓励开展必要的科研工作。
- Technical and scientific progress brings new knowledge about the situation for habitats and species and it shall possible to adapt the priority lists accordingly.  
科技进步带来了关于栖息地和物种情况的新知识，因此可以相应地调整优先名单。
- Education and general information relating to the objectives of the Habitats Directive are essential for ensuring its effective implementation.  
与《栖息地指令》有关的教育和一般信息对于指令的有效实施至关重要。

It should also be noted that the Habitats Directive constitutes the EU's follow-up of its international commitments in the Bern Convention of 1979 (Bern Convention on the Conservation of European Wildlife and Natural Habitats) and the Convention on Biological Diversity of 1992.

还应指出的是，《栖息地指令》是欧盟履行其在《1979 年伯恩公约》（《欧洲野生生物及自然栖息地保育公约》）以及《1992 年生物多样性公约》中的国际承诺的体现。

#### 2.4.1.3 Approaches 方法

**In the EU, the Habitats Directive plays a key role in a wider strategy aiming at securing an environmentally sustainable and at the same time a competitive economy.** The EU has set itself the target of halting loss of biodiversity in Europe by 2020. The EU strategy Europe 2020: A strategy for smart, sustainable and inclusive growth (EC 2010) notes that protection of natural capital and giving a proper value to ecosystem services should be part of the drive towards smart, sustainable and inclusive growth by 2020. As part of the follow-up of this strategy, the EU Commission has also adopted a Green Infrastructure Strategy (EC, 2013), to promote the deployment of green infrastructure in urban and rural areas and ensure an efficient use of resources. **The Green Infrastructure Strategy** aims to ensure optimal management and use of natural capital in the EU, by upholding and restoring ecosystems with an aim to maximize the flow of ecosystem services to the benefit of nature and human well-being. The Natura 2000 sites constitute crucial “biodiversity hubs” in the wider Green



Infrastructure Strategy. Reaching EU's biodiversity goals is dependent on integration of biodiversity concerns into sector policies for transport, energy, agriculture, forestry and fisheries<sup>47</sup>, as well as crosscutting policy frameworks such as the Water Framework Directive (WFD), the Marine Strategy Framework Directive and the Thematic Strategy for Soil Protection. In the chapter on the WFD we have described how such a directive coordinates its requirements with those of the Habitats Directive.

在欧盟,《栖息地指令》在一项更为广泛、旨在确保环境上可持续同时保证经济竞争力的战略中起着关键作用。欧盟自己设定了到 2020 年停止欧洲生物多样性丧失的目标。欧盟“欧洲 2020”战略是一项能促进智能、可持续和包容性增长的战略( EC 2010)。该战略指出,保护自然资本并赋予生态系统服务适当价值应当作为推动到 2020 年实现智能、可持续和包容性增长工作的一部分。在具体落实这项战略时,欧盟委员会还通过了“绿色基础设施战略”( EC, 2013),旨在促进城乡地区绿色基础设施发展,并确保高效利用资源。“绿色基础设施战略”的目的是通过维护和修复生态系统,以提供最大的、有利于自然和人类福祉的生态系统服务流,从而确保欧盟自然资本的最优管理和使用。Natura 2000 网络站点构成绿色基础设施战略中的关键“生物多样性枢纽”。实现欧盟的多样性目标有赖于把生物多样性问题与运输、能源、农业、林业和渔业行业政策融为一体,以及与《水框架指令》( WFD)、《海洋战略框架指令》和《土壤保护专题战略指令》等政策框架横向交叉。在《水框架指令》一章,我们描述了该指令是如何将其要求与《栖息地指令》要求协调一致的。

**The Habitats Directive is built around two pillars: A network of protected sites and a strict system of species protection.** The directive aims to protect a representative set of viable populations of the most threatened species and habitats in the EU in a network of protected areas called **Natura 2000**. The network of protected area is the central tool to reduce regional risk to ecology in the EU. The annexes to the directive list about 1,150 species (459 animal and 696 plant species) and 220 habitat types (special types of forests, meadows, wetlands etc.)<sup>48</sup>, which are considered to be of European interest (“Community Interest”) and are to be protected under the directive.

《栖息地指令》围绕两个支柱构建而成：一个保护区网络和一个严格的物种保护系统。该指令的目的是在一个被称为 **Natura 2000** 的保护区网络框架内保护欧盟一系

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<sup>47</sup> In the EU, the Common Agricultural Policy and the Common Fisheries Policy have high degree of influence on biodiversity, as also the directives setting pollution thresholds (such as the Air Quality Directive, the National Emissions Ceilings Directive, and the Nitrates Directive). The responsibility for forest policy (as large portion of threatened species lives in forests) lies primarily with member states under the subsidiarity principle.

在欧盟,共同农业政策和共同渔业政策对生物多样性有高度影响,各项指令同样也设定了污染临界量(比如《空气指令》、《国家排放上限指令》和《硝酸盐指令》)。制定森林政策的工作主要由成员国根据辅助性原则开展(因为大部分受威胁物种都生活在森林里)。

<sup>48</sup> There are 9 groups of habitats: Coastal and halophytic habitats, Coastal sand dunes and inland dunes, Freshwater habitats, Temperate Heath and Scrub, Schelrophyllous scrub (mattoral), Natural and semi-natural grass formations, Raised bogs and mires and fens, Rocky habitats and caves, Forests. These groups are further divided into sub-groups.

有 9 组栖息地:海岸和盐土栖息地、海岸沙丘和内陆沙丘、淡水栖息地、温带荒地和灌丛、Schelrophyllous 灌丛(mattoral)、自然和半自然草地、高位沼泽及泥沼和沼池、岩石栖息地和洞穴、森林。这些组进一步分成亚组。

列有代表性的受威胁最严重物种和栖息地的存活种群。保护区网络是减少欧盟区域生态风险的核心手段。指令附录列出了大约 1,150 个物种（459 种动物和 696 种植物）和 220 个栖息地类型（森林、草地、湿地等的特殊类型），它们被认为是关乎欧洲利益（“共同体利益”）的物种和栖息地，要受到该指令的保护。

The habitat types of European interest are listed in annex 1 of the Habitats Directive, and are those that are in danger of disappearing in their natural range, have a small natural range, or present outstanding examples of typical characteristics of a biogeographical region. There are seven biogeographical regions in the EU: the Alpine, the Atlantic, the Boreal, the Continental, the Macaronesian, the Mediterranean and the Pannonian (ref. figure 2.11 below). Species of European importance are listed in annex 2 and 4, and are those that are endangered, vulnerable, rare or endemic and require particular attention. Habitat types and species that are in real danger of disappearing and where the EU has a particular responsibility to uphold the conservation due to the proportion of their natural range within the territory of the EU, are especially prioritized.

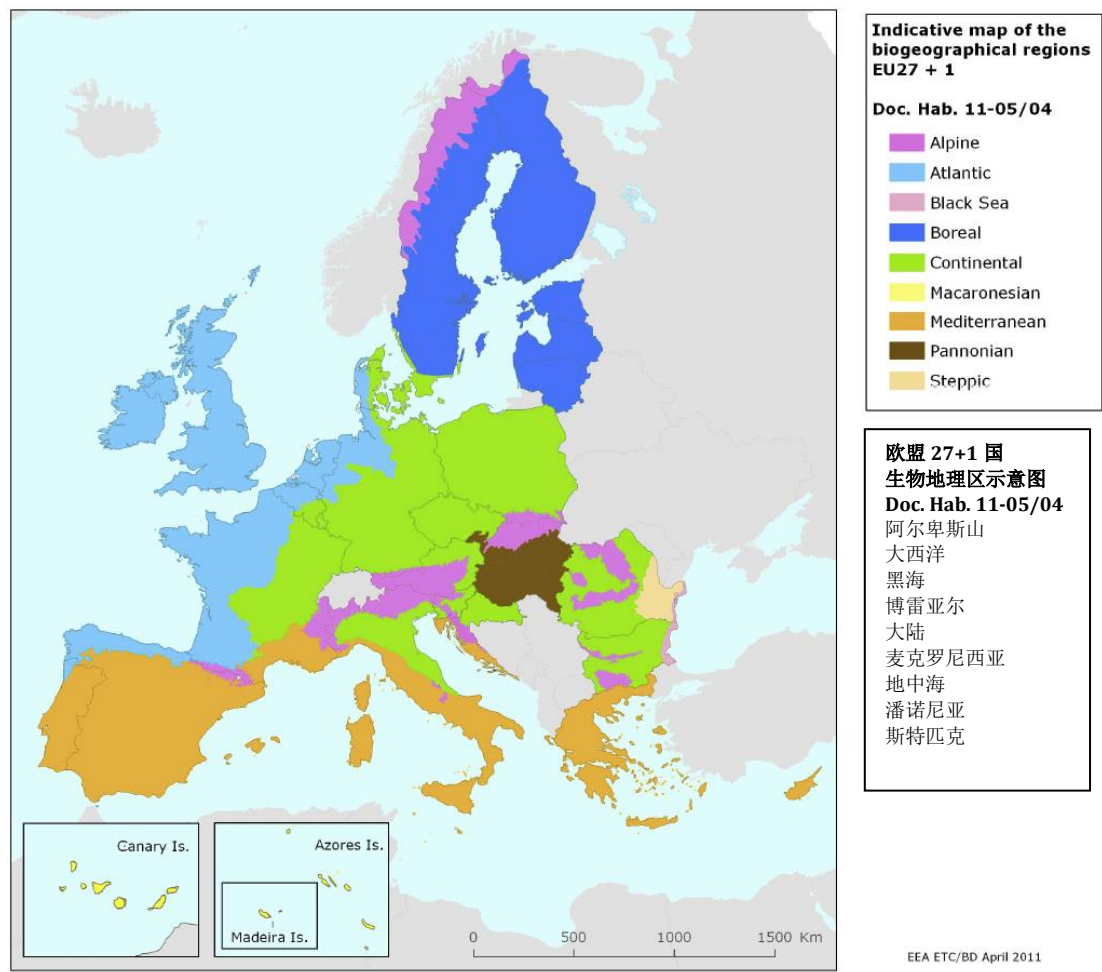
欧洲关切栖息地类型列于《栖息地指令》附录 1，它们是指那些在其自然分布范围内面临消失风险的、自然分布范围较小的、或者突出代表生物地理区典型特征的类型。欧盟有七个生物地理区：阿尔卑斯山、大西洋、博雷亚尔、大陆、麦克罗尼西亚、地中海和潘诺尼亚（参阅下面的图 2.11）。欧洲重视之物种列于附录 2 和附录 4，它们属于濒危、易危、稀有或地方性物种，需要特别关注。真正濒临消失的栖息地类型和物种特别受到优先保护，欧盟有特殊责任支持其保育，因为它们在欧盟领土内的自然分布区比例较大。

The **Birds Directive** was adopted already in 1979 and constitutes the oldest piece of EU nature legislation. The Birds Directive requires the establishment of Special Protection Areas (SPAs) for birds. The Habitats Directive similarly requires Special Areas of Conservation (SACs) to be designated for the species and habitats listed in the directive. **Together, the SPAs and SACs constitute the Natura 2000 network of protected areas.**

《野鸟保护指令》早在 1979 就通过了，是欧盟最古老的自然立法。《野鸟保护指令》要求建立鸟类特别保护区（SPA）。《栖息地指令》同样要求为指令中列出的物种和栖息地指定特别保育区（SAC）。特别保护区和特别保育区一起，共同组成 **Natura 2000** 自然保护区网络。

Figure 2.11The biogeographic regions of the EU, referred to in the Habitats Directive

图 2.11 《栖息地指令》中提到的欧盟生物地理区



Source: 来源:

When the Habitats Directive was adopted, the EU consisted of 12 Member States and today it has 28. The expansion has taken place in rounds; 1995 (Austria, Finland, Sweden), 2004 (Cyprus, Czech Republic, Estonia, Hungary, Malta, Latvia, Lithuania, Poland, Slovakia, Slovenia), 2007 (Bulgaria, Romania), 2013 (Croatia). In each round, the annexes to the Habitats Directive was adapted to include threatened species and habitats in the new countries and the Member States were required to propose sites for protection of their habitats and species of European interest. As a consequence, different country groups in the EU are in different stages of implementing the directive in accordance with when they joined the EU. In spite of the process being complicated, **the system outlined by the directive has shown itself to be dynamic and be able to accommodate integration of new Member States** (Evans, 2012).

《栖息地指令》通过时，欧盟有 12 个成员国，现在有 28 个。欧盟的扩大是分几轮进行的：1995 年（奥地利、芬兰、瑞典）、2004 年（塞浦路斯、捷克共和国、爱沙尼亚、匈牙利、马耳他、拉脱维亚、立陶宛、波兰、斯洛伐克、斯洛文尼亚）、2007 年（保加利亚、罗马尼亚）、2013 年（克罗地亚）。每一轮都对《栖息地指令》

附录进行了调整，把新增国家的受威胁物种和栖息地列入其中，成员国被要求提出保护关乎欧洲利益的栖息地和物种的地点。因此，欧盟不同的国家团体根据其加入欧盟的时间而处于不同的指令实施阶段。虽然过程很复杂，但指令提出的系统表明它很有活力，并且能够适应新增成员国的融入（Evans, 2012）。

#### 2.4.1.4 Tools 工具

When implementing the Habitats Directive, the first step for Member States was to identify **Sites of Community Interest (SCI)**, i.e. the sites in each country that would need to be protected in order to ensure the protection of the species and habitats listed in the directive. In a risk perspective, these are the sites that need to be protected in order to reduce the risk of species extinction to an acceptable level. The directive was adopted in 1992 and the Member States had until 1998 to submit their lists of SCIs to the European Commission.<sup>49</sup> The sites are selected according to the criteria of annex 3 of the directive, entailing an assessment of the ecological quality, the representativity and the area of each habitat type on the site. Furthermore, the density and degree of isolation of each species as well as the quality of the site for the particular species should be assessed. The Commission reviewed the list, selected the SCIs to become part of the Natura 2000 network, and notified the Member States which sites that should become Special Areas of Conservation (SACs) and become part of Natura 2000. (In some cases, the Commission did not consider the suggested list of SCIs to be sufficient to reach the goals of the directive and required Member States to expand their list, ref. below). For each Natura 2000 site, national authorities have submitted a Standard Data Form (SDF) that contains an extensive description of the site and its ecology. The **European Topic Centre for Biological Diversity**, based in Paris, is responsible for validating this data and creating an EU wide descriptive database.<sup>50</sup> This data is subject to a regular validation and updating process.

在实施《栖息地指令》时，成员国要做的第一步是确定**关乎共同体利益的地点（SCI）**，也就是每个国家需要得到保护、以确保保护指令中列出的物种和栖息地的地点/区域。从风险角度来说，需要保护这些地点以将物种灭绝风险降至可接受水平。《栖息地指令》是 1992 年通过的，成员国要在 1998 年之前向欧盟委员会递交 SCI 名单。这些保护区要按照栖息地指令附录 3 的标准选出，并需要评估生态质量、代表性以及保护区每种栖息地类型的面积。此外，还应评估每个物种的密度和孤立程度以及保护区针对特殊物种的质量情况。欧盟委员会审核名单，选出可纳入 Natura 2000 网络的 SCI，并通知成员国哪些地点会成为特别保护区（SAC）、哪些会纳入 Natura 2000。（有些情况下，欧盟委员会认为成员国提出的 SCI 名单不足以实现栖息地指令的目标，要求成员国扩大名单，参阅下文）。对于每个 Natura 2000 保护区，国家有

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<sup>49</sup> At the EU level the European Commission is supported by the Habitats Committee (with members from all member states as well as the EU Commission), which also includes the Habitats Scientific Working Group.

在欧盟层面，欧盟委员会受栖息地委员会（成员来自所有的欧盟成员国以及欧盟委员会）的支持，该委员会包括栖息地科学工作组。

<sup>50</sup> The European Topic Centre for Biodiversity webpage is available here: <http://bd.eionet.europa.eu/>  
欧洲生物多样性课题中心网页地址：<http://bd.eionet.europa.eu/>

关部门都提交了标准数据表（SDF），对每个保护区及其生态状况进行详尽描述。总部设在巴黎的**欧洲生物多样性课题中心**负责审核上报的数据，并建立一个整个欧盟范围的描述性数据库。这种数据需定期审核与更新。

Many of the EU countries share the same natural characteristics and the protection of a sufficient amount of habitats for a certain species thus requires coordination of efforts. The directive addresses this by applying the concept of **biogeographical regions**; geographical areas where animal and plant distribution have similar or shared characteristics throughout – and which often go across country borders. Representatives of countries sharing the same biogeographical regions would thus meet to discuss common challenges and ensure that the SCI-lists of the countries together would constitute a sufficient set of protected areas to reach the goals of the directive.

很多欧盟国家具有相同的自然特征，因此保护特定物种的大量栖息地需要各国通力合作。为此，指令采用了**生物地理区**的概念：动物和植物分布在国家境内外具有相似或共同特征的地理区域。由此，共享相同生物地理区的国家的代表会聚在一起讨论共同挑战并确保各国的 SCI 名单一起组成充足数量的保护区，以达到指令目标。

The main requirement of the Habitats Directive is to ensure a **favorable conservation status** of habitat types and species. The requirement is thus for the member states not only to protect Natura 2000 sites, but also to reach a certain qualitative state for the biodiversity within the sites. It is not enough that the Member States stop further deterioration of the biodiversity within the site, they must actively establish measures that conserve, improve or even restore a favorable conservation status. This is often done through **site-specific management plans** and by adapting other development plans that may affect the site.

《栖息地指令》的主要要求是确保栖息地类型和物种的良好保护状况。这就要求成员国不仅要保护 Natura 2000 保护区，而且保护区内的生物多样性要达到特定的质量状态。成员国停止保护区内的生物多样性进一步恶化还不够，还必须积极制定保护、改善甚或恢复健全保护状况的措施。这常常通过**保护区特定管理计划**、或调整其他可能对保护区有影响的发展计划来进行。

It is important to note that Natura 2000 is not a system of strict nature reserves where human activities are systematically excluded, but adopts a different approach. The directive fully recognises that man is an integral part of nature and the two work best in partnership with one another. Indeed, many sites in the Natura 2000 Network are valuable precisely because of the way they have been managed up to now. Experience has shown that management of Natura 2000 sites is best done by working closely with the landowners and stakeholder groups in or around individual Natura 2000 sites. Much effort has been made to develop and/or identify good practice examples of management of Natura 2000 sites, where conservation of the species and habitats is ensured whilst respecting the local socio-economic and cultural context.<sup>51</sup>

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<sup>51</sup> The EU Commission has launched a mini website which offers 25 examples of successful management of Natura 2000 sites in the following sectors: Farming, Forestry, Rivers, Marine environment and

需要注意的是，Natura 2000 并不完全禁止自然保护区内的人类活动，而是采用不同的方法。指令充分认可，人是自然不可分割的一部分，两者彼此搭档效果最好。实际上，由于截止目前的管理方式，Natura 2000 网络里很多保护区都是可以精确估价的。经验表明，Natura 2000 保护区的管理最好通过与每个保护区内或周围的土地所有者和利益相关者团体密切合作来完成。在制定和/或确定 Natura 2000 保护区管理良好实践案例方面做了大量努力。在这些努力中，在尊重当地社会经济和文化环境的同时，物种和栖息地保护亦有保证。

For habitats a favorable conservation status is considered to occur when the area it covers is stable and increasing, the functions and structure necessary for its long-term maintenance exist and will do so for a foreseeable future and the conservation status for its typical species is favorable. For species a favorable conservation status occurs when the population data show that the species is maintaining itself on a long-term basis, the natural range of the species is stable and that there on a long-term basis will be a sufficiently large habitat to maintain the population. As for the ecological requirements, they can vary from habitat to habitat and from species to species. In other words appropriate measures or management plans must be made for each individual habitat and each individual species building on scientific knowledge.

对于栖息地，当其覆盖的面积稳中有升，其长期维护所必需的功能和结构目前存在并且在可预见的将来也会存在，并且其典型物种的保护现状为良好时，即认为达到了良好保护现状。对于物种，当种群数据表明物种在长期维持自身、物种的自然分布区稳定、并且从长期来看会有一个足够大的栖息地维持种群时，即认为达到了良好保护现状。至于生态要求，因不同的栖息地和不同的物种而各异。换言之，必需根据科学知识对每一个个体栖息地和每一个个体物种制定适当的措施或管理计划。

The obligation to prevent any deterioration of a designated site includes terminating ongoing activities that may previously have been allowed, for example agricultural activities, if necessary. Precautionary measures shall be taken if there is a risk that ongoing activity within and around the site have a negative effect; it is not considered acceptable to wait and see if deterioration occurs. The obligation to secure favorable conservation status in the Natura 2000 areas, thus also effect activities and planning around the Natura 2000 areas.

防止指定保护区退化的义务包括：根据需要终止正在进行的、可能以前被允许的活动，例如农业活动。若保护区内或周围正在进行的活动有产生不良影响的风险，应采取风险预防措施；不可坐观退化是否发生。因而，确保 Natura 2000 保护区内良好保护状况还会影响 Natura 2000 保护区周围的活动与规划。

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Wetlands. It is available here:

[http://ec.europa.eu/environment/nature/natura2000/management/best\\_practice\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/management/best_practice_en.htm)

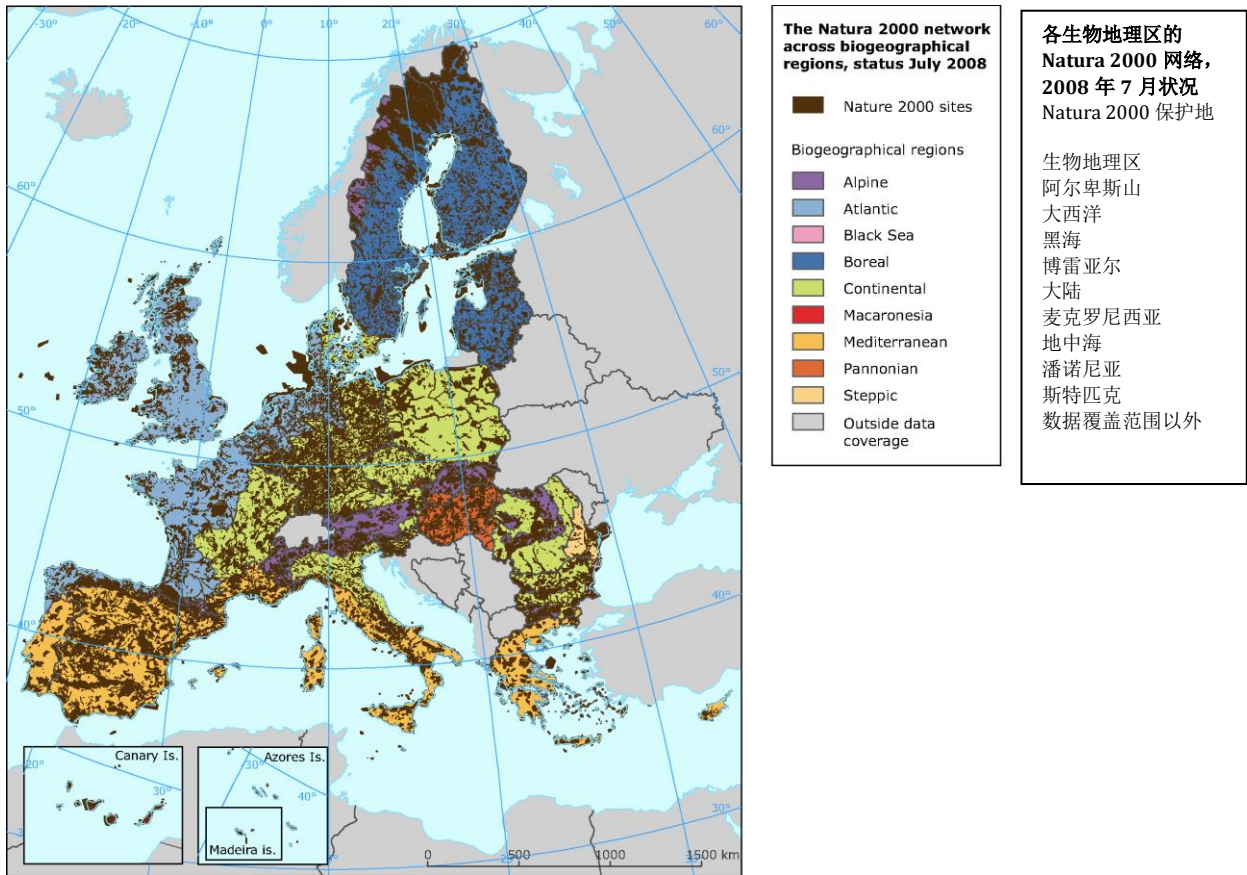
欧盟委员会开通了一个微型网站，提供以下五个行业的 25 个 Natura 2000 保护地成功管理案例：农业、林业、河流、海洋环境和湿地。网址：

[http://ec.europa.eu/environment/nature/natura2000/management/best\\_practice\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/management/best_practice_en.htm)



Figure 2.12 The Natura 2000 network across biogeographical regions (status by 2008)

图 2.12 各生物地理区的 Natura 2000 网络（到 2008 年的现状）



Source: European Environment Agency 来源：欧洲环境署

**Any plans or projects that may have an effect on the Natura 2000 area shall undergo an assessment to estimate the environmental impact,** which may also include obtaining a public opinion. Plans or projects, which have a negative effect on the conservation status of the site, can only be approved if there are imperative reasons of public interests. If the site in question is a priority habitat type or hosts a priority species only overriding interests concerning human health, public safety or an activity that has a beneficial consequence of primary importance to the environment may be approved. In all cases the Member State is obliged to take compensatory measures ensuring the overall coherence of the Natura 2000 network. Furthermore the European Commission must be informed of the measures taken.

任何可能对 Natura 2000 保护区有影响的计划或项目都要进行评估，以预估环境影响，这还可以包括获取公众意见。对保护区保护现状有负面影响的计划或项目只有具备迫切的公众利益理由才可以得到批准。如果所议保护区属于优先保护栖息地类型或者寄住着优先保护物种，只有事关人类健康、公共安全的最高利益或者对环境有重大有益后果的活动才可以得到批准。在所有情况下，成员国都必须采取补救措施确保 Natura 2000 网络的总体连贯性。此外，成员国还必须知会欧盟委员会所采取的措施。

The directive also contains a series of provisions related to the direct influence on the **species** on the list as such, which is considered the second pillar in the protection given by the Habitats Directive. This part of the directive (article 12-16) obligate the Member States to take the requisite measures to establish a system of strict protection for the animal and plant species in need of strict protection (listed in annex 4).<sup>52</sup> These **obligations for species protection apply to the whole of a Member State's territory and not only to the Natura 2000 sites**. Member States are obligated to set up a surveillance system in order to ensure a favorable conservation status of the species and take appropriate measures in due time. Member States and the European Commission are also obliged to encourage the needed research and scientific work. Moreover, it is the obligation of the Member State to promote general knowledge concerning the need to protect wild flora and fauna nationally.

指令还包含一系列与名录上的**物种所受**直接影响有关的规定，这被视为《栖息地指令》所提供保护中的第二个支柱。指令的这一部分（第 12-16 条）要求成员国必须采取必要措施为需要严格保护的动植物物种（附录 4 所列）建立一个严格的保护体系。**这些物种保护义务适用于成员国的整个领土，而不仅仅适用于 Natura 2000 保护区。**成员国必须建立监督系统，以确保物种的良好保护现状，并适时采取措施。成员国和欧盟委员会还必须鼓励开展必要的科研工作。此外，成员国还有义务在全国宣传关于保护野生动植物群必要性的一般知识。

In order to ensure biodiversity the Habitats Directive furthermore states that the **national land-use planning and development strategies ought to encourage features of the landscape which supports the migration and dispersal of wild fauna and flora and hence are of major importance to the species addressed in the directive**. During the implementation of the directive Member States shall also investigate the desirability of reintroducing species which are native to the area and can contribute to the conservation of the sites in question. This requires that the public concerned have been properly consulted on the matter, as some cases (such as the reintroduction of large carnivores) may be controversial. The directive also obliges member states to improve the ecological coherence of the network by ensuring that land management practices and planning procedures in linked areas, or corridors, or buffer zones, are compatible with the conservation management schemes that must be established for each site. This process has led to formation of **biodiversity action plans** in a number of member states.

为了确保生物多样性，《栖息地指令》进一步规定，国家土地利用规划和发展战略应鼓励有利于野生动植物群迁徙和传播、因而对指令所提及的物种具有重大意义的景观功能。在实施指令的过程中，成员国还应调查对当地原产并且有助于保护所议保

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<sup>52</sup> Annex 2 contains a list of "Animal and plant species of community interest whose conservation requires the designation of special areas of conservation". Annex 4 contains a list of "Animal and plant species of community interest in need of strict protection". Note that the two lists overlap. For instance, of the 447 animal references, 45% occur in both lists (EC 2007).附录 2 包含一个“关乎共同体利益、需要指定特别保育区予以保育的动物和植物物种”名单。附录 4 包含一个“关乎共同体利益需要严格保护的动物和植物物种”名单。注意，两个名单有重叠部分。例如，在所提到的 447 种动物里，45%在两个名单里都出现了。



保护区的物种进行野放是否可取。这要求就此问题征询有关公众的意见，因为有些情况（比如大型食肉动物的野放）会引起争议。指令要求成员国必须为每一个保护区制定保护管理方案，确保相连区、廊道或缓冲区的土地管理实践和规划程序与保护管理方案相匹配，以加强网络的生态连贯性。这一过程促进很多成员国制定了生物多样性行动计划。

**The Habitats Directive contains a timeline.** It was adopted in 1992, by June 1994 all Member Countries should adapt national legislation to the requirements of the directive, by June 1995 all Member States should submit a list of proposed sites (SCI) for protection to the EU Commission (this was later pushed to 1998), and by June 2004 the whole network of Natura 2000 sites should be in place. After the approval of suggested sites, Member States have six years to define conservation objectives and the management framework for their Natura 2000 sites. Member States are also obliged to report to the EU Commission on the implementation of the directive every six years, including an assessment of the conservation status of species and habitats listed on the Annexes to the Directive.

《栖息地指令》有一个时间表。1992 年通过，到 1994 年所有成员国都应按指令要求调整国家立法，到 1995 年 6 月所有成员国都应向欧盟委员会提交建议保护地（SCI）名单（后来推到了 1998 年），到 2004 年 6 月整个 Natura 2000 保护地网络应到位。建议保护地获得批准后，成员国用六年时间确定其 Natura 2000 保护地的保护目标和管理框架。成员国还必须每六年向欧盟委员会报告一次指令实施情况，包括对《指令》附录所列物种和栖息地的保护现状的评估。

#### 2.4.1.5 Results 结果

**The Habitats Directive has had a number of important effects on nature management in the EU countries and contributed to reducing regional risks to ecology.** Maybe one of the most important effects is that the focus on ecological status has forced Member States to take the ecological status (and the accumulated and acute risks) for the most threatened species and habitats into account in a systematic manner in overall land-use planning and development. Earlier, nature conservation concerns and efforts often developed in a fragmented and organic manner according to opportunities presenting themselves. The introduction of the directive revealed that this approach in most cases had led to a situation where the national systems did not properly cover and safeguard the most threatened species and habitats in Europe. As a consequence, the introduction of the directive led to a more **science-based, systematic and common minimum standard for nature protection**. This was a significant step forward in European nature protection. The Habitats Directive also led to **increased efforts throughout the EU to register threatened species and habitats and understand the causes for their decline**. A huge improvement of the knowledge base and **increased transnational cooperation to address regional risk** are other important effects.

《栖息地指令》对欧盟国家的自然管理产生了很多重要影响，有利于减少区域生态风险。也许最重要的影响之一就是生态状况的重视迫使成员国在总体土地使用规划与发展中将受威胁最严重物种和栖息地的生态状况（以及累积风险和突发性风险）纳入系统性考虑。早些时候，对自然保护的关注和努力往往是零零散散地视机会而为。栖息地指令的颁布表明这种方法在多数情况下导致国家系统未能恰当地保护和护卫欧

洲受威胁最严重的物种和栖息地。因此，栖息地指令的颁布引出了一项更加以**科学为基础、系统的、共同的自然保护最低标准**。这是欧洲自然保护领域向前迈出的一大步。《栖息地指令》还促使**整个欧盟加大力度登记受威胁物种和栖息地，并了解其衰退原因**。其他重要效果还有：知识基础大幅提高，应对区域风险的跨国合作得以加强。

**Today, Natura 2000 is the largest coordinated network of high biodiversity areas in the world.** By 2013, the network of Natura 2000 sites spans 28 EU countries and consists of more than 27,000 sites covering approximately 18% of EU land territory as well as important marine areas. According to European Commission studies (EC 2012), the **economic benefits** that flow from Natura 2000 in the form of ecosystem services are estimated to be in the order of €200-300 billion/year. It is estimated that there are between 1.2-2.2 billion visitor days to Natura 2000 sites each year, generating recreational benefits worth between €5 and €9 billion per annum. A total of around 4.4 million jobs and €405 billion in annual turnover are estimated to be directly dependent on the maintenance of healthy ecosystems, a significant proportion of which are situated within Natura 2000. The cost of managing and protecting the Natura 2000 sites are estimated at €5.8 billion/year.

如今，**Natura 2000 是全球最大的高度生物多样性区域协调网络**。到 2013 年，Natura 2000 保护地网络跨越 28 个欧盟国家，有 27,000 多个保护地，涉及 18% 的欧盟领土以及重要海洋区域。根据欧盟委员会的研究（EC 2012），Natura 2000 以生态系统服务形式产生的**经济效益**估计大约为 2000-3000 亿欧元/年。Natura 2000 保护地每年接待的游客估计为 12-22 亿人次，每年产生 50 亿到 90 亿欧元之间的游憩效益。估计共有大约 440 万个工作岗位和 4050 亿欧元的年营业额直接依赖于健康生态系统的维护，而健康生态系统很大一部分位于 Natura 2000 内。Natura 2000 保护区的管理与保护成本估计为 58 亿欧元/年。

**The implementation of the Habitats Directive has been delayed and faced with a number of practical problems.** Nature conservation had developed gradually at the national level and the current systems at the time of the introduction of the directive were often a blend of historically determined priorities, scientific approaches and local traditions for nature use and management. Most countries with developed nature protection schemes, such as for instance Sweden, expected that the existing national systems would suffice to meet the requirements of the directive. The top-down and strictly science-based approach of the directive, however, quickly revealed that *all* Member States needed to strengthen efforts significantly in order to meet requirements. In many cases, adaptations of the national systems were more difficult and complicated for the countries that already had elaborate systems (typically the Northern and Western EU countries), while it was easier in countries with less elaborated systems (typically the Southern and Eastern EU countries) (van Keulen, 2007). No member states met the revised deadline to suggest necessary sites for protection by 1998, and in 1997 the EU Commission started legal proceedings towards a number of Member States for failing to meet their obligations under the directive. This led to increased efforts and by 1999 most countries had proposed enough sites to allow for an assessment at biogeographical level of the sufficiency of sites proposed. In the coming years, **the EU Commission several times took legal steps to ensure that Member States designated enough sites to meet the requirement of the directive.** For instance, in September 2001, the EU Court of Justice ruled that France had not put forth enough sites

for the protection of species and habitats mentioned in the directive and France subsequently had to put forth additional sites to the EU Commission. The last biogeographical seminars for the EU15 were held in 2003, by which all the then 15 Member States had made substantial proposals so that the Natura 2000 network could materialize.

《栖息地指令》的实施已延迟，而且面临很多实际问题。自然保护已逐渐在国家层面开展，指令颁布时通行的系统往往是把自然使用和管理方面历史上确定的优先次序、科学方法和地方传统混合在一起。有成熟自然保护方案的国家、比如瑞典，多数都以为现有的国家系统足以满足指令的要求。但指令自上而下、严格以科学为基础的方法很快就表明，所有成员国都需要极大加强努力，以满足指令要求。多数情况下，国家系统的转化对于已经有详尽系统的国家（通常为欧盟北部和西北国家）来说比较困难和复杂，而在系统不太详尽的国家（通常为欧盟南部和东部国家）则比较容易（van Keulen, 2007）。没有一个成员国按照修订后的截止期限在 1998 年之前提出必需的保护地，于是 1997 年欧盟委员会对很多未能履行指令下义务的国家启动了法律程序。各国加强了努力，到 1999 年多数国家提出了足量的保护地，以便可以在生物地理层面评估所提议保护地是否足量。后来几年，欧盟委员会多次采取法律措施，以确保成员国指定足够的保护地以满足指令要求。例如，2001 年 9 月，欧盟法院判定法国没有提出足够用于保护指令中所提及物种和栖息地的地点，随后法国要向欧盟委员会提出更多的保护地。在 2003 年举行的上一届欧盟 15 国生物地理研讨会上，当时的 15 个成员国全部提出了大量的保护地，以使 Natura 2000 网络成形。

Natura 2000 is mostly but not fully finalized, as additional efforts are considered necessary to fully cover the sites needed (more sites are especially needed in marine areas). Implementing the Habitats Directive is an on-going process, and the latest EU-member Croatia (2013) is currently working on setting up their sites to be part of the Natura 2000 network. A survey by a European NGO network (EEA 2011) showed that **the “depth of implementation” varies significantly between countries**. In 2010, only about 40% of Member States had set precise conservation objectives at site level. Most Member States have decided to use the tool of site management plans, but the degree to which such plans have actually been developed for sites varies greatly between countries. Some old Member States such as France, Austria and Sweden, had by 2010 completed management planning for a large number of sites and were firmly on the way to finalize the process for all sites. On the other hand, a number of countries deciding to have such management plans had by 2010 only developed such plans for less than 10% of their sites.

Natura 2000 已具雏形，但尚未完全定型，因为要完全覆盖需要保护的地点还需再努力（特别需要增加海洋地区的保护地）。实施《栖息地指令》是一个持续过程，最新的欧盟成员克罗地亚（2013 年加入欧盟）目前正在设立要纳入 Natura 2000 网络的保护区。由欧洲一个非政府组织网络开展的一项调查（EEA 2011）显示，“**实施深度**”在不同国家之间差异很大。2010 年，仅 40% 的成员国确立了精确的保护区保护目标。多数成员国尚未决定采用保护区管理计划这一手段，但各国之间实际制定保护区管理计划的程度差异很大。有的老成员国，比如法国、奥地利和瑞典到 2010 就完成了大量保护区的管理计划编制，并且正在编制所有保护区的管理计划。另一方面，很多决定制定这种管理计划的国家到 2010 年仅编制了国内保护区不到 10% 的管理计划。

The Habitats Directive has enabled a first **EU-wide monitoring of the status for the most threatened species and habitats**. The reporting on conservation status done in 2008 (the next is due in 2014), showed that there still is a significant way to go to ensure the protection of the most threatened species and habitats.<sup>53</sup> In 2008, 17% of the target species under the directive had favorable conservation status, 52% unfavorable conservation status and the status of 31% was unknown (EEA, 2010). Of the target habitats, only about 10-20% had favorable status (see figure below). The situation appears worst for aquatic habitats, coastal zones and nutrient-poor terrestrial habitats. Of the marine regions, the situation is particularly bad in the Baltic Sea. Of the terrestrial biogeographical regions, the situation was best in the Alpine (incl. Austria) and Boreal region (incl. Finland and Sweden) and worst in the Atlantic region (incl. Belgium, France, the Netherlands, UK).

《栖息地指令》促成了首次**欧盟范围对多数受威胁物种和栖息地状况的监测**。2008 年进行的保护现状报告（下一次将于 2014 年进行）表明，要确保多数受威胁物种和栖息地的保护仍任重道远。2008 年，17%受指令保护的物种呈良好保护现状，52%呈不良保护现状，31%的物种现状不明（EEA, 2010）。在目标栖息地中，大约仅 10-20% 呈良好保护现状（见下面图 x）。水上栖息地、海岸区和营养物贫乏的陆地栖息地情况显得最糟糕。在海洋地区中，波罗的海的情况特别差。在陆地生物地理区，阿尔卑斯山地区（包括奥地利）和博雷亚尔地区（包括芬兰和瑞典）的情况最好，大西洋地区（包括比利时、法国、荷兰、英国）的情况最糟糕。

The aggregated data of conservation status by 2008 do not allow for conclusions about the effectiveness of the protection regime of the Habitats Directive, as time series are not yet available and habitat restoration and species recovery generally requires more time than a few years. For the Birds Directive, which has been in force for a longer time, studies indicate that the bird conservation measures in Natura 2000 areas have been effective (EEA 2010). The reporting in 2014 will provide new and more comprehensive data that will allow for a preliminary assessment of the effect of the measures taken under the directive and related EU initiatives to protect biodiversity and green infrastructure.

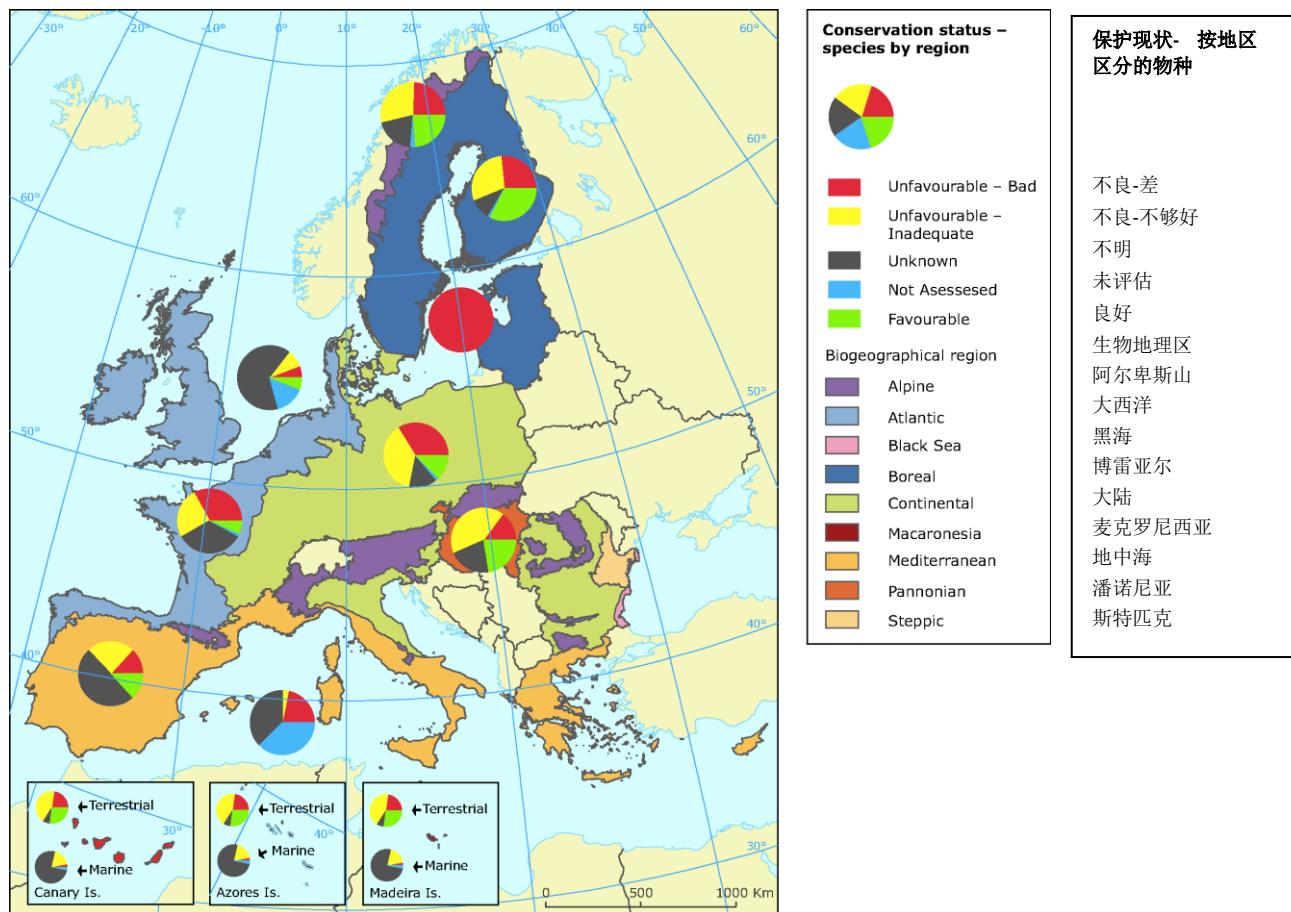
截止到 2008 年的汇总数据无法使我们就《栖息地指令》保护体系的效能得出结论，因为没有时间序列，而且栖息地修复和物种恢复通常需要很多年时间。对于已生效较长时间的《野鸟保护指令》，研究表明 Natura 2000 保护区的鸟类保护措施是有效的（EEA 2010）。2014 年的报告将提供新的更加全面的数据，可用于初步评估根据该指令和欧盟保护生物多样性和绿色基础设施的有关计划所采取措施的成效。

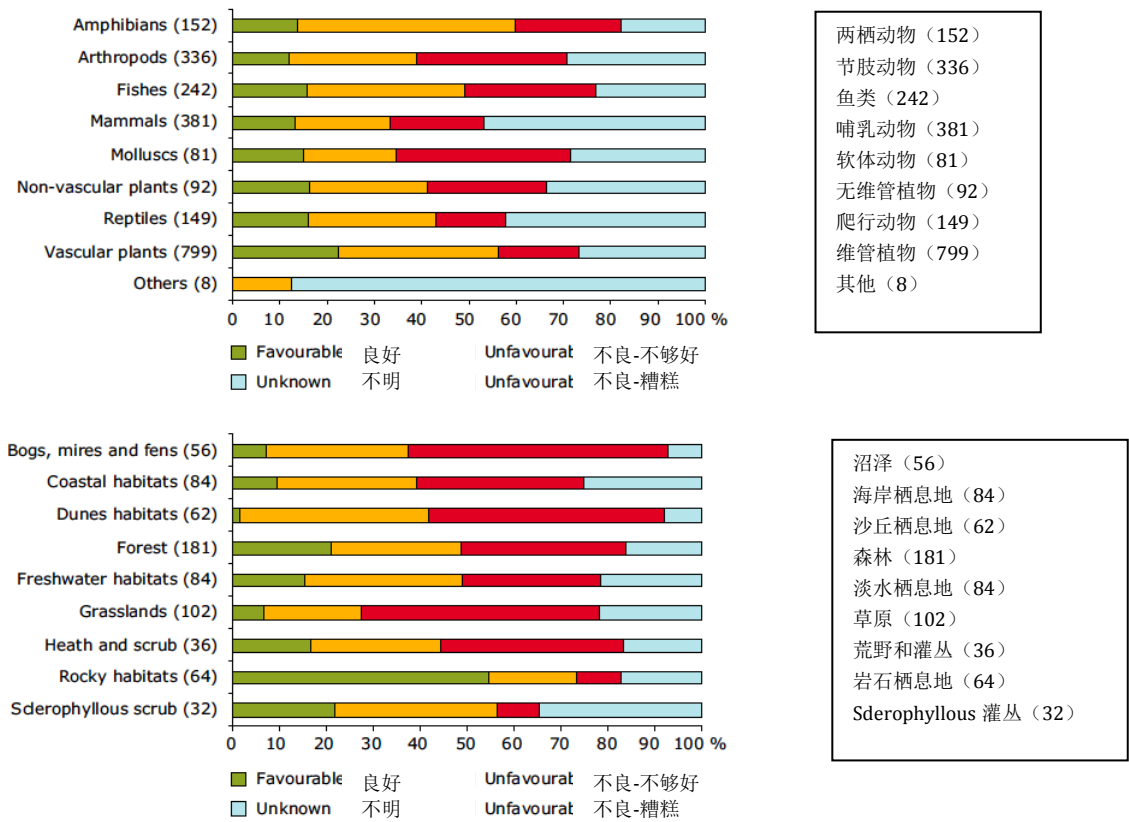
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<sup>53</sup> Note that since the 2008 reporting was the first reporting under the directive, time series does not exist and for a significant percentage of habitats and species data was not available in the first round (ref. figure 2.13 and 2.14). 注意，由于 2008 年的报告是首次根据指令做的报告，因此没有时间序列，大部分栖息地和物种的数据在第一轮都没有（参阅图 2.13 和 2.14）。

**Figure 2.13 and 2.14 Conservation status for Habitats Directive species and habitats (2008)**

图 2.13 和 2.14 《栖息地指令》相关物种和栖息地的保护现状





Source: EEA (2010)来源：EEA （2010）

2.4.1.6 Lessons and suggestions for China  
2.4.1.6 对中国的建议

The Habitats Directive would seem to contain a number of features that are highly relevant for China. China is among the 12 mega-biodiverse countries in the world (CBD 2014).<sup>54</sup> In 2008, an overall inventories report indicated the presence of more than 35,000 species of higher plants (of which 17,300 are endemic, ranking China third in the world after Brazil and Colombia), 6,445 species of vertebrates (667 being endemic) and 10% of the world’s invertebrates throughout the country. Among them are 1,371 species of birds (placing China first in the world) and 3,862 fish species (which account for 20.3% of the world’s total). China is also one of the eight centers of origin for crops, with nearly 10,000 species of crops, including their wild relatives. **China is clearly one of the most important countries globally for conservation of biodiversity** and China is a signatory to the international Convention on Biological Diversity (1992), like the EU.

《栖息地指令》似乎有很多对中国很有意义的特点。中国是全球 12 个生物多样性特别丰富的国家之一（CBD 2014）。2008 年，一份总体清查报告显示，全国有 35,000 万多种高等植物（其中中国特有植物 17,300 种，使中国继巴西和哥伦比亚之

<sup>54</sup> The data about biodiversity in China is taken from the Convention on Biological Diversity’s (CBD 2014) country profile of China.  
中国生物多样性数据摘自《生物多样性公约》（CBD 2014）中国国家概况。

后排名第三），脊椎动物 6445 种（667 种为中国特有），无脊椎动物占世界总数的 10%。其中鸟类有 1,371 种（中国名列世界第一），鱼类 3,862 种（占世界总数的 20.3%）。中国还是八个农作物原产地中心之一，有近 10,000 种农作物，包括其野生近缘种。在生物多样性保护方面，中国显然是全球最重要的国家之一，而且中国和欧盟一样，也是国际《生物多样性公约》（1992）签约国。

Despite some positive trends (such as growth in forest cover)<sup>55</sup>, many natural areas, habitats and species in China are threatened (CBD, 2014). About 90% of grasslands are experiencing different degrees of degradation and desertification, and 40% of China's major wetlands are facing threats of severe degradation - especially mudflats and mangroves. Species loss is also serious. It is estimated that 15% to 20% of wild higher plants in China are endangered, 233 vertebrate species face extinction and about 44% of wild animals are in decline. The main pressures and drivers of the changes to biodiversity are accelerated urbanization and industrialization leading to habitat fragmentation and increasing pollution levels. Environmental pollution has greatly impacted aquatic and river coastal biodiversity and habitats. Overexploitation and disorderly development of biological resources have also aggravated the negative impacts on biodiversity.

虽然有一些积极趋势（比如森林覆盖率的增長），但中国很多自然区域、栖息地和物种仍旧受到威胁（CBD, 2014）。大约 90% 的草地正经历着不同程度的退化和沙漠化，中国 40% 的重要湿地正面临严重退化的威胁——特别是滩涂和红树林。物种灭绝也很严重。据估计，中国野生高等植物濒危比例达 15%-20%，233 种脊椎动物面临灭绝，约 44% 的野生动物呈数量下降趋势。致使生物多样性发生变化的主要压力和驱动因素是城市化和工业化加速，导致栖息地破碎化，污染日益严重。环境污染极大影响了水生和河流沿岸生物多样性与栖息地。生物资源的过度开采和无序开发也加重了对生物多样性的负面影响。

**China's challenges related to preserving natural capital and sustainable use of ecosystems services are huge.** Faced with severe biodiversity loss, the Chinese government notes in its last report to the Convention of Biological Diversity<sup>56</sup>, that it is **striving to address the root causes, improve related legislation and management systems, and integrate biodiversity into national economic and social development plans and sectorial development plans.** The Communist Party of China (Xinhua, 2013) has recently stressed the need for an “ecological red line” to ensure the basic ecological protection necessary.

中国在保护自然资本和可持续使用生态系统服务方面面临巨大挑战。面对生物多样性严重丧失，中国政府在上一次提交给《生物多样性公约》的报告中指出，中国政

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<sup>55</sup> China's forest resources have witnessed continuous growth and forest cover has increased from 8.6% in 1949 to 20.36% at present.

中国的森林资源持续增长，森林覆盖率由 1949 年的 8.6% 增长到了目前的 20.36%。

<sup>56</sup> MEP (2008): *China's Fourth National Report on Implementation of the Convention on Biological Diversity*. Ministry of Environmental Protection, 2008.

MEP (2008: 中国履行《生物多样性公约》第四次国家报告。环境保护部，2008。

府正在努力“治本”，改进有关的立法和管理系统，把生物多样性纳入国家经济社会发展计划及行业发展计划。中国共产党（新华社，2013）最近强调需要用一条“生态红线”来确保必要的基本生态保护。

The following suggestions are not based in a detailed assessment of the current system and practices for nature protection in China, and should be seen as preliminary suggestions. It is, moreover, clear that any application of international experience as represented by the Habitats Directive, will need to be adapted to Chinese management traditions and unique circumstances.

以下建议并非基于对中国当前自然保护体系和实践的详细评估，应被视为初步建议。此外，显然需要根据中国的管理传统和独特情况运用《栖息地指令》中所描写的国际经验。

**The Habitats Directive can be seen to represent EU's ecological red line and a tool for regional risk assessment and management related to ecology**, and is an example of how such a standard can be established and implemented. The Habitats Directive provides an example of a **strictly scientific approach and a process of trans-national or regional cooperation** that likely is relevant in China. The approach is rooted in a scientific assessment of which species and habitats must be maintained in order to preserve biodiversity and provides a legal obligation to ensure the necessary protection. Such a basis has not yet been established in China in a similar and overall manner, and would likely be useful in order to focus and mainstream conservation efforts.

《栖息地指令》堪称欧盟的生态红线，是如何建立并执行生态红线的一个范例。《栖息地指令》提供了一个完全科学的方法和跨国及区域合作过程的范例，可能对中国有借鉴意义。这种方法根植于科学评估必须维持哪些物种和栖息地以便保护生物多样性，并将确保必要的保护规定为一项法定义务。这样的基础尚未在中国以类似和全面的方式建立，因此对于集中并整合保护工作可能会有用。

The Habitats Directive provides a **methodology for assessing the necessary scale of protection of species and habitats at biogeographical level** and a process in which the “burden of protection” can be shared between the states sharing a certain biogeographical region. Such an approach is likely also useful in a Chinese context where several provinces often share biogeographical regions.

《栖息地指令》提供了一种用于评估生物地理区物种和栖息地必要保护规模的方法，也提供了一套在共享一个生物地理区的州之间分担“保护重担”的程序。这种方法在中国背景下可能有用，因为在中国往往是几个省共用生物地理区。

One of the deliveries of the Habitats Directive is a **system for monitoring and regular reporting on status for the most threatened species and habitats at a continental level**, which allows for precise knowledge of status, trends and effects of measures. Such a system has not yet been established in China in a similar manner and would likely be useful as it is a prerequisite for targeted measures to preserve biodiversity.

《栖息地指令》交付的成果之一是一个用于监测并定期报告欧洲受威胁最严重物种和栖息地现状的系统，该系统可以使我们准确了解现状、趋势和措施效果。这样的



系统尚未在中国以类似全面的方式建立，因此可能会有用，因为它是保护生物多样性的目标措施的一个先决条件。

Concern is currently being expressed in China about how an ecological red line should be introduced in China (Caixin, 2013; China Dialogue, 2014). There is concern that the concept may lead to creation of a new protection category that will exist parallel to the existing system with ecological protection zones, biodiversity conservation areas, forest parks and geological parks (which all have their own protection requirements), leading to overlap, extra work with unclear added benefit and unclear mandates. There is also concern that such a concept will be impossible to follow-up, as it will require coordination with developments in all sectors influencing the ecology. The Ministry of Environment (MEP 2013) has begun work on operationalizing the ecological red line concept, publishing a draft Technical Guideline on Determination of Ecological Red Line and conducting pilot work in four regions. The pilot work in Inner Mongolia, Jiangxi, Guangxi and Hubei provinces is aimed at determining the spatial implications of an ecological red line, focusing on “key national eco function zones”, ecological sensitive areas and fragile areas. According to the scheme, the estimated area defined by ecological red line will make up about 20% of the area in each province. The pilot work and related technical work is estimated to be finalized by the end of 2014.

对于如何在中国引入一条生态红线，中国目前表示出担心（Caixin, 2013; China Dialogue, 2014）。人们担心，此概念可能导致创建一个新的保护类别，它与现有由生态保护区、生物多样性保育区、森林公园和地质公园（全部都有自己的保护要求）组成的系统并存，带来重叠额外的工作，而额外效益不确定，职责不明确。同时还有一种担心是，这样一个概念是不可能落实的，因为它需要与影响生态的所有行业的发展协调一致。环保部（MEP 2013）已开始将生态红线概念付诸实施、发布确定生态红线的技术导则草案和实施四个区域的试点工作等方面的工作。内蒙古、江西、广西和湖北等省的试点工作旨在决定某生态红线的空间涵义、侧重“主要国家生态功能区”、生态敏感区和脆弱生态区。根据方案，由生态红线定义的评估区域将约占据各省区域的 20%。据估计，试点工作和相关技术工作将于 2014 年年底最后敲定。

**The Habitats Directive shows how an ecological red line can be set at a continental level and implemented as a common minimum requirement to be mainstreamed across states incl. guidelines for cross-sector integration.** A similar system in China would provide a framework in which existing protection zones etc. could be integrated and supplemented to the extent necessary. This would focus and reinforce the protection in existing protect areas and not compete with current efforts. The ecological red line concept appears to have a similar approach and the suggested spatial extent (approximately 20% of land) would also be similar to the impact of the Natura 2000 network of protected sites under the Habitats Directive.

《栖息地指令》说明了如何在大陆层面划定和实施一条生态红线，并在各州形成主流的通用最低要求，同时包括用于跨行业整合的导则。中国的一个类似系统可提供一个框架，在这个框架下可在必要范围内对现有保护区进行整合与补充。这会专注于，并且加强现有保护区内的保护，而且不会与目前的工作产生竞争。该生态红线概念似乎采取类似的方法，建议的空间范围（约占陆地的 20%）将类似于《栖息地指令》保护区 Natura 2000 网络的效果。

Similar to in the EU, it would likely also be valuable to consider the ecological sites of “Chinese interest” in such a system (to paraphrase the EU terminology of “Community Interest”) as crucial hubs in the wider ecological system in China, upholding natural capital and providing a flow of ecosystem services to the benefit of Chinese society. **Estimations of economic benefits** from protection of a network of prioritized species and habitats, such as those that have been carried out in the EU, may also **help prioritize efforts and integrate them with sector strategies for economic development - instead of these being seen as antagonistic to each other.**

与欧盟情况类似，把这样一个系统里的关乎“中国利益”（套用欧盟的“共同体利益”术语）的生态保护地视为中国广泛生态系统里的关键枢纽，支撑自然资本并提供造福中国社会的生态系统服务流，这种看法可能也是很有价值的。估算优先级物种和栖息地网络保护带来的经济效益，比如欧盟已进行的估算，可能也有助于厘清各项工作的轻重缓急，并把他们与经济发展的行业战略融合在一起——而不是把这些视为彼此互不相容。

Finally, in the EU, it has been important to have the EU Commission as a watchdog ensuring that Member States fulfill their obligations. In a similar manner, the central level in China would probably need to take on a watchdog role ensuring that necessary scientific quality and political action is taken to protect prioritized species and habitats at the regional level.

最后，在欧盟，让欧盟委员会作为确保成员国履行其义务的监督部门，已显得十分重要。同样，中国中央层面可能也需要扮演监督部门的角色，确保必要的科学质量和采取区域层面的政治行动来保护优先级物种和栖息地。

## 2.4.2 EU Soil Thematic Strategy 欧盟土壤保护主题战略

### Box 2.6 Soil contamination in Europe

#### 框 2.6 欧洲的土壤污染

Soil contamination is a problem of varying intensity and significance across Europe. In most cases, cleaning up all historically-contaminated sites, commonly of industrial origin, to background concentrations or levels suitable to all uses is not viewed as technically or economically feasible. As a result, clean-up strategies are designed to employ sustainable, long-term solutions, often using a risk-based approach to land management aimed at achieving "fitness for use" appropriate to the location. In the absence of specific EU legislation to address the clean up of contaminated soil, Member States apply the "polluter pays" principle to varying degrees in clean-up programs. Public funding is also used in a number of Member States to finance remediation costs when necessary (US-EPA, 2013).

土壤污染问题在欧洲各地具有不同的强度和意义。多数情况下，把全部历史遗留污染场地（通常是工业污染的）清理到适合于所有用途的背景浓度或水平被认为在技术上或经济上是不可行的。因此，清理策略的目的是利用可持续的长期解决方案，往往采用基于风险的方法进行土地管理，旨在达到符合当地的“适用性”的目的。在没有特定的针对污染场地清理的欧盟立法情况下，成员国将“污染者付费”原则应用于不同程度的清理计划。必要时，很多成员国还用公共资金来补偿修复费用（US-EPA, 2013）。

The European Environment Agency (EEA) collects data on soil contamination and clean-up. The distribution of soil pollution sources across economic sectors differs from country to country, however, industrial activities are estimated to be responsible for over 60% of Europe's soil pollution (the oil sector accounts for 14% of this total). Among the most common harmful contaminants are heavy metals (37%) and mineral oils (33%). It has been estimated that about 3 million soil contamination sites need remediation (EEA, 2010). The figure is, however, uncertain due to limited data. More than 80,000 sites have been cleaned up during the last 30 years in EU countries where data on remediation are available (Figure 2.15).

欧洲环境署（EEA）收集土壤污染和清理数据。土壤污染源在各经济部门的分布因国家而异，但工业活动估计是 60% 的欧洲土壤污染的原因（石油业占总数的 14%）。最常见的有害污染物包括重金属（37%）和矿物油（33%）。估计约有 300 万个土壤污染场地需要修复（EEA, 2010）。然而，由于数据有限，这个数字并不准确。最近 30 年，在有修复数据的欧盟国家已清理了 8 万多个场地（图 2.15）。

Different EU policies for water, waste, chemicals, industrial pollution prevention, nature protection, pesticides and agriculture are contributing to soil protection. Of most relevance are The Waste Framework Directive; the Water Framework Directive, the Groundwater Directive, the Directive on Nitrates from agricultural sources, and the Integrated Pollution Prevention and Control Directive. However, as these policies have other aims and other scopes of action, they are not sufficient to ensure an adequate level of protection for all soil in Europe. The prevention of soil degradation is also limited by

the scarcity of data. In this context, the European Commission in 2006 adopted a Soil Thematic Strategy in 2006 and a proposal for a Soil Framework Directive with the objective to protect soils across the EU. The EU Soil Thematic Strategy recognizes eight major threats: soil erosion, decline of soil organic matter, soil contamination, loss of soil biodiversity, salinization, compaction, soil sealing and landslides. The proposed Soil Framework Directive is still being debated in the Council and the European Parliament and its adoption has so far been blocked by a minority of Member States (Germany, France, United Kingdom, The Netherlands and Austria; these countries question its added-value in relation to existing regulations and the Directive's compliance with the subsidiarity principle, while also being concerned about cost-effectiveness of measures proposed) (EC-JRC, 2013).

欧盟针对水、废弃物、化学品、工业污染防治、自然保护、杀虫剂和农业的不同政策均对土壤保护有所贡献。作用最大的有《废弃物框架指令》、《地下水指令》、《农业源硝酸盐指令》和《综合污染防治与控制指令》。然而，由于这些政策有其他目的和其他行动范围，因此不足以确保欧洲所有土壤都达到一个适当的保护水平。防止土壤退化还受到数据不足的限制。在这种背景下，欧盟委员会于 2006 年通过了一项《土壤保护主题战略》，并提出了一项《土壤框架指令》提案，旨在保护整个欧盟范围的土壤。《欧盟土壤保护主题战略》指出了八大威胁：水土流失、土壤有机质下降、土壤污染、土壤生物多样性丧失、盐碱化、土壤压实、板结和山体滑坡。《土壤框架指令》提案仍在由欧洲理事会和欧洲议会讨论，到目前为止大多数成员国（德国、法国、英国、荷兰与奥地利；这些国家怀疑该指令对现有法规的增加值以及该指令是否符合辅助性原则，同时还担心提议措施的成本效益）都反对通过该提案（EC-JRC, 2013）。

In preparation for action at EU level, the Commission has been working to support soil awareness initiatives, research and monitoring projects, such as LUCAS, a survey on land cover, land use and agro-environmental indicators run by Eurostat. The Commission has also continued to integrate the objective of soil protection into other EU policies, including agriculture and rural development. Around €3.1 billion has been allocated to the rehabilitation of industrial sites and contaminated land as part of the Cohesion Policy for the period 2007-2013. Hungary, the Czech Republic and Germany have allocated the most funding (€475, 371, and 332 million respectively).

在欧盟层面的行动准备中，欧盟委员会一直致力于支持土壤意识计划、研究和监测项目，比如 LUCAS，这是由欧盟统计局开展的一项关于土地覆被、土地使用和农业环境指标的调查。欧盟委员会还继续把土壤保护目标融入到欧盟其他政策里，包括农业和农村发展政策。2007-2013 期间，已为工业场地和污染土地的修复工作拨款 31 亿欧元左右，作为“凝聚政策”的一部分。匈牙利、捷克共和国和德国拨款数额最大（分别为 4.75、3.71 和 3.32 亿欧元）。

A number of other government and non-government resources exist in Europe to support work on the remediation of contaminated lands, including

欧洲有很多其他政府和非政府组织支持污染土地的修复工作，包括：

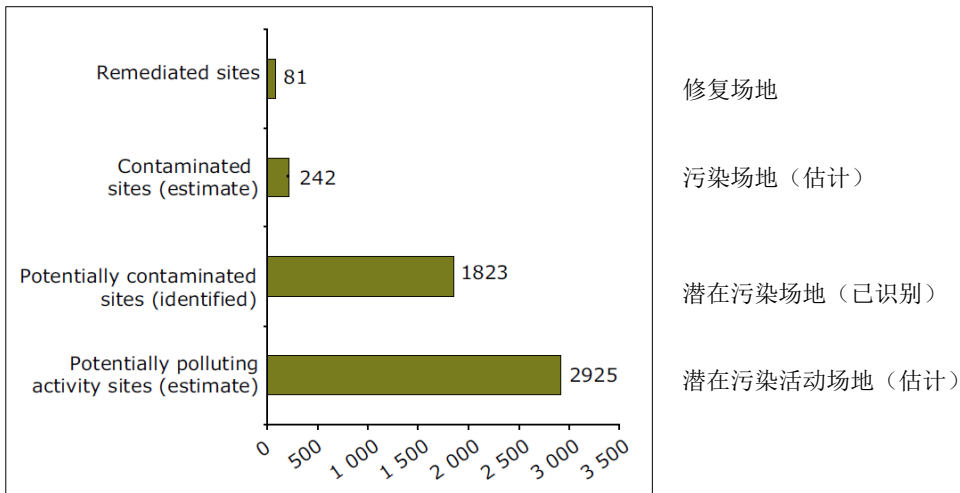
EUGRIS, a web portal for information and services on topics related to soil and water (<http://www.eugris.info/>)

EUGRIS，一个门户网站，提供土壤和水专题信息与服务（<http://www.eugris.info/>）

- NICOLE (The Network for Industrially Contaminated Lands in Europe), a leading independent forum on contaminated land management in Europe, supporting the development and application of sustainable technologies (<http://www.nicole.org/>)
- NICOLE（欧洲工业污染土地网），欧洲领先的关于污染土地管理的独立论坛，支持可持续技术的开发与应用(<http://www.nicole.org/>)
- EURODEMO (European Coordination Action for Demonstration of Efficient Soil and Groundwater Remediation, which promotes sustainable, cost-effective soil and groundwater remediation technologies (<http://www.eurodemo.info/>)
- EURODEMO（欧洲高效土壤和地下水修复协调行动，推广可持续、具有成本效益的土壤和地下水修复技术）（<http://www.eurodemo.info/>）

Figure 2.15 Contaminates sites (1000) in Europe 2006.

图 2.15 2006 年欧洲污染场地（1000 处）



Source EEA and JRC (2010).来源： EEA 和 JRC（2010）

Lessons and suggestions for China 对中国的建议

In China, pollution of urban and agricultural soils has increased with the rapid industrialization and urbanization during the last two decades. Cheng (2003) reported that the geological background levels of heavy metals are low in China, while a range of case studies show that soils and plants are contaminated and may affect human health through the food chain. Huang et al (2007) examined the distribution of heavy metal contents in topsoils and subsoils of the Yangzhong district, Jiangsu Province, China. Compared to subsoils, topsoils were enriched in Cd, Hg, Pb, Cu, Zn, and As. High levels of Cd and Hg are observed in most of the sampled agricultural soils. The spatial

distribution of high Cu, Pb, and Zn concentrations corresponded well to the locations of urban areas. Compared to data obtained in 1990, Cd and Hg show increased concentrations in 2005, which the authors attributed to the long-term use of agrochemicals. Wei and Yang (2010) found in a review study on heavy metal contamination in urban soils and agricultural soils in Chinese cities that the concentrations of Cr, Ni, Cu, Pb, Zn, As, Hg and Cd were generally higher than the background values of soil in China. Agricultural soils were found to be significantly influenced by Cd, Hg and Pb derived from anthropogenic activities.

在中国，最近二十年城市土壤和农业土壤污染随着工业化和城市化的快速推进而日益加剧。Cheng（2003）报告称，中国的重金属地质学背景水平较低，而一系列案例研究却表明土壤和植物受到了污染，并且可能会通过食物链影响人类健康。Huang等人（2007）研究了重金属含量在中国江苏省扬中开发区表层土和深层土中的分布情况。与深层土相比，表层土富含镉、汞、铅、铜、锌和砷。在多数农业土壤样本中观察到了高浓度的镉和汞。铜铅锌高浓度的空间分布与城市地区的坐落位置十分一致。与1990年获取的数据相比，2005年镉和汞的浓度增加了，研究者将其归因于长期使用农药。Wei和Yang（2010）通过一项在中国城市开展的城市土壤和农业土壤中的重金属浓度回顾研究发现，中国的铬、镍、铜、铅、锌、砷、汞和镉浓度普遍高于土壤的背景值。研究发现，农业土壤受到了源于人类活动的镉、汞和铅的极大影响。

In addition to research studies as exemplified above, the Ministry of Environmental Protection recently carried out a comprehensive survey of soil pollution in China. A report issued jointly by the Ministry of Environmental Protection and the Ministry of Land and Resources found that **nearly one-fifth of the farming land is polluted**<sup>57</sup>. The report was based on a survey conducted from 2005 to 2013 on about 630 square km of land across the country. The main pollution source is human industrial and agricultural activities, particularly irrigation by polluted water, the improper use of fertilizers and pesticides and the development of livestock breeding cause pollution to farming land. The top three pollutants are Cr, Ni and As according to the report.

除了以上列举的研究之外，环境保护部最近还开展了一项中国土壤污染综合调查。环境保护部和国土资源部联合发布的一份报告指出，**近五分之一的农用地受到了污染**。该报告基于2005到2013年对全国各地约630平方公里土地开展的一项调查。主要污染源是人类的工农业活动，特别是用污染水进行灌溉、肥料和农药使用不当以及畜牧业发展对农用地造成了污染。根据该报告显示，前三名污染物为铬、镍和砷。

Given the severe situation for soil pollution in China, especially regarding agricultural soils, **there is a strong need to strengthen mitigation policies**. In the EU one so far has relied on the different EU policies for water, waste, chemicals, industrial pollution prevention, nature protection, pesticides and agriculture when it comes to protecting soils. These policies are, however, not effective in cases where there is a need to remediate already contaminated land. Substantive resources have therefore been allocated to rehabilitation of polluted soil. **Due to the potentially very large costs of cleaning up heavily polluted sites, China may look into the ‘fitness for use’-**

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<sup>57</sup> [http://news.xinhuanet.com/english/indepth/2014-04/17/c\\_133270984.htm](http://news.xinhuanet.com/english/indepth/2014-04/17/c_133270984.htm)

**approach applied in the EU, as a first step to protect human health and environment from the effects of soil pollution.** This would imply, inter alia, that **food production should not take place on polluted soils.**

考虑到中国严峻的土壤污染形势，特别是农业土壤的污染形势，中国迫切需要加强灌溉政策。在欧盟，土壤保护迄今为止一直靠的是欧盟针对水、废弃物、化学品、工业污染预防、自然保护、农药和农业的不同政策。然而，在需要修复已污染土地的情况下，这些政策就不起作用了。因此，欧盟已拨出巨额资金用于污染土壤的修复。由于清理严重污染场地的费用可能会非常高，中国可考虑将欧盟所采用的‘适用性’方法作为保护人类健康和环境免受土壤污染影响的第一步。这特别意味着不应在污染土壤上进行粮食生产。

## 2.4.3 US Superfund 美国超级基金

### 2.4.3.1 Introduction 引言

In most countries one has discovered heavy polluted areas both on land and in sediments in the sea where there were previously some industrial or similar activities. Since the polluter is sometimes no longer around to be faced with these damages, or for some reason is not able to pay for the cleaning-up of the area, some arrangement have to be found to deal with this. In this chapter we present how the US has dealt with this through their Superfund. Other countries have similar arrangements.

在多数国家，人们发现在曾经有过工业活动或类似活动的陆地上和海中沉积物里，都有重度污染区。由于有时应承担这些损害赔偿的污染者已不存在，或者因故无法支付此地区的清理费用，就要通过某种安排来解决这个问题。本节我们介绍美国是如何通过超级基金解决这个问题的。其他国家有类似的安排。

Hazardous waste regulations began in the United States in 1976 with the Resource Conservation and Recovery Act to govern hazardous waste from its initial generation to final disposition (cradle-to-grave regulation) and the Toxic Substances Control Act to anticipate possible hazards from chemicals. Following the events at Love Canal and Times Beach in the 1970s, the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund) was enacted in 1980 to assist in the cleanup of abandoned hazardous waste disposal sites. In the mid-1980s, the Hazardous and Solid Waste Amendments (1984) and the Superfund Amendments and Reauthorization Act (1986) were passed.

美国对危险废物的监管始于 1976 年，用《资源保护与回收法》对危险废物实行从初始产生到最终处置的管制（从“摇篮”到“坟墓”的全程监管），用《有毒物质控制法》来预计化学品带来的可能危害。20 世纪 70 年代拉夫运河与时代海滩事件发生后，1980 年颁布了《环境响应、补偿与责任综合法》（CERCLA，又称“超级基金”），以帮助清理废弃的有毒废物处置场。20 世纪 80 年代中期，通过了《危险固体废物修正案》（1984 年）和《超级基金修正和再授权法案》（1986 年）。

The aim of hazardous waste regulation is to prevent harm from occurring due to hazardous waste and to pass the burdens of cleanup of hazardous waste on to the original producers of the waste. Some of the problems of hazardous waste regulation are that the negative effects of hazardous waste can be difficult to detect, and due to the large amount of waste that is generated, regulation can be difficult and costly.

危险废物监管的目的是预防因危险废物而发生的危害，并把危险废物的清理重担转移给废物的原始制造人。危险废物监管的一些问题是，危险废物的负面影响难以发现，而且由于废物的产生量很大，监管难度大，花费高。

### 2.4.3.2 Principles 原则

Superfund is an environmental program established to address cleaning of abandoned sites **contaminated with hazardous substances, as well as "pollutants or contaminants"** which are defined more broadly. It allows the Environmental Protection Agency (EPA) to **identify parties responsible for the hazardous substances releases and compel those parties to clean up the sites, or EPA may clean up itself using the**



**Superfund (a trust fund) and eventually claim cost recover from responsible parties.** Superfund also envisages a process called Natural Resources Damage Assessment (NRDA) conducted by the US Department of the Interior (DOI) and other ministries (see below). Here we put most emphasis on the processes carried out by EPA, since these are likely more relevant for China to learn from.

超级基金是为了解决被危险物质以及定义更广泛的“污染物”污染的废弃场地的清理问题而制定的一个环境计划。它使得美国环境保护局（EPA）得以确定危险物质释放的责任方并强制要求责任方清理场地，环保局也可以先用超级基金（一种信托基金）自行清理，最后再向责任方索回清理费用。超级基金还提出了一种叫做自然资源损害评估（NRDA）的程序，由美国内政部和其他部（见下文）开展这种评估。这里我们着重介绍美国环保局执行的程序，因为可能有更多值得中国借鉴之处。

A Potentially Responsible Party (PRP) is a possible polluter who may eventually be held liable under CERCLA for the contamination or misuse of a particular property or resource. Four types of PRPs may be liable for contamination at a Superfund site:

潜在责任方（PRP）就是最终可能根据 CERCLA 为污染或者某种特定财产或资源的滥用承担责任的污染者。四类 PRP 可能要对超级基金场地的污染承担责任：

- the current owner or operator of the site  
场地当前的所有人或营运人；
- the owner or operator of a site at the time that disposal of hazardous substances occurred  
危险物质处理时，场地的所有人或营运人；
- a person who arranged for the disposal of hazardous substances at a site, and  
安排在某场地处理危险物质的人；
- a person who transported hazardous substances to a site, who also has selected that site for the disposal.  
将危险物质运送到某场地、并且选择该场地进行处理的人。

**The Superfund cleanup process is complex. It involves the steps taken to assess sites, place them on a National Priorities List (NPL), and establish and implement appropriate cleanup plans.** The NPL primarily serves as an information and management tool for the EPA. The NPL is updated periodically by federal rulemaking. The identification of a site for the NPL is intended primarily to guide EPA in:

超级基金的清理程序很复杂，要采取的步骤是：对场地进行评估，将其列入“国家优先名单（NPL）”，然后制定并实施适当的清理计划。NPL 主要是美国环保局的信息和管理工具。NPL 根据联邦规则进行定期更新。一旦确定某场地要列入 NPL，美国环保局应当开展以下工作：

- determining which sites warrant further investigation to assess the nature and extent of the risks to the human health and environment  
确定哪些场地有必要进行进一步调查，以评估人类健康和环境所承受风险的性质和程度
- identifying what CERCLA-financed remedial actions may be appropriate  
确定哪些由 CERCLA 资助的修复行动是恰当的

- notifying the public of sites which EPA believes warrant further investigation and 将美国环保局认为有必要进行进一步调查的场地告知公众
- notifying PRPs that EPA may initiate CERCLA-financed remedial action. 告知潜在责任方美国环保局可能发起由 CERCLA 提供资金的修复行动。

Inclusion of a site on the NPL does not itself require PRPs to initiate action to clean up the site, nor does it assign liability to any person. The NPL serves primarily informational purposes, notifying the government and the public of those sites or releases that appear to warrant remedial actions. Whether action to reduce environmental risks should be taken is based on health and ecological risk assessments, see below.

将场地列入“国家优先名单”本身并不要求潜在责任方发起行动来清理场地，也不认定任何人的责任。“国家优先名单”的主要作用是提供信息，将看起来有必要采取修复行动的那些场地和泄漏场所告知政府和公众。是否采取降低环境风险的行动是基于健康和生态风险评估，见下文。

### 2.4.3.3 Approaches 方法

#### Response actions 响应行动

CERCLA authorizes two kinds of response actions for the EPA:

CERCLA 授权美国环保局采取两类响应行动：

- *Removal actions.* These are typically short-term response actions, where actions may be taken to address releases or threatened releases requiring prompt response. Removal responses are generally used to address localized risks such as abandoned drums containing hazardous substances and contaminated surface soils posing **acute risks** to human health or the environment.  
清除行动。这些通常是短期响应行动，可针对需要迅速响应的泄漏或者潜在泄漏采取行动。清除响应一般用来应对本地化风险，比如装有对人类健康或环境造成突发性风险的危险物质的废弃容器或者被污染的表层土。
- *Remedial actions.* These are usually long-term response actions. Remedial actions seek to permanently and significantly reduce the risks associated with releases or threats of releases of hazardous substances (**accumulated risks**), and are generally larger and more expensive actions which may include such measures as preventing the migration of pollutants with containment, or preferably removing and/or treating or neutralizing toxic substances.  
修复行动。这些通常是长期响应行动。修复行动寻求永久及显著降低与危险物质的泄漏或潜在泄漏有关的风险，而且一般是规模较大、花费较高的行动，可能包括围堵设施防止污染物迁移、或者最好是清除和/或处理或中和有毒物质之类的措施。

#### Superfund Cleanup Process 超级基金清理程序

This process is used to decide whether or what remedial actions to take. The Superfund cleanup process begins with site discovery or notification to EPA of possible releases of

hazardous substances. Sites are discovered by various parties, including citizens, state agencies, and EPA regional offices. Once discovered, sites are entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), EPA's inventory of potential hazardous substance release sites. Some sites may be cleaned up under other authorities as mentioned above. EPA then evaluates the potential for a release of hazardous substances from the site through the steps in the Superfund Cleanup Process. Community involvement, enforcement and emergency response can occur at any time in the process. Below is an overview of the various steps.

这一程序用来确定要不要采取或者要采取哪些修复行动。超级基金清理程序的第一步是发现可能有危险物质释放的场地，并通知美国环保局。场地可以被各种当事方发现，包括市民、州机构和美国环保局的地方办公机构。一旦被发现，这些场地即被输入“综合环境响应、补偿与责任信息系统”（CERCLIS），这是美国环保局的潜在危险物质释放地点目录。有些场地可以由上述其他机构清理。然后美国环保局通过超级基金清理程序中的步骤评估场地释放危险物质的可能性。公众参与、执行和应急响应可以在这一过程的任何时间发生。下面是各种步骤的概述。

### ***Preliminary Assessment/Site Inspection*** 初步评估/场地检查

The Preliminary Assessment (PA) and Site Inspection (SI) are used by EPA to evaluate the potential for a release of hazardous substances from a site.

初步评估（PA）和场地检查（SI）被 EPA 用来评估某个场地释放危险物质的可能性。

#### ***Preliminary Assessment*** 初步评估

This is an assessment of readily available information about a site and its surrounding area. A PA is designed to determine, based on limited data, whether a site poses little or no threat to human health and the environment or if it does pose a threat, whether the threat requires further investigation. The PA also identifies sites requiring assessment for possible response actions. If the PA results in a recommendation for further investigation, a Site Inspection is performed.

这是对关于一个场地及其周围区域的现成信息的评估。初步评估的目的是根据有限数据确定一个场地对人类健康或环境是构成极小的威胁或是不构成威胁，还是如果它确实构成威胁，这种威胁是否需要进一步调查。初步评估还确定需要对响应行动进行评估的场地。如果初步评估建议进行进一步调查，则进行场地检查。

#### ***Site Inspection*** 场地检查

This identifies sites that enter the NPL Site Listing Process and provides the data needed for Hazard Ranking System (HRS) scoring and documentation (see below). SI investigators typically collect environmental and waste samples to determine what hazardous substances are present at a site. They determine if these substances are being released to the environment and assess if they have reached nearby targets. The SI can be conducted in one or two stages. The first stage, or focused SI, tests hypotheses developed during the PA and can yield information sufficient to prepare an HRS scoring

package. If further information is necessary to document an HRS score, an expanded SI is conducted.

这一步骤可以确定进入 NPL 场地排列过程的场地，并提供危险排序系统（HRS）评分与记录（见下文）所需的数据。场地检查人员通常采集环境样本和废物样本，以确定场地存在的危险物质。他们确定这些物质是否被释放到环境中，并评估它们是否到达了附近目标。场地检查可以分一个或两个阶段进行。第一阶段又叫有明确目标的场地检查，检验初步评估期间做出的假设，并且可以产生足以编制一个 HRS 评分包的信息。如果需要进一步的信息来记录 HRS 分数，则进行扩大场地检查。

### ***National Priorities List (NPL) Site Listing Process***

#### ***国家优先名单（NPL）场地列入过程***

The NPL is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.

NPL 是美国各地危险物质、污染物或致污物的已知释放或潜在释放的国家优先治理名单。NPL 的目的主要是指导美国环保局确定哪些场地需要进一步调查。

Sites are first proposed to the NPL. EPA then receives public comments on the sites, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

首先向 NPL 提议场地。然后美国环保局收到公众对场地的评议，对公众评议做出回应，把继续满足列入要求的那些场地列入 NPL。

There are three mechanisms for placing sites on the NPL:

把场地列入 NPL 有三种机制：

1. Applying EPA's Hazard Ranking System (HRS). 应用美国环保局的危害排序系统（HRS）

The HRS is the principal mechanism EPA uses to place uncontrolled waste sites on the National Priorities List (NPL). It is a numerically based screening system that uses information from initial, limited investigations - the preliminary assessment and the site inspection - to assess the relative potential of sites to pose a threat to human health or the environment. Any person or organization can petition EPA to conduct a preliminary assessment.

HRS 是美国环保局用来把非管制废弃物场地列入国家优先名单（NPL）的基本机制。它是一个按数字进行筛选的系统，利用来自初始有限调查——初步评估和场地检查的信息来评估场地威胁人类健康或环境的相对可能性。任何人或组织都可以请求美国环保局开展初步评估。

2. States or Territories can designate one top-priority site regardless of score.  
州或地区可以选定一个最优先列入 NPL 的场地，不管其得分是多少。

There are no particular requirements for this.

对这一点没有特殊要求。

3. Allows listing a site if it meets all three of these requirements:  
满足以下全部三个条件的场地可被列入 NPL:

- the Agency for Toxic Substances and Disease Registry (ATSDR) of the U.S. Public Health Service has issued a health advisory that recommends removing people from the site  
美国公共卫生部有毒物质与疾病登记署已发出健康通知，建议人们迁出相关场地
- EPA determines that the site poses a significant threat to public health, and  
美国环保局确定该场地严重威胁公众健康，而且
- EPA anticipates it will be more cost-effective to use its remedial authority (available only at NPL sites) than to use its emergency removal authority to respond to the site.  
美国环保局预计对该场地行使修复权（仅可对 NPL 场地行使）比行使紧急清除权更经济。

### ***Remedial Investigation/Feasibility Study (RI/FS) 修复调查/可行性研究 (RI/FS)***

After a site is listed on the NPL, a remedial investigation/feasibility study (RI/FS) is performed at the site. This determines the nature and extent of contamination, and assesses the treatability of site contamination and evaluates the potential performance and cost of treatment technologies.

场地被列入 NPL 后，即在该场地开展修复调查/可行性研究（RI/FS）。这一步骤可以确定污染性质和程度，评估场地污染是否可处理，评价处理技术的潜在性能和成本。

### ***Records of Decision (ROD) 决策记录 (ROD)***

The Record of Decision (ROD) is a public document that explains which cleanup alternatives will be used to clean up a Superfund site. The ROD for sites listed on the NPL (NPL Site Listing Process) is created from information generated during the Remedial Investigation/Feasibility Study (RI/FS).

决策记录（ROD）是一种公共文件，说明要采取哪些清理方案来清理超级基金场地。列入 NPL 场地（NPL 场地列入过程）的决策记录是根据修复调查/可行性研究过程中产生的信息创建的。

A ROD contains site history, site description, site characteristics, community participation, enforcement activities, past and present activities, contaminated media, the contaminants present, scope and role of response action and the remedy selected for cleanup.

决策记录的内容包括场地历史、场地描述、场地特征、公众参与、执行活动、过去和当前的活动、被污染的介质、存在的污染物、响应行动的范围和职责以及为清理行动选定的修复措施。

### ***Remedial Design/Remedial Action (RD/RA) 修复方案设计/修复行动 (RD/RA)***

Remedial Design (RD) is the phase in Superfund site cleanup where the technical specifications for cleanup remedies and technologies are designed. Remedial Action (RA) follows the remedial design phase and involves the actual construction or implementation phase of Superfund site cleanup. The RD/RA is based on the specifications described in the record of decision (ROD). The bulk of the cleanup usually occurs during this phase.

修复方案设计（RD）是超级基金场地清理中制定清理修复措施和清理技术的技术规范阶段。修复行动（RA）发生在修复方案设计阶段之后，包含超级基金场地清理的实际建设或实施阶段。修复方案设计/修复行动建立在决策记录（ROD）中所描述的规范基础之上。大多数清理活动通常在这一阶段开展。

### ***Construction Completion 施工完成***

EPA has developed the construction completion milestone to better communicate the successful completion of cleanup activities. Sites qualify when:

EPA 建立了施工完成时间表，以更好地宣传清理活动的成功完成。符合以下条件时，场地即合格：

- any necessary physical construction is complete, whether or not final cleanup levels or other requirements have been achieved, or  
场地所需的物理构筑已完成，不论最后的清理水平或其它要求是否已达到，或者
- EPA has determined that the response action should be limited to measures that do not involve construction, or  
美国环保局已确认响应行动仅限于不涉及施工的措施。或者
- the site qualifies for deletion from the NPL.  
场地符合从 NPL 上删除的条件。

### ***Post Construction Completion 施工完成后***

The goal of Post Construction Completion activities is to ensure that Superfund response actions provide for the long-term protection of human health and the environment. EPA's Post Construction Completion activities also involve optimizing remedies to increase effectiveness and/or reduce cost without sacrificing long-term protection of human health and the environment.

施工完成后活动的目标是确保超级基金响应行动对人类健康和环境提供长期保护。美国环保局的施工完成后活动还包括在不牺牲对人类健康和环境的长期保护的情况下，优化修复方案，以提高效能和/或降低成本。

### ***National Priorities List Deletion 从国家优先名单上删除***

EPA may delete a site from the NPL if it determines that no further response is required to protect human health or the environment. A site may be deleted from NPL once all response actions are complete and all cleanup goals have been achieved.

如果美国环保局确认不需要采取进一步的响应来保护人类健康或环境，则可将场地从 NPL 上删除。一旦所有的响应行动都完成并且所有的清理目标都已达到，即可将场地从 NPL 上删除。

Sites that have been deleted from the NPL remain eligible for further Superfund-financed remedial action in the (unlikely) event that conditions in the future warrant such action. Partial deletions can also be conducted at NPL sites.

如果未来（极少数）情况下需要采取由超级基金提供资金的修复行动，那么已从 NPL 上删除的场地仍可以进一步开展这样的行动。场地达到要求的部分还可以部分删除。

### ***Site Reuse/Redevelopment*** 场地再利用/再开发

EPA's goal is to make sure that at every cleanup site, EPA and its partners have an effective process and the necessary tools and information needed to fully explore future uses, before the cleanup remedy is implemented. This gives EPA the best chance of making its remedies consistent with the likely future use of a site. In turn, EPA gives communities the best opportunity to productively use sites following cleanup.

美国环保局的目标是确保在清理修复措施实施之前，美国环保局及其合作伙伴在每一处清理场地都拥有充分开发未来用途所需的有效程序及必要手段和信息。这为美国环保局提供了使其修复措施符合场地未来可能用途的最佳机会。反过来，美国环保局则为社区提供了在清理之后高效使用场地的最佳机会。

### **Natural Resources Damage Assessment (NRDA)** 自然资源损害评估（NRDA）

Natural Resource Trustees (i.e. persons or institutions authorized to act on behalf of the public) conduct NRDA's to calculate the monetary cost of restoring injuries to natural resources that result from releases of hazardous substances or discharges of oil. Damages to natural resources are evaluated by identifying the functions or 'services' provided by the resources, determining the baseline level of the services provided by the injured resource(s), and quantifying the reduction in service levels as a result of the contamination.

自然资源损害受托人（即被授权代表公众行事的人或机构）开展自然资源损害评估，以计算修复由危险物质释放或者石油排放对自然资源造成的损伤的货币成本。通过确定资源所提供的功能或‘服务’、确定受损伤资源所提供服务的基准水平、对污染所致的服务水平降低进行量化，评估对自然资源造成的损害。

A framework and standards are developed for the NRDA process in coastal and marine environments (Type A) and other environments (Type B). The Type A process involves the use of a computer model to assess damages, in a standard and simplified manner, that result from chemical or oil discharges in coastal and marine environments. The Type B process is used in situations that require an individual approach. Both Type A

and Type B regulations call for the following four sequential phases in the assessment of damages:

为沿海及海洋环境（A 型）和其他环境（B 型）下的 NRDA 程序制定了框架和标准。A 型程序需要使用计算机模型以标准和简化方式对沿海和海洋环境下化学品或石油排放引起的损害进行评估。B 型程序用于需要个别方法的情况。在损害评估中，A 型和 B 型规程都需要以下四个连续的阶段：

- **Phase 1: Pre-assessment Screen.** A pre-assessment screen is conducted to determine if additional action is warranted. Trustees must determine whether an injury has occurred and a pathway of exposure exists. The pre-assessment screen is a prerequisite to conducting a formal NRDA.  
**第 1 阶段：预评估筛选。**进行预评估筛选，以确定是否有必要采取额外行动。受托人必须确定损伤是否已发生以及暴露途径是否存在。预评估筛选是开展正式 NRDA 的前提。
- **Phase 2: Assessment Plan.** Trustees must confirm the exposure of Trust Resources and develop an Assessment Plan to identify how the potential damages will be evaluated. Draft Assessment Plans under both Type A and Type B procedures must be available for public review and comment.  
**第 2 阶段：评估计划。**受托人必须确认受托资源的风险，并制定评估计划，以确定如何评估潜在损害。A 型和 B 型程序下的评估计划草案必须提供给公众审议。
- **Phase 3: Assessment Implementation.** The purpose of the Assessment Implementation phase is to gather the data necessary to quantify the injuries and determine damages. The work consists of three steps: (1) injury determination; (2) quantification; and (3) damage determination. Under Type A, these steps are performed through a computer model. Under Type B, the steps are performed through laboratory and field studies.  
**第 3 阶段：评估实施。**评估实施阶段的目的是收集量化和确定损害所必需的数据。这项工作有三个步骤：（1）确定损伤；（2）量化；和（3）确定损害。在 A 型程序下，这些步骤是通过一个计算机模型执行的。B 型程序下，这些步骤是通过实验室研究和实地研究执行的。
- **Phase 4: Post-Assessment.** A Report of Assessment detailing the results of the Assessment Implementation phase is prepared. A reasonable number of restoration alternatives including natural attenuation are usually proposed. A preferred alternative is selected based on several factors, including technical feasibility, relationship of costs to benefits, and consistency with response actions.  
**第 4 阶段：后评估。**编制一份详细描述评估实施阶段结果的评估报告。通常提出合理数量的修复备选方案，包括自然衰减。根据几个因素选出首选方案，包括技术可行性、成本效益关系以及与响应行动的一致性。

#### 2.4.3.4 Tools 工具

There are many guidelines, manuals and tools under the Superfund regime. Below we present an example of an assessment tool that could be useful for China to learn from.



超级基金制度下有很多导则、手册和工具。下面我们举例说明值得中国借鉴的评估工具。

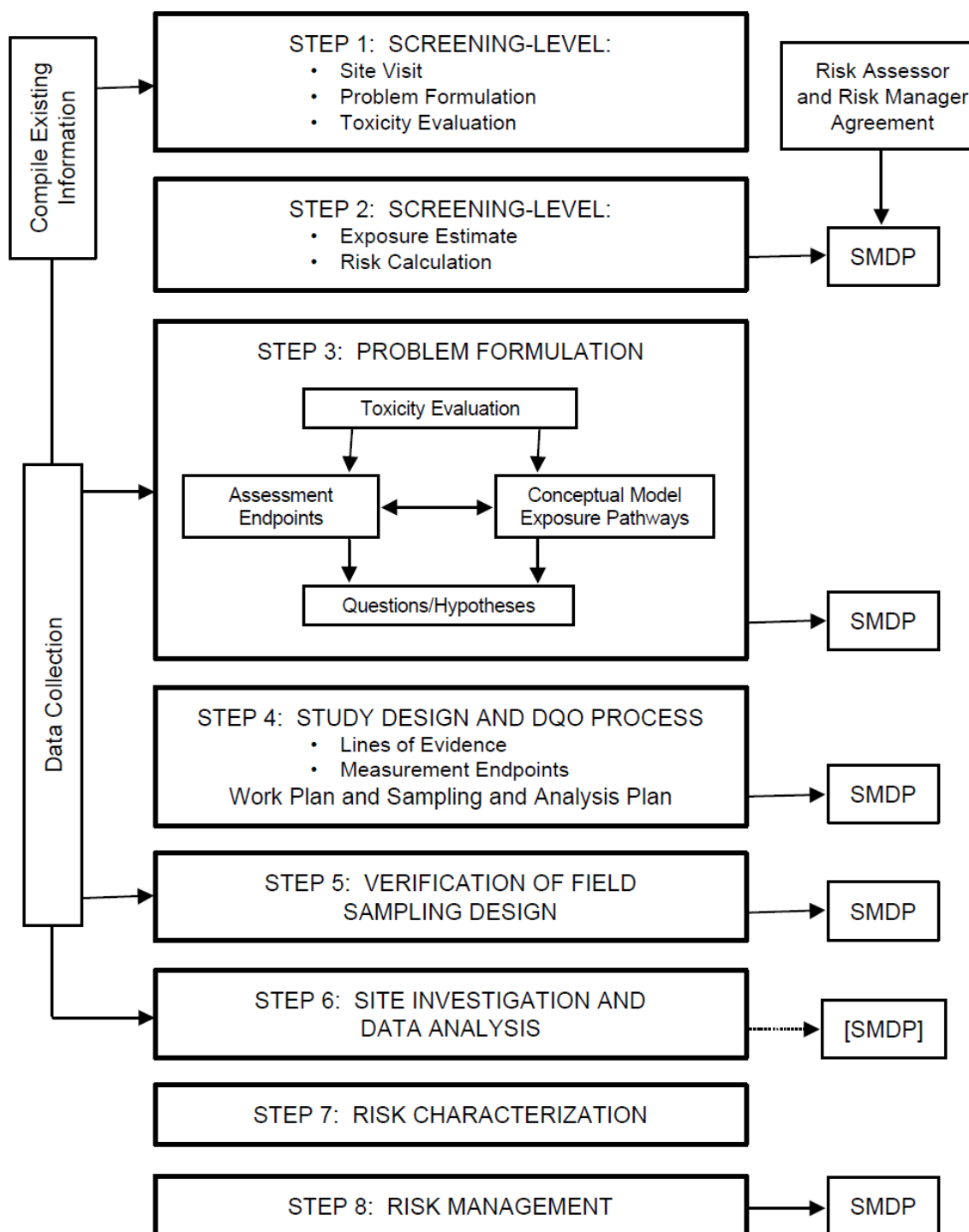
### **Superfund Ecological Risk Assessment 8-Step Process**

#### **超级基金生态风险评价八步过程**

In the Superfund program, Ecological Risk Assessments (ERA) is done according to the Ecological Risk Assessment Guidance for Superfund (ERAGS). The steps in these assessments are described below.

在超级基金计划中，根据《超级基金生态风险评价导则》（ERAGS）进行生态风险评价。下面描述评价步骤。

**Figure 2.16. Eight step Ecological Risk Assessment Process for Superfund.**

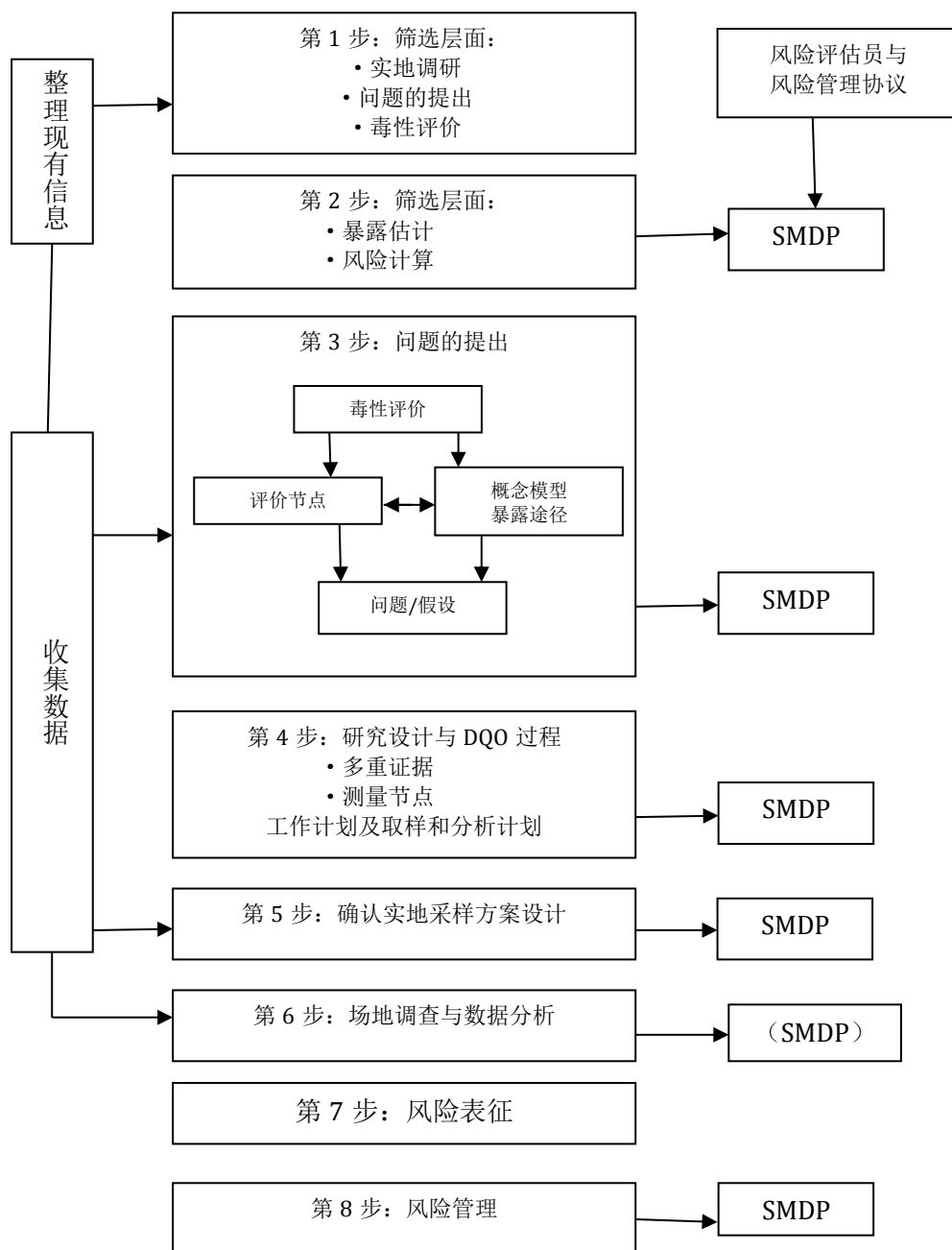


Note: SMDP is the abbreviation for "Scientific Management Decision Point"; these are points in the Ecological Risk Assessment process when the site project manager and scientific advisors decide upon what additional steps, if any, are necessary to take.

注：SMDP 是“科学管理决策点”的缩写；这些是生态风险评价过程中现场项目经理和科学顾问对必需采取的附加步骤做出决定时的节点。

Source: Superfund 来源：超级基金

图 2.16 超级基金生态风险评价八步过程



## 1. Screening-level problem formulation and toxicity evaluation

### 筛选层面问题的提出与毒性评价

In this first step it is important to get a brief overview of the situation at the site through the following activities:

第一步重要的是要通过以下活动概括了解现场情况：

- Problem formulation: information is gathered about the site  
问题的提出：收集场地信息
- Site visit 实地调研
- Ecological effects evaluation: review of scientific literature to determine at what levels the chemicals present will have adverse effects (any effect that causes harm to the normal functioning of plants or animals due to exposure to a substance (i.e. a chemical contaminant))  
生态影响评价：查阅科学文献，确定化学品达到什么水平会有不良影响（因接触某物质（即化学污染物）而对植物或动物的正常机能造成危害的任何影响）

#### *Problem Formulation 问题的提出*

This includes the development of a conceptual model, which is a representation of how the particular contaminants at a site are expected to behave in the environment. The conceptual model is based on fate (e.g., does a contaminant break down in the environment or is it persistent?) and transport (how does a contaminant move through the environment and where does it end out?). The conceptual model is used to narrow attention to the animals and/or plants likely to be exposed to the contaminants at the site. In risk assessment language, the species that may be exposed to contaminants are called "receptors".

这包括构建一个概念模型，它是对某个场地上特殊污染物在环境中表现的描述。概念模型的基础是污染物的归趋（例如污染物会在环境中降解还是持久存在？）和运移（污染物在环境中是如何移动的、又终止于何处？）。概念模型用来把注意力集中到场地上可能接触污染物的动物和/或植物。在风险评估语言中，可能接触污染物的物种被称为“受体”。

It is often not possible to study every species that is potentially at risk at a site. The purpose of the problem formulation is to focus attention on a few species or groups of species that are appropriate for answering the question of whether an ecological risk exists at the site. For this step, the risk assessor gathers information about the site that can help determine the potential risk to plants and animals found at the site being studied. This part should includedescriptions of the past, current, and future land-uses (i.e., industrial, residential, undeveloped), facilities that exist or existed at the site,the environmental characteristics/ecological types (wetlands, forests, grasslands, water-bodies, human-made/disturbed areas), areas that are potentially, or known to be at risk from chemical contamination. It is also crucial to assess what contaminants that are known or suspected to be at the site, and whether the contamination has moved off-site to impact other areas.

要研究某个场地上每一个可能处于危险中的物种常常是不可能的。问题提出的目的是把注意力集中到几个物种或几组物种上，它们适于回答场地上是否存在生态风险这个问题。对于这一步，风险评估人员收集有助于确定所研究场地上发现的动植物所受潜在风险的场地信息。这部分应包括描述过去、当前和未来的土地利用方式（即工业用地、居住用地和未开发土地）、场地上目前或过去存在的设施、环境特征/生态类型（湿地、森林、草地、水体、人工区/受干扰区）、有潜在或已知化学污染风险的区域。同样重要的还有，要评估场地上已知或疑似存在哪些污染物，以及污染是否已转移到场地外面，进而影响其他区域。

#### *Site Visit 场地调研*

The site visit is part of the process by which the risk assessor attempts to determine the potential risk to the environment.

场地调研是风险评估人员试图确定潜在环境风险的过程的一部分。

#### *Screening Level Ecological Effects Evaluation 筛选层面的生态影响评价*

For this step, the risk assessor determines from a review of scientific literature at what level (concentration) various chemical contaminants will not cause adverse effects in the plants and animals that may come in contact with the contaminants at the site. These levels are known as No-Observed-Adverse-Effects-Levels (NOAELs). The actual concentrations of the contaminants found at the site will later be compared to the respective NOAELs during risk calculations.

对于这一步，风险评估人员通过查阅科学文献确定各种化学污染物处于什么水平不会在场地上可能接触污染物的动植物中造成不利影响。这些水平又称为“无可测不利影响水平”（NOAEL）。随后在风险计算过程中会把在场地上发现的污染物的实际浓度与相应的 NOAEL 水平进行对比。

The plants and animals that are most sensitive to chemical contamination are considered for further study. At this step, these concentrations (NOAELs) generally come from a review of the scientific literature. There may be different sources of information with differing concentrations.

考虑进一步研究对化学污染最敏感的动植物。在这一步，这些浓度（NOAEL）通常是通过查阅科学文献获得的。可能有不同的资料来源，浓度各不相同。

## **2. Screening-level exposure estimate and risk calculation 筛选层面的暴露估算与风险计算**

This step consists of the following calculations: 这一步包括以下计算：

- estimating exposures - calculating how much plants and animals are exposed to chemicals at the site  
暴露估算——计算场地上有多少植物和动物暴露于化学品

- risk calculation - calculation of Hazard Quotients<sup>58</sup> i.e. the comparison of the levels of chemical contamination at the site to levels that are known to cause harm.

风险计算——计算危害商，即场地化学污染的水平与已知会造成危害的水平的对比。

These calculations are done by 1) estimating to what level a plant or animal is exposed to a particular contaminant, and 2) comparing maximum contaminant concentrations to screening numbers (these comparisons result in Hazard Quotients). These are the last two phases of the Screening Level Ecological Risk Assessment (SLERA). The process concludes with a decision if:

这些计算是通过 1) 估算植物或动物对某种特定污染物的暴露水平，以及 2) 将最大污染物浓度与筛选数字对比（对比结果即危害商）进行的。这些是筛选层面生态风险评估（SLERA）的最后两个阶段。整个程序结束时确定以下情况：

1. ecological threats are almost, or entirely, absent and therefore no further work is needed 生态风险几乎或完全不存在，因此不需要进一步的工作
2. the ecological risk assessment should continue to determine whether risk exists, or  
应继续进行生态风险评估以确定风险是否存在
3. there is the possibility of adverse ecological effects, and a more detailed ecological risk assessment, with more information about the site, is needed.  
可能有不利生态影响，需要更加详细的生态风险评估，需要更多关于场地的信息。

### *Estimating Exposure 暴露估算*

Information from Step 1 (Problem Formulation) is used to estimate exposures for the screening-level ecological risk calculations. The ways that plants and animals can be exposed should be considered (these are called "exposure pathways"). For the exposure pathways that are described for this site, the highest measured or estimated on-site contaminant concentration for each environmental medium (sediments, water or soil) should be used to estimate exposure to contaminants. This should help ensure that potential threats to the environment are not missed. Averages should not be used in the SLERA because they can underestimate the level of risk.

来自第 1 步（问题的提出）的信息用来估算筛选层面生态风险计算的暴露水平。应考虑植物和动物的暴露途径（这些称为“暴露途径”）。对于该场地暴露途径，用为每一种环境介质（沉积物、水或土壤）测得的或估算的场地污染物最高浓度来估算

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<sup>58</sup> The ratio of an exposure level by a contaminant (e.g., maximum concentration) to a screening value selected for the risk assessment for that substance. If the exposure level is higher than the toxicity value, then there is the potential for risk to the receptor

污染物接触水平（例如最大浓度）与为该物质的风险评估所选的筛选值之比。如果暴露水平高于毒性值，就由可能对受体造成风险。

暴露于污染物的水平。这有助于确保对环境的潜在威胁不会被漏掉。SLERA 中不应使用平均值，因为平均值会低估风险水平。

### *Risk Calculation 风险计算*

Ecological risk can be estimated numerically using the Hazard Quotient (HQ) approach. The HQ is a ratio, which can be used to estimate if risk to harmful effects is likely or not due to the contaminant in question. The HQ is calculated using one of the following Hazard Quotient Equations:

采用危害商（HQ）方法可以对生态风险进行数字化估算。HQ 是一个比值，用来估计所议污染物是否存在导致有害影响的风险。用以下危害商公式之一计算 HQ：

$HQ = Dose / Screening\ Benchmark$  HQ = 剂量/筛选基准

$HQ = EEC / Screening\ Benchmark$  HQ = EEC/筛选基准

Dose = an estimated amount of how much contaminant is taken in by a plant or animal, in terms of the body weight of the plant or animal (e.g., mg contaminant/kg body weight per day).

剂量 = 按植物或动物摄入污染物（以植物或动物体重计）的估计量（例如 mg 污染物/kg 体重/日）。

EEC = estimated (maximum) environmental contaminant concentration at the site; how much contaminant is in the soil, sediment, or water (e.g. mg contaminant/kg soil).

EEC=场地污染物的估计（最大）环境浓度；土壤、沉积物或水中有多少污染物（例如 mg 污染物/kg 土壤）。

Screening Benchmark = generally a No-Adverse Effects Level concentration; if the contamination concentration is at or below this level, the contaminant is not likely to cause adverse effects.

筛选基准 = 通常为无不利影响水平的浓度；如果污染浓度等于或低于这个水平，污染物就不可能引起不利影响。

If:                      Then:

如果：                      那么：

HQ > 1.0              Harmful effects cannot be ruled out 有害影响不能被排除

HQ = 1.0              Contaminant alone is not likely to cause ecological risk  
仅污染物本身不大可能引起生态风险

HQ < 1.0              Harmful effects are NOT likely 不大可能产生有害影响

Final determination of risk from contaminants in question is made in the Baseline Ecological Risk Assessment (See Steps 3 - 7). If a HQ is calculated to be equal or greater than one for a particular contaminant, that contaminant is then referred to as a Contaminant (or Chemical) of Potential Ecological Concern.

在基线生态风险评估中，对所议污染物带来的风险进行最后确定（见第 3-7 步）。如果计算得出的特定污染物的 HQ 大于等于 1，则该污染物即被称为潜在生态关注污染物（或化学品）。

How large the HQ is (i.e., by how much it exceeds one) is not relevant to a Screening Ecological Risk Assessment. This is because EPA has not recognized any official means of evaluating the size of the results of these calculations, only whether or not the HQ exceeds one.

HQ 多大（即它超过某个值多少）与筛选生态风险评估无关。这是因为美国环保局尚未确认用来评价这些计算结果大小的官方手段，仅可判断 HQ 是否超过 1。

If the HQ indicates the possibility of an ecological risk at a site, it should be decided whether to proceed with further, in-depth, studies of the site. In addition, for those cases that proceed, information from the screening-level calculations can indicate and justify which contaminants and exposure pathways can be eliminated from further study because they are unlikely to pose a significant risk. At this stage, the decision made should be documented.

如果 HQ 表明场地有生态风险可能，应决定是否对该场地进行进一步的深入研究。另外，对于进行进一步深入研究的那些案例，筛选层面计算产生的资料可表明和说明通过进一步研究可消除哪些污染物和暴露途径，因为它们不大可能造成重大风险。在这一阶段，所做决策应予以记录。

### 3. Baseline problem formulation 基线问题的提出

In this phase the conservative assumptions used in the Screening Level Ecological Risk Assessment (SLERA) in the previous steps should be replaced with more realistic assumptions. Decisions about whether or not chemicals should be eliminated from further consideration should be made about contaminants for which their respective Hazard Quotients (HQs) are at or below one. The following issues should be considered:

在这一阶段，应当用更现实的假设代替前面几步筛选层面生态风险评估中所用的保守假设。对于危害商（HQ）小于等于 1 的污染物，应确定化学品是否免于进一步考虑。以下问题应当关注：

- Refining Contaminants of Potential Ecological Concern (COPECs): deciding whether or not chemicals found at the site should be considered further in determining potential ecological risk  
潜在生态关注污染物（COPEC）的明确：确定在场地所发现的化学品是否应当在判断潜在生态风险时进一步予以考虑
- Contaminant fate and transport: what happens to the chemicals, biologically, chemically, physically and how they move among plants and animals



污染物的归趋和运移：化学品在生物、化学、物理上发生了什么，以及它们如何在植物和动物当中迁移

- Mechanisms of toxicity: what are the harmful effects on plants and animals  
毒性机制：对植物和动物有哪些有害影响
- Ecosystems potentially at risk: habitats and plants and animals present; sensitivity by plants and animals to chemicals; water bodies present  
生态系统面临潜在风险：存在的栖息地和动植物；动植物对化学品的敏感性；存在的水体
- Exposure pathways: how the chemicals pass through the food web from the source of contamination  
暴露途径：化学品从污染源到食物网的分布
- Assessment endpoints: the characteristic(s) of a plant or animal that can be measured in terms of harmful effects  
评估节点：可用有害影响计量的植物或动物的特征
- Conceptual site model: collection of exposure pathways  
场地概念模型：收集暴露途径
- Risk questions: using various lines of evidence, answer the question "does chemical X cause harmful effects in plant or animal Y?"  
风险问题：用各种证据，回答“化学品 X 是否对 Y 种植物或动物造成有害影响？”这个问题

#### *Comparisons to Background Concentrations/Reference Locations*

##### *与背景浓度/参照地的对比*

While comparisons of contaminant concentrations in the media at the site being investigated to concentrations of contaminants at reference or background locations *may* be done, there are several restrictions on the application of this line of evidence.

虽然可以把被调查场地介质中的污染物浓度与参照地或背景地点的污染物浓度进行比较，但采用这种证据有几项限制。

If the concentration of a contaminant at the site exceeds its respective screening benchmark, it **MUST** be further evaluated in the Baseline (Steps 3 to 8) portion of the Ecological Risk Assessment. This further evaluation must be done even if the concentration of the contaminant at the site does not exceed background levels. This is because there is still the potential for risk due to direct toxicity or bioaccumulation.

如果该场地污染物浓度超过其相应的筛选基准，则必须在生态风险评估的基线部分（第 3 步到第 8 步）进行进一步评价，即使场地的污染物浓度没有超过背景水平。这是因为仍有直接毒性或生物累积所致的潜在风险。

There are no established standards for determining the level of risk from a contaminant at a site from how much the contaminant concentration exceeds its respective screening benchmark. Thus, this line of evidence is not typically used in Ecological Risk Assessments, especially without other lines of evidence.

没有既定标准用来以污染物浓度超过其相应筛选基准多少为依据来确定场地污染物所致的风险水平。因此在生态风险评估中一般不采用这条证据，特别是在没有其他证据的情况下。

### *Contaminant Fate & Transport* 污染物的归趋和运移

The environmental fate and transport of the contaminants is how contaminants are taken up by plants and animals; how they are transferred among plants and animals (i.e., through animals eating plants or other animals); how the contaminants affect plants and animals; how the chemical contaminants might move through, or be transformed physically, chemically, and biologically in the environment; and how the contaminants are eliminated from plants and animals.

污染物的环境归趋和运移就是污染物如何被动植物吸收；如何在动植物中转移（即通过食用植物或其他动物的动物转移）；污染物如何影响动植物；化学污染物如何在环境中运移或发生物理、化学和生物转化；以及污染物如何从动植物中消除。

### *Mechanisms of Ecotoxicity* 生态毒性机制

A contaminant can cause adverse ecological effects in many ways. First, a COPEC might affect a plant and animal after exposure for a short period of time (acute) or after a long period of time (chronic). Second, the effect of a COPEC might be lethal (killing the plant or animal) or sublethal (causing harmful effects other than death, such as reduced growth, reproduction, or life-span, behavioral changes, etc.). Third, a COPEC might act directly (lethal or sublethal effects) or indirectly (through damaging food sources or habitat, or altering predator-prey relationships or competition between species) on a plant or animal.

污染物可以通过很多方式造成不利的生态影响。首先，在短期暴露（突发性）或者一段长期暴露（慢性）之后，COPEC（潜在生态关注污染物）可能会影响某种植物和动物。其次，COPEC 的影响可能是致命的（致使植物或动物死亡）也可能是亚致命的（造成死亡之外的有害影响，比如生长减缓、繁殖力下降或寿命缩短、行为变化等）。再次，COPEC 可能直接（致命影响或亚致命影响）或间接（通过破坏食物源或栖息地，或者改变捕食者与猎物之间的关系或者物种之间的竞争）作用于某种植物或动物。

### *Ecosystems at Risk* 生态系统面临危险

Because some groups of plants or animals can be more sensitive than others to a particular contaminant, available information on ecological effects of contaminants can help focus the investigation on specific ecological resources (plants, animals, habitat types) that should be evaluated more thoroughly. The following questions should be answered:

由于某些族群的植物或动物可能比其他族群对特定污染物更敏感，可以使用污染物生态影响方面的相关资料把调查集中在需要较彻底评估的特定生态资源（植物、动物、栖息地类型）上。应回答下面的问题：

- what habitats are present?存在哪些栖息地？
- what types of water bodies are present?存在什么类型的水体？

- what species of plants and animals can be found at the site?  
场地上有哪些种类的植物和动物？
- how sensitive are the different species to chemical contamination?  
不同物种对化学污染的敏感度如何？
  - some species are more sensitive to some chemicals  
有些物种对有些化学品比较敏感
  - predators can become more highly exposed to COPECs through biomagnification in the food chain or from feeding more often (or exclusively) on a specific type of prey that accumulates contaminants more easily than other prey types;  
捕食者通过食物链上的生物放大或者通过经常（或专门）捕食比其他物种更容易累积污染物的特定类型的猎物更多地接触 COPEC。
  - species may prefer to feed in or be active in contaminated (or non-contaminated) areas.  
物种可能更喜欢在受污染（或非污染）区喂食或活动。

All of these factors must be considered when refining exposure pathways.

在细化暴露途径时，必须考虑以上全部因素。

#### *Exposure Pathways 暴露途径*

This is how contaminants pass through an ecosystem from the source to the receptors. For example, a contaminant might pass from sediment to surface water to a fish via the fish's gills (complete pathway is sediment to surface water to gill to fish body).

暴露途径就是污染物在生态系统里从污染源到受体的运移方式。例如，某种污染物可能从沉积物传递到地表水，经由鱼鳃到达鱼体（完整的途径是从地表水到鱼鳃到鱼体）。

For specific contaminants, it is frequently possible to reduce the number of exposure pathways that need to be evaluated to one or a few critical exposure pathways. These especially important means of exposure (1) reflect very high levels of exposure of contaminants to plants and animals, and (2) make up exposure pathways to plants and animals that are exceptionally sensitive to the contaminant(s). Multiple critical exposure pathways should all be evaluated because it is often difficult to predict which pathways can be responsible for the greatest ecological risk. As a group, these exposure pathways make up the conceptual site model for the site under investigation.

对于特定污染物，常常可以把需要评估的暴露途径的数量减少到一个或几个关键暴露途径。这些特别重要的暴露手段（1）反映了污染物对动植物很高的暴露水平，并且（2）组成了对特别敏感动植物的暴露途径。如果有多个暴露途径，应全部评估，因为往往难以预计最大的生态风险是由哪些暴露途径引起的。作为整体，这些暴露途径组成被调查场地的场地概念模型。

#### *Selection of Assessment Endpoints 评估节点的选择*

This refers to characteristics about a population, species, or group of species that can be measured and can be affected by an ecological stressor. The species or groups of species usually have some common characteristics, such as a specific exposure route or sensitivity to particular contaminants. Endpoints can be limited to single species.

节点是指人群、物种、种群的特征，可用生态压力因素测量，并且受生态压力因素影响。物种或种群通常有一些共同的特征，比如接触特殊污染物的特定途径或者对特殊污染物的敏感性。节点可限于单一物种。

In any case, selection of the endpoints should be based on the following criteria:

任何情况下均应根据以下标准选择评估节点：

- ecosystems, communities, and/or species potentially present at the site  
场地上存在的生态系统、群落和/或物种
- contaminants present and their concentrations  
存在的污染物及其浓度
- what are the harmful effects of the contaminants found at the site - this should include the following:  
场地上发现的污染物有哪些有害影响——包括：
  - what plants and animals could, or will, be at risk  
哪些动植物可能或者将会有危险
  - how the plants and animals might be affected by the contaminants (i.e., what form of damage might the contaminants cause: lowered reproductive rates, tumors, slower growth, death, etc.)  
动植物可能受到污染物怎样的影响（即污染物会造成什么形式的损害：繁殖率下降、肿瘤、生长减缓、死亡等）
  - the chemical and physical form of the contaminants' influence;  
污染物影响的化学和物理方式
  - bioavailability 生物利用度
  - and the type and scale of any adverse responses by the plants and animals that are potentially affected by the contaminants at the site  
受场地污染物潜在影响而导致动植物产生不良反应的类型和规模
- plants or animals that are potentially sensitive, or highly exposed, to the contaminants and attributes of those groups' natural history  
对污染物具有潜在敏感性或高度接触污染物的动植物及其种群的自然历史属性
- exposure pathways - including if the contaminants affect plants and animals via direct contact/exposure with a particular medium (e.g., water or sediment) or indirect exposure through food chains, or both.  
暴露途径——包括污染物是否通过直接接触特定介质（例如水或沉积物）而影响动植物；还是通过食物链间接暴露；或是同时通过两种途径暴露。

### *Conclusion 结论*

At the conclusion of this step, it should be agreed on four items: contaminants of concern, assessment endpoints, exposure pathways, and risk questions. Those items can be summarized with the assistance of the Conceptual Site Model (CSM). Without

agreement on the CSM to this point, measurement endpoints cannot be selected, and a site study cannot be developed effectively.

在这一步骤结束时，应就四项内容达成一致：关注污染物、评估节点、暴露途径和风险问题。借助场地概念模型（CSM）可以总结这些内容。若不能就 CSM 达成这种一致，就无法选出测量节点，也无法有效开展场地研究。

#### **4. Study design and data quality objectives process 研究设计和数据质量目标程序**

Step 4 should result in the establishing of a Work Plan & Sampling and Analysis Plan, i.e. a description of how the investigation will proceed at the site. It should contain the following issues:

第 4 步应制定一项工作计划和采样分析计划，例如，描述场地调查的过程步骤。应包含以下问题：

- measurement endpoints - what is measured (i.e., reproduction, mortality, growth, etc.) in relationship to the assessment endpoints  
测量节点——应当测量哪些与评估节点相关的指标（如繁殖、死亡率、生长等）
- study design - what type of testing will be done to evaluate the potential ecological risk at the site  
研究设计——要做什么类型的测试来评估场地上的潜在生态风险
- data quality objectives and statistical considerations - a series of planning steps to ensure the quality, type, and quantity of data will be adequate and defensible  
数据质量目标和统计应考虑一系列规划步骤，以确保数据的质量、类型和数量是恰当和站得住脚的。

There are three general types of studies that are done:

开展的研究有三个通用类型：

- bioaccumulation and tissue residue field studies,  
生物累积和组织残留实地研究
- population/community evaluations, or biological field surveys  
人口/社区评估，或生物实地调查
- toxicity testing, which measure the effects of a particular contaminant on a particular species.  
毒性试验，测量特定污染物对某个特定物种的影响。

Samples should be taken from locations with contaminated media (soil, sediment, water) and from reference sites. Reference data might be data that had been collected from the site before the contamination occurred or new data collected from a reference site.

从有污染介质（土壤、沉积物、水）的地方以及参照地抽取样本。参照数据可以在污染发生之前从场地收集的数据或者从参照地收集的新数据。

## 5. Field sampling plan verification 实地采样计划的验证

Step 5 should ensure that the samples specified by the Work Plan and Sampling Analysis Plan (SAP) from Step 4 actually can be collected. This is necessary because conditions may have changed between the time the sampling plan was developed and when the samples are supposed to be collected. Changes may include factors such as flooding, drought, too much or too little snow and ice, and some of the species that were expected to be there are no longer present (or are in too small numbers to allow for collection).

第 5 步应确保第 4 步工作计划和采样分析计划（SAP）中规定的样本采集实际可行性。这十分必要，因为在制定取样计划至要采样之间，情况可能已发生变化。变化可包括以下因素：洪水、干旱、冰雪太多或太少、一些应存在的物种已不再存在（或者数量太少，无法取样）。

Final decisions on reference areas should also be made in this step. Characteristics to be evaluated for deciding on reference areas should include slope of the land, habitat, species potentially present, soil and sediment characteristics, and for surface waters: flow rates, water depth, temperature, turbidity (how cloudy the water is), oxygen levels, water hardness, and pH. Several reference sites might be necessary depending on the variables associated with the reference and contaminated sites.

这一步还应对参照区做出最后决定。选定参照区时要评估的特征应包括土地的坡度、栖息地、潜在存在的物种、土壤和沉积物特征，对于地表水还应包括：流速、水深、温度、浊度（水的浑浊程度）、氧气含量、水硬度和 pH 值。可能需要几个参照地，视与参照地和污染场地有关的变量而定。

## 6. Site investigation and data analysis 场地调查和数据分析

In this step the activities envisaged in the Work Plan (WP) and Sampling Analysis Plan (SAP) created in the previous steps should be carried out. During the sampling process, the data quality objectives should be strictly adhered to, as failure to do so can significantly alter the interpretation of the data.

在这一步要开展前面几步制定的工作计划（WP）和采样分析计划（SAP）中提出的活动。在采样过程中，应严格遵守数据质量目标，因为如果达不到数据质量目标会极大改变数据的释义。

Even at this stage there might be unexpected complicating factors that have arisen since the Field Verification, such as the extent of contamination being different than expected or new contaminants are discovered. If there are new issues to be considered, the WP/SAP might have to be modified to accommodate these new considerations. Otherwise, the sampling and analysis may proceed with the WP/SAP as is.

即使在这一阶段也可能有自从实地核查以来出现的意外复杂因素，比如污染程度与预计的不同或者发现了新的污染物。如果有新的问题要考虑，就可能需要修改工作计划/采样分析计划，以适应这些新的问题。如果没有新问题，取样和分析可按工作计划/采样分析计划原计划继续进行。

The results of this analysis describe the relationship between size, frequency, or duration of a chemical contaminant and the size of the response. The relationships

between the assessment endpoints and their respective measures of effect are also described (see Step 3). This type of analysis can help to determine the tradeoff between the level of cleanup and likely benefits of that cleanup. The balance of ecological and financial costs versus benefits of different cleanup options can also be determined.

这类分析结果描述化学污染物的大小、频率或持续时间与响应程度大小之间的关系。还描述评估节点与各自的效应度量标准之间的关系（见第 3 步）。这类分析可以帮助确定清理水平和可能产生的效益之间的权衡关系，还可以确定生态和财务成本与不同清理方案的效益之间的平衡。

## 7. Risk characterization 风险表征

Risk characterization includes two major components: risk estimation and risk description. Risk characterization should be well-balanced, clear, reasonable, consistent, easy to follow and understand, with all assumptions, uncertainties, and professional judgments clearly identified.

风险表征包括两个主要组成部分：风险估测和风险描述。风险表征应均衡、清晰、合理、一致、易于理解，并明确确定所有的假设、不确定因素和专业判断。

*Risk estimation* means combining exposure profiles with exposure-effects information and summarizing the associated uncertainties. Data interpretation methods should be presented in the risk characterization documentation. In addition to developing point estimates of exposure concentrations, it might be possible to develop a distribution of exposure levels based on the potential variability in various exposure parameters. This is called a dose-response curve, where likely responses (i.e., harmful effects) can be predicted from specific levels of contamination. Probabilities of exceeding a threshold for adverse effects might then be estimated.

风险估测是指把暴露的整体描述与暴露-效应信息结合在一起，总结相关的不确定因素。风险表征文件里应提出数据解释方法。除了算出暴露浓度的点估计值之外，还可以根据各种暴露参数的潜在变异性获得暴露水平的分布图，这叫做剂量-反应曲线，通过该曲线可根据具体污染水平预测可能的反应（即：有害影响）。然后可估计不利影响超过某个阈值的概率。

A key to *risk description* is the documentation of environmental contamination levels that bound the threshold for adverse effects on the assessment endpoints. In addition to identifying one or more thresholds for effects, the risk assessment team might develop estimates of the probability that exposure levels would exceed the ecotoxicity thresholds given the distribution of values likely for various exposure parameters. The estimates should also be put in context with a description of the extent, magnitude, and potential ecological significance of those estimates. Additional ecological risk descriptors are as follows:

*风险描述*的关键在于环境污染水平文件，这些环境污染水平限制评估节点所受不利影响的阈值。除了确定一两个效应阈值外，风险评估团队还可以根据各种暴露参数可能的数值分布，估计暴露水平超过生态毒性阈值的概率。除了估计值以外，叙述文本中还应当包括那些估计值的范围、程度和潜在生态意义。描述生态风险的其他指标如下：

- the location and area extent of existing contamination above a threshold for harmful effects 超过有害影响阈值的现有污染地点和区域范围
- the degree to which the threshold for contamination is exceeded or is likely to be exceeded in the future, particularly if exposure-response functions are available, 目前超过或者将来可能超过污染阈值的程度，特别是在有暴露-反应函数的情况下，
- how long it would take for the contaminants to disappear from the environment, either from decay, breakdown, or physically moving out of the site 污染物通过腐烂、降解或者物理上移出场地而从环境中消失需要多长时间。
- the potential for natural recovery once the sources of contamination are removed. 污染源被清除之后的自然恢复潜力。

## 8. Risk management 风险管理

This is the stage where decisions are made about what remedial (clean-up) actions, of any, are to be undertaken.

这一阶段对要开展哪些修复（清理）行动做出决定。

### 2.4.3.5 Results 结果

Over the years, Superfund has located and analyzed tens of thousands of hazardous waste sites. As of October 31st, 2013 there were 1,313 sites listed on the National Priority List (NPL), of which 1,156 sites construction have been completed. An additional 372 have been delisted, of which 58 have been partially deleted. 54 new sites have been proposed waiting for an assessment.

多年来，超级基金探明并分析了成千上万个危险废物场地。截止到 2013 年 10 月 31 日，有 1,313 个场地列入国家优先名单（NPL），其中 1,156 个场地的修复施工已完成。又有 372 个场地被从名单上删除，其中 58 个场地被部分删除。54 个新场地经提议等待评估。

**Approximately 70 percent of Superfund cleanup activities have historically been paid for by parties responsible (PRPs) for the cleanup of contamination.** The only time cleanup costs are not borne by the responsible party is when that party either cannot be found or is unable to pay for the cleanup. For those sites, the Superfund law originally paid for toxic waste cleanups through a tax on petroleum and chemical industries. The chemical and petroleum fees were intended to provide incentives to use less toxic substances. Over five years, \$1.6 billion was collected, and the tax went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. The last full fiscal year (FY) in which the Department of the Treasury collected the tax was 1995. At the end of FY 1996 the invested trust fund balance was \$6.0 billion. This fund was exhausted by the end of FY 2003; since that time funding for superfund sites for which the potentially responsible party (PRP) could not be found has been appropriated by Congress out of general revenues.

历史上，大约 70% 的超级基金清理活动已经向污染清理责任方（PRP）追回了清理费用。只有当找不到责任方或者责任方无力支付清理费用时，清理费用才不由责任方承担。对于那些场地，超级基金法通过对石油化工行业征税先行支付有毒废物清理



费用。征收石化税费的目的是奖励使用毒性较小的物质。五年来征收了 16 亿美元，税款转到用于清理废弃场地或者非管制危险废弃物场地的信托基金。美国财政部征收此税的上一个完整财政年度（FY）是 1995 年。1996 财年末，信托基金的余额为 60 亿美元。到 2003 财年末该基金用尽；自那时起，找不到潜在责任方（PRP）的超级基金场地的清理费用由美国国会从普通税收中拨款。

**Despite the name, Superfund lacks sufficient funds to clean up even a small number of the sites on the NPL.** As a result, EPA will typically negotiate consent orders with PRPs to study sites and develop cleanup alternatives, subject to EPA oversight and approval. EPA then issues a Proposed Plan for remedial action for a site on which it takes public comment, after which it makes a cleanup decision in a Record of Decision (ROD). RODs are typically implemented under consent decrees by PRPs or under unilateral orders if consent cannot be reached. If a party fails to comply with such an order, it may be fined up to \$37,500 for each day that non-compliance continues.

超级基金名不副实，它甚至缺乏足够的资金来清理 NPL 上的少部分场地。因此，美国环保局一般会与潜在责任方议定开展场地研究并制定备选清理方案的同意令，同意令需由 EPA 监督和批准。然后美国环保局发布场地修复行动建议方案，听取公众意见，之后以决策记录（ROD）的方式做出清理决策。决策记录通常由潜在责任方根据同意判决书执行，如果无法达成同意，则根据单边判决执行。如果一方未能遵守该等判令，不遵守行为每持续一天则被处以 37,500 美元的罚款。

**Implementation has been difficult.** By 1995, Superfund cleanup took an average of twelve years per site. **Superfund has been probably the most criticized of environmental programs based on costs of remediation, implementation problems, and the questionable seriousness of the problems it addresses** ([www.wikipedia.com](http://www.wikipedia.com)).

实施难度大。到 1995 年，超级基金平均用 12 年清理一个场地。由于修复费用高、实施问题多、其所解决问题的严重程度值得怀疑，超级基金或许已成为最受人诟病的环境计划([www.wikipedia.com](http://www.wikipedia.com))。

### Box 2.7 Environmental remediation funding in Europe.

框 2.7 欧洲的环境修复资助

**The EU:** EU Directive 2004/35/EC establishes a comprehensive liability regime for damage to the environment. The directive applies the "Polluter Pays Principle" (PPP). The liable party is an "operator," who carries out certain dangerous activities listed in the Directive.

**欧盟：**欧盟指令 2004/35/EC 建立了一个全面的环境损害责任机制。该指令应用“污染者付费原则”（PPP）。责任方是“经营者”，即做出了指令中列出的特定危险行动的人。

Potentially-polluting entities are not required by the EU to carry insurance or establish other financial security mechanisms to protect them against the cost of potential clean up. About 35% on average of remediation expenditure of polluted sites come from public budgets in EU countries when legally responsible polluters no longer exist, cannot be

identified, or are insolvent. The rehabilitation of industrial sites receives funding through EU Structural Funds; the total budget for this purpose was 2 250 billion Euro for the period 2005-2013.

欧盟不要求潜在污染实体利用保险或建立其他财政安全机制以逃脱可能的清理成本。对欧盟国家而言，当法律上应负责任的污染者不存在、无法确定，或无偿还能力时，平均约 35% 的污染场地修复经费来自公共预算。工业场地的复原得到欧盟结构基金的资助；2005 至 2013 期间，用于此目的的预算为 2.25 万亿欧元。

**Germany:** The authorities choose among owner, polluter or occupier of a contaminated site to pay for the remediation of the site. The Federal (i.e. local) States are responsible for cleaning of abandoned industrial (and similar) sites, and apply the PPP wherever the polluter can be identified. If the polluter is insolvent or funding of the clean-up would make him go bankrupt, special support may be available in some Federal States.

**德国：**当局在污染场地所有人、污染者或占有者之间选择一方为场地修复付费。联邦（地方）各州负责废弃工业（以及类似）场地的清理，并在能确定污染者的时候使用 PPP。如果污染者无偿还能力或清理费用足够使他破产，那么在一些州中他可能得到特殊帮助。

Since 1999 when the “Federal Soil Protection and Contaminated Sites Ordinance” entered into force, more than 22 large-scale remediation projects whereby the financing of the remediation has been shared by the Federal Government (75%) and the local states (25%). The total costs were more than 3 billion Euros. About 500 million Euros of public money are spent each year on this. Also, several millions are spent on various research programmes on how to assess and clean up contaminated sites (Frauenstein, 2007).

自 1999 年《联邦土壤保护和污染场地条例》生效以来，超过 22 个大型修复工程的修复资金是由联邦政府（75%）和地方各州（25%）一起承担的。总花费超过 30 亿欧元。每年用于修复的公款约为 5 亿欧元。此外，还有几百万用于各种各样的关于如何评估和清理污染场地的研究方案（Frauenstein, 2007）。

**The Netherlands:** The current land owner is responsible for remediation of contaminated land, including financing. If he is not the polluter he must eventually try and get compensation from the polluter, applying private law. A public program for financial support to clean up contaminated sites has been in place. Usually the government subsidizes 50% of the remediation costs. For the period 2000 – 2014 the total remediation costs for historical contamination are 5.13 billion Euro, of which half have been funded by the government. Some 15 000 sites have been remediated.

**荷兰：**污染场地的当前所有人负责场地的修复，包括提供资金。如果他并非污染者，那么他最后须通过运用私人法从污染者那里获得补偿。用于清理污染场地的公共方案已安排妥当。通常情况下，政府资助 50% 的修复费用。对于 2000 至 2014 这一期间，历史遗留污染的总修复费用为 51.3 亿欧元，其中一半来自政府资助。约 15000 个污染场地已被修复。

**UK:** The financial responsibility for remediation is usually with the polluter of the land. Where the polluter cannot be found, landowners or occupiers can be liable for the costs.

Buyers of land can be held responsible for remediation payment. There is no specific government grant for remediation of contaminated land, but some loan arrangements have been applied (Prokop et.al., 2000).

**英国：**通常情况下，修复的经济责任在于土地污染者。在无法找到污染者的情况下，土地所有人或占有人可承担费用。土地购买人可负责支付修复的费用。英国没有针对污染土地修复的具体政府资助，但有一些贷款协议（Prokop et.al., 2000）。

Tax relief is provided to companies who clean up land that has been contaminated by industrial processes. Companies can claim a 150% corporation tax relief for costs involved in cleaning up contaminated land. Companies with sufficient profits to cover the expenditure will receive a corporate tax deduction for 150% of the qualifying costs. Companies not making profits can either carry the relief forward to be deducted against future profits or exchange all or some of the resulting loss for a tax credit. The payable tax credit is currently worth 16% of the losses.

负责清理受工业程序污染的土地的公司可获得税款减免。关于污染土地清理的花费，公司可要求 150% 的公司所得税减免。对于那些收益足以支付清理费用的公司，它们将获得清理费用 150% 的公司所得税减免。对于收益不足的公司，它们可要求以后针对将来的收益使用公司所得税减免，或将造成的所有或部分损失换做抵税额。可付的抵税额当前为损失的 16%。

#### 2.4.3.6 Lessons and suggestions for China 对中国的启示和建议

Contaminated sites, known as brownfields, are becoming increasingly common in major Chinese cities as urban sprawl has overrun many polluting factories, pushing them to new locations and leaving health risks behind. Many brownfield and historical sites, if not managed well, will pose an environmental and health hazard in China's most densely populated areas, as well as an obstacle to urban and economic development. Monitoring of contaminated sites is inadequate. Only a few big cities such as Beijing and Chongqing have thoroughly investigated the scope of the pollution and its environmental risks (China Daily, 2011).

随着城市扩张，很多致污工厂被迫迁至新址，留下健康风险，污染场地（又称棕色地块）在中国主要城市越来越常见。如果管理不好，很多棕地和历史遗留场地会在中国人口最密集的地区造成环境与健康危害，并阻碍城市和经济的发展。污染场地监测不力。只有少数像北京和重庆这样的大城市彻底调查了污染范围及环境风险（中国日报，2011）。

World Bank (2010) shows that China's rapid urbanization has resulted in the need to redevelop industrial land once occupied - and contaminated - by old industries that sat on the cities' perimeters decades ago. Such sites are often heavily contaminated because pollutants leaked into the soil during previous production processes and because hazardous wastes weren't handled properly. In some cases, the concentration of pollutants in the soil can be hundreds of times higher than regulations permitted.

世界银行（2010）指出，中国的快速城市化使其有必要对几十年前坐落在城市周边的老工业企业占用并污染的工业用地进行再开发。这种场地常常受到严重污染，因

为在以前的生产过程中污染物渗漏到土壤里，而且危险废弃物未得到妥善处理。有些情况下，土壤中污染物的浓度超出法规允许的几百倍。

A land pollution census conducted by the Ministry of Environmental Protection from 2007 to 2010 found that the soil quality is degrading in many regions, such as the Pearl River Delta, Yangtze River Delta and Pan-Bohai Bay area (China Daily, 2011). Soil is already heavily polluted in some industrial zones and mining areas with heavy metals including cadmium, mercury, lead, chromium and arsenic, and with organic chemical compounds, such as oil hydrocarbons. **Experts estimate that contaminated industrial sites in the country number 300,000 to 600,000.**

环境保护部从 2007 年到 2010 年开展的土地污染普查发现，很多地区的土壤质量在下降，比如珠江三角洲、长江三角洲和泛渤海湾地区（中国日报，2011）。在一些工业区和矿区，土壤已经受到了包括镉、汞、铅、铬和砷在内的重金属以及石油烃之类的有机化合物的严重污染。据专家估计，全国受污染工业场地有 30 万到 60 万处。

Remediation for contaminated sites has become an urgent need as the country's rapid urbanization creates a huge demand for usable land, which in turn requires both funding and technical guidelines from the government. With more people moving from rural areas into the cities, clean and safe land is essential. **In China, the most commonly used remediation practice is to remove the polluted soil, which is then deposited into a landfill or burned, and replace it with clean soil** (China Daily, 2011).

污染场地迫切需要修复，因为中国的快速城市化带来了对可用土地的巨大需求，这反过来又需要政府提供资金和技术指导。随着更多的人从农村迁到城市，干净安全的土地是必不可少的。在中国，最常用的修复实践是清除受污染土壤，然后在填埋场填埋或者焚烧，再换上干净土壤（中国日报，2011）。

Developers sometimes shy away from remediation because of the costs. Some developers argue that they should not pay all the costs of remediation because they didn't cause the pollution. But there are examples of companies cleaning up a site, not because there is any law mandating them to do so, but because cleaning up the site enhance their reputation and allowed them to fully utilize the area (China Daily, 2011).

开发商有时会因为费用问题而逃避修复（中国日报，2011）。一些开发商辩称，他们不应当承担全部的修复费用，因为不是他们造成的污染。但也有公司清理场地的例子，他们不是因为法律要求他们这么做，而是因为清理场地可以提高其知名度，并且这让他们可以充分利用清理后的区域（中国日报，2011）。

According to the World Bank (2010) **China lacks sound regulations and laws as well as technical frameworks to manage and remedy brownfields.** Moreover, different government departments - the ministries of environmental protection, land and resources, agriculture and others - are involved with the tasks of managing land pollution.

MEP in 2014 released five official guidances on contaminated sites remediation, including terminologies, investigation phase, monitoring, risk assessment and remediation technologies. These are built on experiences learnt from the US Superfund and Chinese practices. However, a higher level law regarding soil/sites remediation is

still necessary as a basis for these guidances and a guide to the remediation market in China.

根据世界银行的报告（2010），中国缺乏合理的法律法规以及技术框架来管理和修复棕地。此外，不同政府部门——环境保护部、国土资源部、农业部及其他——在参与治理土壤污染的工作。

环境保护部于 2014 年发布了 5 份污染场地修复官方导则，包括术语、调查阶段、监测、风险评估和修复技术。这些导则的制定是基于对美国超级基金和中国实践经验的借鉴。然而，作为这些导则的基础，以及中国修复市场的指引，高水平的土壤/场地修复法律仍十分必要。

According to Caldwell and Wang (2011) **China has no national-level law or regulation to address the soil pollution crisis. However, there are some regulations at province and city levels, among others in Jiangsu Province and Nanjing city.** Caldwell and Wang highlight the need for a national law or regulation to control soil pollution. According to them, MEP in 2009 drafted the *Provisional Rules for the Environmental Management of Contaminated sites*. This basically follows the same basic site remediation process as CERCLA, but under the latter the government plays a more active role. **Caldwell and Wang recommend that a modified version of the Provisional rules is made into national Chinese law, considering China's unique situation and not copying CERCLA too much.**

据 Caldwell 和 Wang（2011）分析，中国没有国家级的法律或法规来应对土壤污染危机。然而，江苏省和南京市有一些省级和市级法规。Caldwell 和 Wang 强调需要用国家法律或法规来控制土壤污染。根据他们的建议，环保部于 2009 年起草了《污染场地土壤环境管理暂行办法》。该《暂行办法》基本上遵循了和美国 CERCLA（《环境响应、补偿与责任综合法》）相同的场地修复基本程序，但后者下的政府扮演着更加积极的角色。Caldwell 和 Wang 建议将修订后的《暂行办法》纳入中国国家法律，考虑中国的国情，而不要照搬美国的 CERCLA。

**World Bank (2010) recommended using economic measures such as loans, dedicated subsidies and environment taxes to support clean-ups of toxic sites. Another possibility is setting up a superfund, where stakeholders put in money every year to support remediation.**

世界银行（2010）建议采用经济措施来支持有毒场地的清理，比如贷款、专项补贴和环境税。还有一种可能是设立超级基金，每年由利益相关方向基金里注资来支持修复。

There could in our view be several lessons for China from the US Superfund scheme:

我们认为中国可从美国超级基金计划得到以下几个启示：

- ***Get an overview of the (number of) abandoned sites causing severe environmental problems.*** This should be a first attempt at getting an overview, without applying any comprehensive investigations or analysis. The work could eventually be organized on provincial level, based on some broad selection

criteria established at national level. Construct a NPL-like system to evaluate the priority of contaminated site control.

**掌握引起严重环境问题的废弃场地（的数目）的概况。**这应当是初步尝试了解概况，不进行任何综合调查或分析。这项工作最终可根据国家层面制定的一些广泛选择标准在省级层面组织开展。建立一个像 NPL 一样的系统来评价污染场地治理优先次序。

- **Build an integrated and cooperative management way** for different government sections.

**为不同政府部门建立一种一体化的合作管理方式。**

- **Apply a stepwise approach** when assessing the listed sites for damages from various releases and emissions to the environment. It could perhaps be useful to start with a screening process to make a preliminary assessment of the potential problems, to see if they are “large enough” to warrant further investigation and eventually a clean-up or other actions to curb the problem. This could both be cost effective and time saving, resulting in finding the sites in most need of actions to reduce damages to health and/or ecology.

在评估入选场地因各种向环境的释放和排放所致损害时**采用分步法**。有用的作法是从筛选过程开始，对潜在问题进行初步评估，看看它们是否“大得足以”有必要开展进一步的调查、并最终开展清理或其他活动来解决问题。这样既经济又省时，最终可以发现最需要采取措施来减少健康和/或生态损害的场地。

- **Assess ways of financing the clean-up actions.** Financing has been a major challenge in most countries, resulting in that most actions have had to be financed through public budgets. This has been a major hindrance for the clean-up process. Thus, finding new and innovative ways of financing could be crucial for the success.

**评估清理行动的融资方式。**融资已成为多数国家的一大挑战，导致多数行动必须通过公共预算获得资金。这已成为清理程序的一大障碍。因此，找到创新的融资方法对于成功很关键。

- **Keep it simple.** Superfund has over the years developed rather comprehensive schemes for analyzing and prioritizing between sites. This requires a lot of skills and analyzing capacity, and is perhaps not necessary to assess whether the damages are unacceptable or to prioritize between sites.

**保持简单。**多年来，超级基金形成了相当综合全面的框架，用于分析场地并区分场地的优先次序。这需要很多技能和分析能力，或许这对于评估损害是否不可接受或者区分场地的优先次序来说是没有必要的。

- **Keep an eye on lessons learned from US and EU experiences.** This could, for example, be related to mega-site management strategies, complex groundwater contamination control.

**留意由美国和欧盟经验得到的启示。**例如，注意学习在巨型场地管理战略、复杂的地下水污染控制方面的经验。

## 2.5 Emissions to air 空气污染物排放

### 2.5.1 Preparations for climate-friendly air quality management in the EU and USA

#### 欧盟和美国对气候友好型空气质量管理的准备工作

##### 2.5.1.1 Introduction 引言

Climate change and air pollution are closely interconnected problems. Air pollutants and greenhouse gases (GHG) to a large extent have the same emission sources. It has become clear that air pollutants in themselves, especially particles and tropospheric ozone, play an important role in the climate system. Depending on their physicochemical properties, they may contribute to warming or cooling. There is also a link via atmospheric chemistry processes as some air pollutants affect the lifetimes of GHGs. Finally, global warming may enhance air pollution problems in an area and make it more difficult to reach targets. For instance, in the US a study showed a strong correlation between the number of days the ambient temperature exceeds 37° Celsius and the days in which ozone concentrations exceed air quality standards. As global warming is forecast to increase the number of such days, future progress in meeting the ozone standard may be impeded (Aunan et al, 2006; James and Schultz, 2011).

气候变化与空气污染是密切相关的问题。很多情况下，空气污染物和温室气体（GHG）排放源相同。而且，空气污染物本身、特别是颗粒物和对流层臭氧在气候系统中扮演着重要角色。受颗粒物和臭氧的理化特性影响，它们可导致气候变暖或变凉。同时，有些空气污染物通过大气化学过程影响温室气体的寿命，使它们之间产生关联。最后，全球变暖可加剧地区的空气污染问题，并加大实现目标的难度。例如，美国的一项研究表明，环境温度超过 37 摄氏度的天数与臭氧浓度超过空气质量标准的天数之间存在密切关联。由于预计全球变暖会导致这样的天数增多，因此臭氧标准的达标进展会受到阻碍（Aunan et al, 2006; James and Schultz, 2011）。

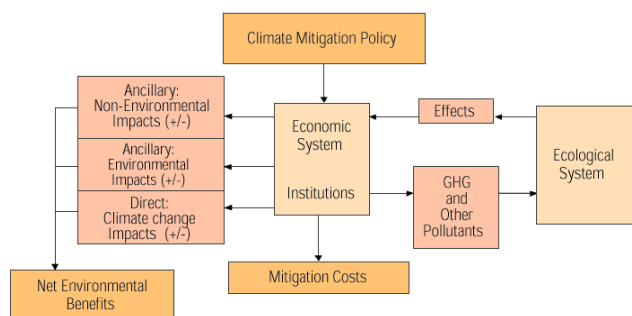
In spite of the close links, **policies to mitigate climate change and air pollution are often considered in isolation** and executed and enforced by separate government agencies, under different legal frameworks. In attempts to increase the understanding and highlight the link between the two spheres, **the terms ‘co-benefits’ or ‘ancillary benefits’ have been used for the non-climate benefits of GHG mitigation policies that are either explicitly incorporated into the development of mitigation policies or arise as a result of the implementation of GHG mitigation policies.** These include reductions in local and regional air pollution associated with the reduction of fossil fuels. From the perspective of policies to abate local air pollution, GHG mitigation may be seen as an ancillary benefit.

尽管联系紧密，但减缓气候变化和空气污染的政策常常各自为战，执行方面由不同的政府机构在不同的法律框架下各自为政。在尝试加强了解并强调这两个领域之间的联系时，温室气体减排政策的非气候效益使用了术语‘协同效益’或‘伴生效益’，非气候效益是制定减排政策时明确规定的，或者是由于实施温室气体减排政策而产生的。这些效益包括与化石燃料消耗减少有关的局地或区域空气污染减少。从减轻局地大气污染的政策来看，温室气体减少可以是一个伴生效益。

Figure 2.17 illustrates the generation of ancillary benefits to GHG emission reduction policies. **These policies often lead to reductions in both GHGs as well as changes in other pollutants, and mitigation costs. Changes in GHG emissions in turn lead to changes in air and water pollution, which ultimately extend throughout the environment and feed back into the economy.** Then, depending on baseline conditions, technologies, and institutions, such as labor markets, tax systems, and existing environmental and other types of regulations (represented by “institutions” in the economic system box), these feedbacks may become environmental impacts (such as the value of changes in conventional air or water pollution); non-environmental impacts (such as the value of employment effects); and, direct climate change impacts (IPCC, 2007).

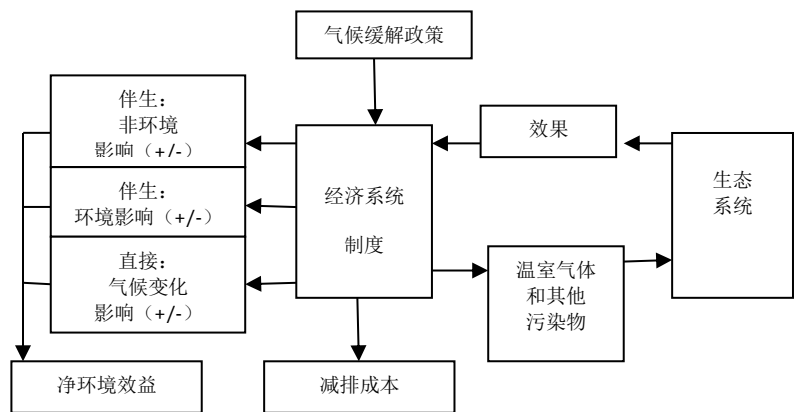
图 2.17 显示了温室气体减排政策伴生效益的产生流程。这些政策往往带来温室气体的减少和其他污染物的变化，以及减排成本的降低。反过来，温室气体排放变化又带来空气污染和水污染的变化，这些变化最终延伸到整个环境，并反馈到经济中。然后，根据基准状况、技术和制度，比如劳动力市场、税制和现有的环境法规和其他类型的法规（在经济系统表示为“制度”），这些反馈可变成环境影响（比如常规空气污染或水污染变化的价值）；非环境影响（比如就业效应的价值）；和直接的气候变化影响（IPCC, 2007）。

Figure 2.17 Mechanism for the generation of ancillary impacts. From co-benefits to co-control



Source IPCC (2007)

图 2.17 伴生影响的产生机制。从协同效益到协同控制



来源 IPCC (2007)



As a consequence of the focus on co-benefits/ancillary benefits of policies targeting either air quality or GHGs, **there is an increasing interest in the development of holistic policies that at the outset take into consideration both issues.** In the EU this has led to, for instance, **initiatives to develop a more climate-friendly air quality management.** Climate-friendly air quality management refers to techniques, policies, and regulations that promote concurrent reductions ('co-control') of harmful air pollutants and greenhouse gas (GHG) emissions, i.e. **a multi-pollutant approach.** The principal idea is that this may lead to cost savings and potentially to more ambitious targets and policies in both fields. The opportunity for co-control lies in the fact that **the sources of air pollutants and GHGs often are the same.** Thus, **the structural shifts in the electricity, industrial, and transportation sectors that GHG reduction policies drive will also reduce emissions of harmful air pollutants.**

随着对空气质量和温室气体政策的协同效益/伴生效益的重视，对制定把两个问题都纳入考虑的全盘政策有了越来越浓厚的兴趣。欧盟已经开展了气候友好型空气质量管理的举措。气候友好型空气质量是指促进有害空气污染物和温室气体同时减排（‘协同控制’）的技术、政策和法规，即多污染物方法。其基本思路是这可以带来两个领域的成本节约以及带来潜在的更加宏伟的目标和政策。协同控制的关键点在于，空气污染源和温室气体源往往是相同的。因而，温室气体减排政策推动的电力、工业和运输行业的结构性变化还会减少有害空气污染物的排放。

**Shifting to regulation through a multi-pollutant approach will require institutional, policy and technical changes.** In many ways, **China and other developing countries that are in the process of establishing environmental regulatory systems may have an advantage over the veteran agencies in the United States and the EU.** China is not bound by long-standing institutional history and practice. It can consider environmental and energy problems together through an economic lens to comprehensively and holistically reduce criterion and GHG emissions.

转向通过多污染物方法进行监管需要制度变化、政策变化和技术变化。中国以及正在建立环境监管体系的其他发展中国家在很多方面都比美国和欧盟资深机构更有优势。中国不受悠久的制度历史和实践的约束，可以透过经济镜头统筹考虑环境和能源问题，全面全盘减少标准污染物和温室气体的排放。

Recent studies have shown that **significant benefits can be achieved through integrating climate change mitigation and air quality improvement efforts.** According to one study, the benefits may amount to additional CO<sub>2</sub> reductions of 15% in Western Europe (Bollen et al 2009). van Vuuren et al (2004) examined the local air pollution benefits to Europe from implementing the Kyoto Protocol. Modeling of existing EU national emissions directives coupled with GHG reductions needed to meet Kyoto targets showed **a strong correlation between reductions in CO<sub>2</sub> and SO<sub>2</sub>, with additional high benefits for PM.** This linkage was related to decreased coal combustion. For Mexico City the cost saving from integrating air quality and GHG policies was addressed in a study by West et al (2004). They analyzed least-cost strategies for meeting co-control targets for multiple pollutants, and found that implementation of the air quality plan for the city as it was formulated originally would reduce the CO<sub>2</sub> emissions in 2010 by about 3%. By adjusting the plan towards including cost-saving GHG mitigation measures the authors find that this would lower the net costs of the plan. Thus, **surprisingly, the costs of combining efforts to reduce air**

**pollution and GHG may be lower than the costs of a strategy focused on reducing air pollution alone.**

最近的研究表明，通过整合气候变化减缓与空气质量改善工作可以实现巨大效益。根据一项研究，这种效益相当于西欧二氧化碳排放额外减少 15%（Bollen et al 2009）。van Vuuren et al（2004）研究分析了通过实施《京都议定书》给欧洲带来的局地空气污染效益。对欧盟现有的国家排放指令以及为了满足《京都议定书》目标所需的温室气体减排量进行建模表明，二氧化碳减少和二氧化硫减少之间有很强的关联，并且附带产生巨大的 PM（颗粒物）效益。这种关联与煤炭燃烧量减少有关。对于墨西哥城，在 West 等人（2004）开展的一项研究中提出了通过统合空气质量政策与温室气体政策来节省成本。他们分析了实现多污染物协同控制目标的最低成本策略。他们发现，实施最初制定的墨西哥城空气质量计划会使得 2010 年的二氧化碳排放减少约 3%。研究者发现，对该计划进行调整，把节省成本的温室气体减排措施列入其中，可以降低该计划的净成本。这样产生的结果是，减少空气污染与温室气体的联合努力的成本可能低于仅注重减少空气污染的策略的成本。

Models that analyze combinations of policies and the trajectories of their implementation have enabled agencies to consider the potential effects of new requirements before they are implemented. This prevents adoption of policies that are more costly or that may impose constraints on electricity supply reliability, and it facilitates the creation of complementary programs to cover multiple pollutants. The number of modeling platforms continues to expand, but among the most commonly used today, especially in Europe, are IIASA's GAINS model (Greenhouse gas – Air pollution Interactions and Synergies) and MARKAL (MARKet Allocationmodel) (James and Schultz, 2011).

用来分析政策组合及政策实施轨迹的模型使各级政府得以在实施政策之前考虑新要求的潜在效果。这样可以防止采用花费较高或者可能对供电可靠性造成约束的政策，并促进制定涵盖多种污染物的补充计划。建模平台的数量不断扩大，但现今最常用的、特别是欧洲最常用的是国际应用系统分析研究所（IIASA）开发的 GAINS 模型（温室气体-空气污染相互作用与协同效应）和 MARKAL（市场配置模型）（James 和 Schultz, 2011）。

#### **2.5.1.2 Co-control in the EU 欧盟的协同控制**

There are several initiatives and studies that support an integration of EU policies within climate change and air pollution. One example is work related to EU's 2005 Thematic Strategy on Air Pollution. This Strategy is one of the seven thematic strategies provided for in the Sixth Environmental Action Programme. It is based on research carried out in the Clean Air For Europe (CAFE) programme and the subsequent research framework programmes, and was adopted following a lengthy consultation process involving the European Parliament, Non-Governmental Organizations as well as industry and private individuals.

有几项举措和研究支持欧盟气候变化与空气污染政策的整合。一个例子是与欧盟《2005 年空气污染主题战略》有关的工作。该战略是《第六个环境行动计划》中规定的七个主题战略之一。它基于在《欧洲清洁空气》（CAFE）计划中开展的研究以及后

续研究框架计划，并在经过了由欧洲议会、非政府组织以及企业和个人参与的漫长协商过程之后获得通过。

The 2005 Thematic Strategy on Air Pollution supplements the current legislation, establishes objectives for air pollution and proposes measures for achieving them by 2020. The Strategy sets health and environmental objectives and emission reduction targets for the main pollutants. Compared with the situation in 2000, the Strategy sets specific long-term objectives (for 2020):

《2005 年空气污染主题战略》补充了现行立法，制定了空气污染目标，并提出了到 2020 年实现这些目标的措施。该战略确立了健康和环境目标以及主要污染物减排目标。该战略确立了具体的长期目标（2020 年），与 2000 年的情况相比：

- 47% reduction in loss of life expectancy as a result of exposure to particulate matter;  
因暴露于颗粒物污染所致平均预期寿命减损程度降低 47%；
- 10 % reduction in acute mortality from exposure to ozone;  
因暴露于臭氧污染所致突发性死亡减少 10%；
- reduction in excess acid deposition of 74% and 39% in forest areas and surface freshwater areas respectively;  
林区 and 地表淡水区的过度酸沉降分别减少 74% 和 39%；
- 43% reduction in areas or ecosystems exposed to eutrophication.  
遭受富营养化的区域或生态系统减少 43%。

To achieve these objectives, SO<sub>2</sub> emissions will need to decrease by 82%, NO<sub>x</sub> emissions by 60%, volatile organic compounds (VOCs) by 51%, ammonia by 27%, and primary PM<sub>2.5</sub> (particles emitted directly into the air) by 59% compared with the year 2000.

要实现这些目标，与 2000 年相比，二氧化硫排放需要减少 82%，氮氧化物排放减少 60%，挥发性有机化合物（VOC）减少 51%，氨减少 27%，原生 PM<sub>2.5</sub>（直接排放到空气中的微粒）减少 59%。

In connection with the comprehensive review of the Thematic Strategy on Air Pollution around 2010 the issue of potential co-control of air pollutants and GHGs was highlighted. IIASA's GAINS model is specially designed to investigate opportunities for co-control of air pollution, and GHGs and was employed for estimating such opportunities in relation to the review process (IIASA, 2012). The model has also been employed for the Commission's proposal on the Climate and Energy package.

在全面审查 2010 年左右的《空气污染主题战略》时，空气污染物和温室气体的潜在协同控制问题受到了特别关注。IIASA 的 GAINS 模型是专门为找寻协同控制空气污染和温室气体的机会而设计的，在审查过程中被用于判断这种可能性（IIASA, 2012）。该模型还被用于欧盟委员会的《气候与能源一揽子计划》提议。

Taking into account the most recent set of air pollution legislation in the EU, the cost of meeting the long-term objectives in the Thematic Strategy on Air Pollution was estimated to amount to around EUR 80 billion per annum in 2020 and around 90 billion

per annum 2050 (Amann 2012). To illustrate the potential benefits of a co-control approach to air pollution abatement, as opposed to an approach primarily based on the application of end-of-pipe technologies, the effect of a decarbonization scenario aiming at an 80% GHG reduction in the EU in 2050<sup>59</sup> was investigated by IIASA (2012). To reach the target for GHG mitigation in the decarbonization scenario carbon values would need to be applied to all sectors and all greenhouse gas emissions (EC, 2011). The decarbonization scenario assumes that lower emissions are achieved through a range of policies, including enhanced energy efficiency improvements and the electrification of the transport sector (see Box 2.3). According to the modelling exercise, the decarbonization scenario offers similar reductions of SO<sub>2</sub>, NO<sub>x</sub> and PM<sub>2.5</sub> emissions as would result from a full implementation of all remaining air pollution control technologies (i.e. those not part of current air pollution measures). In a decarbonizing world, additional air pollution control costs that are required to comply with current air quality legislation are up to 20% lower than in the baseline case. This is due to the lower levels of polluting activities resulting from the policies included in the decarbonizing scenario (Amann 2012). **In other words, co control offers the promise of cutting the 90 billion abatement costs by 20 percent, saving around EUR 18 billion per annum.**

通过考虑欧盟最近出台的一系列空气污染法规，实现《空气污染主题战略》中的长期目标的成本，到 2020 年，估计每年为 800 亿欧元左右，到 2050 年，每年为 900 亿欧元左右（Amann 2012）。为了说明与基于末端技术方法对照之下空气污染治理协同控制法的潜在效益，IIASA（2012）开展了欧盟温室气体于 2050 年减少 80% 的脱碳情景的研究。为了达到脱碳情景中温室气体减排目标，需要为所有行业和所有的温室气体排放设定碳值（EC, 2011）。脱碳情景假设通过一系列政策实现减排，包括提高能源效率和运输部门电气化（见框 2.3）。根据模型结果，脱碳情景实现的二氧化硫、氮氧化物和 PM<sub>2.5</sub> 减排量与充分实施全部现存空气污染控制技术（即不在当前空气污染措施之列的那些技术）带来的减排量相差无几。在脱碳情景中，为了遵守现行空气污染法律而需要的空气污染控制额外成本比基线情况下低 20%。这是因为脱碳情景中所包含的政策使得污染活动水平降低（Amann 2012）。换言之，碳控制可以保证将 900 亿欧元的治理成本削减 20%，每年节省 180 亿欧元左右。

### Box 2.8 A decarbonization scenario for the EU

#### 框 2.8 欧盟脱碳情景

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<sup>59</sup> In March 2011, the European Commission published its Roadmap for moving to a low carbon economy in 2050, the so-called 'Commission Roadmap for the EU'. In this Roadmap, the Commission lays down the ambition to reduce domestic greenhouse gas emissions by 80% in 2050 (compared to 1990), in the context that also other developed and developing countries reduce their emissions such that global emission are reduced by 50% by 2050 (Colette et al 2012).

2011 年 3 月，欧盟委员会发布了迈向 2050 年低碳经济的路线图，即所谓的‘欧盟委员会路线图’。在此路线图中，欧盟委员会提出到 2050 年将欧盟温室气体减排 80% 的雄伟目标（与 1990 年相比），在其他发达国家和发展中国家同时减排的背景下，到 2050 年全球减排 50%（Colette et al 2012）。

The decarbonization scenario employs the ‘Global Action with Effective and Widely Accepted Technology’ scenario that has been developed with the PRIMES model for the communication of the European Commission on ‘A roadmap for moving to a competitive low carbon economy in 2050’ (CEC, 2011a). It assumes a policy environment that enables all major low carbon technologies, and is reflected by the following additional but realistic assumptions compared to current policies:

脱碳情景利用通过 PRIMES 模型开发的‘用有效和得到广泛认可的技术开展全球行动’情景，为欧盟委员会宣传‘迈向 2050 年有竞争力的低碳经济路线图’（CEC, 2011a）。它假设了一种允许采用所有主要的低碳技术的政策环境，并通过以下与现行政策相比增多但合理的假设来体现：

1. All renewable technologies are facilitated to a larger extent (e.g., by planning and infrastructures, expressed in higher renewable values). The extent of cost saving technological progress in solar technologies is assumed to be larger.

所有的可再生能源技术都得到更大程度的利用（例如通过规划和基础设施，以较高的可再生能源价值表示）。假设太阳能技术进步的成本节省程度加大。

2. Energy intensity improvements are brought about in the context of high ETS (EU’s GHG allowance trading system) prices and demand side policies mirrored through high carbon values; in addition greater renewables penetration increases conversion efficiency and hence improves energy intensity.

在以高碳值反映的高 ETS（欧盟的温室气体排放权交易体系）价格和需求面政策背景下实现能源强度的提高；另外，可再生能源渗透率增大，提高了转换效率，进而提高了能源强度。

3. It is assumed that carbon capture and storage (CCS) is successfully demonstrated and is commercially available after 2020, benefiting from cost improvements driven by carbon prices; it also assumed that there is public acceptance for the technology.

假设碳捕获和封存（CCS）得到成功论证，并且 2020 年以后可在市场上买到，这得益于碳价格拉动的成本改善；还假设公众接受这项技术。

4. It is assumed that current national nuclear policies are implemented as planned. Nuclear energy is assumed to be enabled by increased public acceptance and higher safety of nuclear waste operations. However, no new nuclear power plants will be built in countries which continue to exclude this.

假设目前的国家核政策按计划实施。假设通过提高公众接受度和提高核废料处理的安全性，使核能得到利用。然而，在继续排斥核能的国家不会建设新的核电站。

5. Electrification of transport is enabled by research and development and other policies promoting progress in battery-driven vehicles. A decrease of battery costs (per kWh) by a factor of four in 30 years as well as lighter batteries, faster charging and higher power densities are assumed. An infrastructure enabling full electrification including smart grids is built up so that from 2030 a transition to electric cars can take place. Constraints

to electrification only remain in certain parts of non-urban long-distance road travelling, especially for trucks and buses.

通过研发和其他促进发展电池驱动车辆的政策实现运输电气化。假设电池成本（每千瓦时）在 30 年里下降四倍，电池更轻，充电更快，功率密度更高。构建一种可实现完全电气化的基础设施，包括智能电网，以使从 2030 年开始可以过渡到电动汽车。电气化限制仅存在于某些部分的非城市长途道路行车，特别是卡车和公共汽车。

Whereas most model exercises focus on co-control of GHG and classical air pollutants, **there are also studies showing a potential for co-control of GHG and mercury** (a hazardous/toxic pollutant). For instance, scenarios that simulate a substantial expansion of renewable energies within the power sector show potentially extensive **co-benefits for mercury abatement due to the restructuring of the energy system and changes in the fuel mix** (Rafaj et al, 2014). The potential for mercury reductions in Europe depends on the rate of fuel switches and renewable technology deployment, but is also influenced by the stringency and timing of the air quality measures. The overall scope for co-benefits is therefore higher in regions relying on coal combustion as a major energy source (Rafaj et al, 2014).

鉴于多数模型模拟都侧重于温室气体和传统空气污染物的协同控制，**也有几项研究证明了温室气体和汞（一种有害/有毒污染物）的协同控制潜力**。例如，模拟可再生能源在电力行业内大量增加的情景表明，由于能源系统的结构调整和燃料组合的变化，**汞减排的协同效益可能较好**（Rafaj et al 2014）。欧洲的汞减排潜力取决于燃料转换的速度和可再生能源技术的部署，但也受空气质量措施的严格性和时间安排的影响。因此，协同效益的作用在以煤炭为主要能源的地区比较大（Rafaj et al 2014）。

#### 2.5.1.3 Co-control in the US 美国的协同控制

Together with selected state and local environmental management agencies, the US-EPA is exploring the development of so-called comprehensive Air Quality Management Plans (AQMPs). These plans will address the control of multiple pollutants and air related considerations such as land-use, transportation, energy and climate change (US-EPA 2012a). **US-EPA is currently working with three pilot areas in order to develop a template for co-control for US states:** New York, North Carolina and St. Louis (Missouri and Illinois). The areas have each agreed to develop a multi-pollutant focused AQMP that will involve appropriate stakeholders and will outline how the participating agency plans to address air pollutants in an integrated manner. Each area may include considerations of ecosystem impacts and air quality linkages to energy, land-use, transportation and other non-traditional policies. Each AQMP will include a set of pollution reduction strategies that demonstrate one or more of the following:

与选定的州和地方环境管理机构一起，美国环保局正在探索制定所谓的综合空气质量管理计划（AQMP）。这些计划将论及对多种污染物以及诸如土地利用、交通、能源和气候变化之类的空气相关问题的控制（美国环保局 2012a）。**美国环保局目前正在做三个试点区，以便为美国以下这几个州开发一个协同控制模板：纽约州、北卡罗来纳和圣路易斯（密苏里州和伊利诺伊州）**。每个试点区均同意制定以多污染物为重点的 AQMP，该计划将由利益相关者参与，并概述参与机构打算如何以综合方式处理空气污染物。每个试点区均考虑了生态系统影响和空气质量与能源、土地利用、交通

和其他非传统政策的联系。每个 AQMP 均包括一套证明以下一个或多个问题的污染减少策略：

- attainment/maintenance of the National Ambient Air Quality Standards  
达到/维持国家环境空气质量标准
- risk reductions from Hazardous Air Pollutants,  
危险空气污染物所致风险降低
- improvements in visibility and ecosystem health, and  
能见度和生态系统健康改善,
- integration with land use, transportation, energy and climate.  
与土地利用、交通、能源和气候融为一体。

Examples of programs that are currently in effect in the US include Massachusetts' Multi-Pollutant Regulation, North Carolina's Clean Smokestack Act, and New Hampshire's Multi-Pollutant legislation. **Energy efficiency in fossil-fueled power plants is an important element in the plans, which aim at reducing classical air pollutants such as PM, SO<sub>2</sub>, and NO<sub>x</sub>, as well as mercury and CO<sub>2</sub>.** For instance, combined heat and power (CHP) installations have been shown to be one of the most cost-effective policies to reduce GHG and emissions of local pollutants (McKinsey & Company 2009). In addition to programs that have been in effect for several years, numerous US state and local air quality agencies are engaged in comprehensive planning processes with a multi-pollutant/co-control approach. For instance, New York's Air Quality Management Plan (AQMP) will be using a multi-pollutant approach, including GHGs, which emphasizes emissions reductions from the state's energy efficiency and renewable energy programs. This is following up on several previous initiatives taken by the city. For instance, in 2007 a comprehensive sustainability plan for New York City's future was released, with a strategy to reduce the City's greenhouse gas footprint, while also accommodating a population growth of nearly one million, and improving its infrastructure and environment (NYSEPB, 2009).

美国现行的计划包括马萨诸塞州的多污染物法规、北卡罗来纳州的清洁烟囱法案和新罕布什尔州的多污染物立法。在以减少颗粒物、二氧化硫、氮氧化物以及汞和二氧化碳等传统空气污染物为目的的计划中，化石燃料发电厂的能源效率是一个重要元素。例如，热电联产设备已被证明是最经济划算的减少温室气体和局地污染物排放的政策之一（McKinsey & Company 2009）。除了已施行若干年的计划之外，美国很多州和地方空气质量机构也在用多污染物/协同控制方法开展综合规划。例如，纽约州的空气质量管理计划（AQMP）将采用将温室气体纳入的多污染物方法，这种方法强调通过纽约州的能源效率和可再生能源计划实现减排。这是对纽约市以往采用的几项计划的跟进。例如，2007 年发布了纽约市未来可持续发展综合计划，提出了一项减少纽约市温室气体足迹、同时也容纳近 100 万人口增长并改善纽约市基础设施和环境的战略（NYSEPB, 2009）。

The US-EPA is providing policy and technical assistance to the pilot areas. This includes program coordination, legal and policy consultation, information about emission inventories, information on multi-pollutant control measures and costs, and support for air quality modeling and exposure/benefits assessment. A broad range of tools and resources, including emission modelling tools, a Greenhouse Gas Equivalencies

Calculator, air quality models (like the Community Multi-scale Air Quality (CMAQ) model), the Benefits Mapping and Analysis Program (BenMAP) (a tool for estimating the health impacts and associated economic values), and the Hazardous Air Pollutant Exposure Model (a screening-level exposure model appropriate for assessing average long-term inhalation exposures) can be downloaded from US-EPA's web page (US-EPA 2012b).

美国环保局为试点区提供政策和技术帮助。这包括计划协调、法律和政策协商、关于排放清单的信息、关于多污染物控制措施和成本的信息以及为空气质量建模和暴露/效益评估提供的支持。从美国环保局网页上可下载各种工具和资源，包括排放建模工具、温室气体当量计算器、空气质量模型（像公共多尺度空气质量（CMAQ）模型）、环境效益描述和分析程序（BenMAP）（一个估算健康影响及相关经济价值的工具）和危险空气污染物暴露模型（一个筛选层面的暴露模型，适用于评价平均长期吸入暴露量）（美国环保局 2012b）。

Although not one of US-EPA's multi-pollutant planning pilot areas, the California Bay Area (San Francisco and surroundings) has been engaged in a similar process and, in September 2010, **adopted the first comprehensive multi-pollutant clean air plan of its kind in the US**. The Bay Area Air Quality Management District (BAAQMD) Board, the authorizing agency, is the regulatory body that develops and implements air quality plans for the San Francisco Bay Area of California, a seven-county jurisdiction with a population of approximately seven million. The Plan applies to all pollutants, including criteria, toxic, and GHG emissions. It includes 55 control measures across stationary sources, mobile sources, transportation, land-use, and energy/climate sectors, many of which are designed to address root causes of emissions, not just end-of-pipe emissions. Such measures include, for example, GHG emissions incorporated into air quality permits; several transportation control measures, such as zero emissions vehicles, plug-in hybrid vehicles, improved transportation of commercial goods, public bus services, and integration of bicycling; energy efficiency, renewable energy, and urban heat island mitigation; and, indirect source review to set emissions standards for construction, operations, and vehicle traffic related to land-use and residential, commercial, and industrial property development. The Plan monetizes the benefits of control measures in terms of public health, climate mitigation, and compliance costs, to produce a value for each ton of pollution reduced. **In the Plan, a 1% reduction in pollutants is estimated to provide USD 158 million in health benefits from PM<sub>2.5</sub> (diesel, wood burning, secondary nitrates, and sulfates); USD 14 million in health benefits from reducing ozone; and USD 29 million in health benefits from reducing GHG.**

虽然不属于美国环保局的多污染物计划试点区，但加州湾区（旧金山及周边城市）已进入类似的进程，于 2010 年 9 月通过了美国第一个多污染物清洁空气综合计划。授权机构湾区空气质量管理区（BAAQMD）委员会是监管机构，制定并实施加州旧金山湾区的空气质量计划。湾区有 7 个县，人口约 700 万。该计划适用于所有的污染物，包括标准污染物、有毒污染物和温室气体排放。它包括 55 项固定污染源、流动污染源、运输、土地利用和能源/气候行业的控制措施，其中很多措施旨在解决排放的根本原因，而不只是末端排放。这种措施包括将温室气体排放纳入空气质量许可证；多项运输控制措施，比如零排放车辆、插电式混合动力车、改善商用物资的运输、公交车服务以及鼓励骑自行车；能源效率、可再生能源及缓解城市热岛效应；以及审查间接污染源，设定与土地利用以及居住地产、商业地产和工业地产开发有关的建设、运营和车辆通



行排放标准。该计划对控制措施的效益按公众健康、气候缓解及合规成本进行货币计算，得出每吨污染减少量的价值。在该计划中，污染物减少 1% 估计会带来 1.58 亿美元因控制 PM<sub>2.5</sub> 而产生的健康效益（柴油、木材燃烧、次生硝酸盐和硫酸盐）；1400 万美元因减少臭氧而产生的健康效益；2900 万美元因减少温室气体而产生的健康效益。

#### 2.5.1.4 Lessons and suggestions for China 对中国的启示

There are several studies addressing air quality co-benefits of GHG mitigation in China and potential cost savings of a multi-pollutant/co-control approach (e.g., Amann et al 2008, Aunan et al 2006, 2007; Bollen et al 2012, UNDP 2010, Vennemo et al 2009<sup>60</sup>). The UNDP (2012) study finds that **a combined policy scenario for China in which GHG mitigation measures, such as energy efficiency, cogeneration, and renewable electricity generation, are used to meet air quality objectives may achieve these objectives at an estimated 60% of the cost of using end-of-pipe air quality measures exclusively, while also reducing CO<sub>2</sub> emissions by 9%. An air quality action plan that is designed to simultaneously achieve significant reductions in GHGs and contribute to meeting China's own 40 to 45% carbon intensity reduction target, can offer more benefits to the broader society, and may get support across government agencies and sectors.** Development of a multi-pollutant regulatory framework would provide certainty to businesses and industries, so that they at the outset can optimize capital investments and improve operating processes to meet current and future climate and air quality targets and standards. Businesses can thereby make investments with long-term planning horizons and avoid having to retrofit emissions control equipment into constrained spaces (James and Schultz 2011).

中国有多项研究探讨了温室气体减排带来的空气质量协同效益以及多污染物/协同控制方法的潜在成本节省量（例如 Amann et al 2008, Aunan et al 2006, 2007; Bollen et al 2012, UNDP 2010, Vennemo et al 2009）。联合国开发计划署（UNDP）（2012）研究发现，在中国的联合政策情景中，采用能源效率、热电联产和可再生能源发电等温室气体减排措施来实现空气质量目标。这种联合政策情景可以以仅仅采用末端质量措施约 60% 的成本实现这些目标，同时还减少二氧化碳排放 90%。一项旨在既极大减少温室气体，又有助于实现中国自己碳强度降低 40-45% 的目标的空气质量行动，可以更多更广泛地造福社会，并且可得到各政府部门和各行各业的支持。制定一个多污染物监管框架会给工商企业带来确定性，这样他们在一开始就可以优化资本投资并改进运营流程，以达到当前和未来的气候与空气质量目标和标准。由此，企业可以从长期规划视角进行投资，而不必将排放控制设备改装到受限空间（James and Schultz 2011）。

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<sup>60</sup> In addition, recently the US Lawrence Berkeley National Lab has also used the LEAP model, developed by the Stockholm Environmental Institute (SEI), to evaluate climate-friendly air quality management strategies, specifically analyzing optimized co-control strategies for meeting China's dual goals of reducing carbon intensity and SO<sub>2</sub> emissions. This report is forthcoming.

另外，美国劳伦斯伯克莱国家实验室最近还利用斯德哥尔摩环境研究所（SEI）开发的 LEAP 模型评价了气候友好型空气质量管理策略，特别分析了用于满足中国减少碳强度和二氧化硫排放双重目标的优化协同控制策略。该报告即将问世。

Amann et al (2008), using the GAINS model, demonstrate that low carbon strategies result in lower emissions of SO<sub>2</sub>, NO<sub>x</sub> and PM at no additional costs. GAINS estimates that each percent of CO<sub>2</sub> reduction will typically reduce health impacts from fine particulate air pollution by 1%. **By selecting a smart mix of measures to simultaneously cut air pollution and greenhouse gas emissions, China can almost halve air pollution control costs as well as lower greenhouse gas emissions by 8%.** The low carbon measures that simultaneously cut air pollutants in the scenario are as follows:

Amann 等人（2008）利用 GAINS 模型论证了低碳战略可以在不增加成本的情况下减少二氧化氯、氧化氮和颗粒物的排放。按 GAINS 模型估算，二氧化碳每减少 1%，一般可使细颗粒物带来的健康影响降低 1%。**通过选择一个聪明的同时减少空气污染和温室气体排放的措施组合，中国可以将空气污染成本削减近一半，并且可以将温室气体排放减少 8%。**设想情景中可以同时削减空气污染物的低碳措施如下：

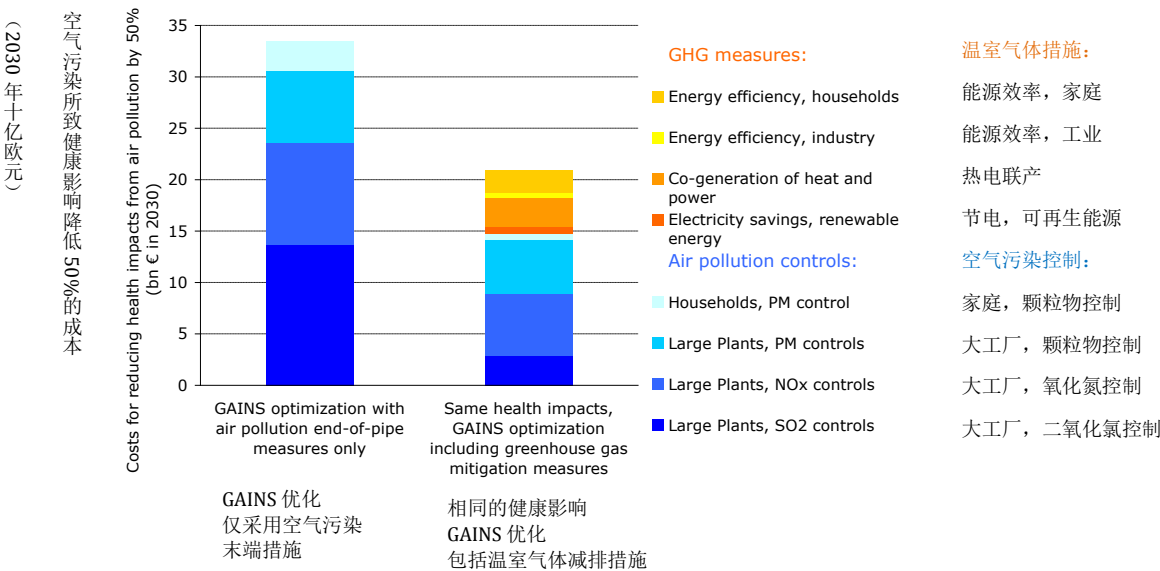
- 1) Reduced consumption of coal and oil, through 通过以下方式减少煤和石油消耗
  - a. energy efficiency improvements, e.g., 提高能源效率，例如，
    - i. increased combustion efficiencies, 提高燃烧效率，
    - ii. improved insulation, 改进保温，
    - iii. co-generation of electricity and heat, etc.; 热电联产等；
  - b. fuel substitution. 燃料置换。
- 2) Behavioural changes leading to lower demand for fossil fuels.  
可减少化石燃料需求的行为变化。
- 3) Integrated gasification combined cycle (IGCC) plants  
整体煤气化联合循环（IGCC）厂。

Figure 2.18 illustrates the cost reductions that can be obtained from implementation of the suggested package of measures.

图 2.18 显示了通过实施所建议的一揽子措施可实现的成本降低。

Figure 2.18 Costs for reducing health impacts of PM in China 2030 by 50%

图 2.18 2030 年中国将 PM 健康影响降低 50% 的成本



Source: Amann et al (2008).来源: Amann 等人 (2008)

Fei Liu et al (2013) identified strong synergies between air quality and climate relevant measures that would allow improving cost-efficiency of air pollution policies. In order to help local policymakers to identify viable and efficient solutions, they developed a city-scale emission model (GAINS-City) based on the GAINS model. The GAINS-City model relies on a technology-based approach to evaluating the co-benefits of various policies. This approach allows for estimation of emission reductions of several pollutants (including SO<sub>2</sub>, NO<sub>x</sub>, PM) and CO<sub>2</sub> for individual policies and support evaluation of co-benefits. In addition, a reduction index, an integrated rank of the individual reductions potential, was defined to recommend the priority of policies implementation. A case study in Beijing demonstrated the model features. According to the authors, the approach will have great potential to be applied in many large cities with local input data and/or minor structure modifications. Based on the technology-based evaluation approach, policy packages were designed and implemented in policy scenarios. The emissions under three scenarios (Baseline, Air Quality, and Strict Air Quality) in the base year (2005) and future years (2020 and 2030) were estimated. The results indicated a significant reduction potential. **In 2030, implementation of the Air Quality and Strict Air Quality scenarios could result in reductions of 39-48% of SO<sub>2</sub> emissions, 38-42% of NO<sub>x</sub> emissions, 37-55% of PM<sub>2.5</sub> emissions and 5-22% of CO<sub>2</sub> emissions respectively, compared with the Baseline scenario.** The results demonstrated that air quality policies and measures could also have CO<sub>2</sub> emissions reductions as a co-benefit. However, there is no significant difference of reductions between the two policy scenarios, which indicates the limited further reduction potential in the stricter air quality case. According to the authors, this calls for a wider application of cleaner technologies, such as integrated gasification combined cycle (IGCC) and carbon capture and storage (CCS), and more aggressive air quality control measures by neighboring provinces to control regional air pollution.

Fei Liu 等人 (2013) 研究得出空气质量与气候变化相关政策之间有强烈的协同效应, 这种协同有助于提高空气污染政策的成本效益。为了帮助地方政策制定者确定可行有效的解决方案, 他们根据 GAINS 模型开发了一个城市尺度的排放模型 (GAINS-City)。GAINS-City 模型利用以技术为本的方法来评价各种政策的协同效益。这种方法可以估算个别政策带来的几种污染物 (包括二氧化硫、氮氧化物、颗粒物) 和二氧化碳的减排量, 并且支持协同效益评估。另外, 确定了用减排指数、也就是个别减排潜力的综合排名来推荐政策实施的优先次序。北京的一项案例研究演示了该模型的特点。据研究者分析, 通过地方输入数据, 或较小的结构修改, 该方法具有在很多大城市应用的巨大潜力。根据以技术为本的评价方法, 在政策情景中设计并实施了一揽子政策。估算了基年 (2005 年) 和未来年度 (2020 和 2030 年) 三种情景 (基线、空气质量和严格空气质量) 下的排放量。结果显示减排潜力巨大。**2030 年, 空气质量和严格空气质量情景的实施可使得与基线情景相比二氧化硫减排 39-48%; 氮氧化物减排 38-42%, PM<sub>2.5</sub> 减排 37-55%, 二氧化碳减排 5-22%。**结果证明了空气质量政策可以产生二氧化碳减排的协同效益。然而, 这两种政策情景之间并没有显著的减排差异, 表明较严格的空气质量情况下进一步减排的潜力有限。据研究者分析, 这需要周边省份更广泛地采用清洁技术, 比如整体煤气化联合循环 (IGCC) 和碳捕捉与封存 (CCS) 技术以及更加积极的空气质量控制措施, 以控制区域空气污染。

In summary, **current studies show that in a country like China, where the economy and industries are developing rapidly and large investments are geared towards curbing air pollution, it may prove costly to disregard the opportunity for co-control of air pollutants and GHGs, as China likely will need to tighten its climate policies in the near future.** As mentioned above, because China is at a relatively early stage of building its environmental regulatory systems, it may in some ways be easier to establish co-control mechanisms compared to countries where different governmental institutions have long-term regulatory systems and practices. Based on international experience, James and Schultz (2011) concluded that the most important lessons for China are as follows:

总之，当前的研究表明，在一个像中国这样的国家，经济和各产业快速发展，巨额投资用于遏制空气污染，如果不抓住协同控制空气污染物和温室气体的机遇，代价会很大，因为在不久的将来中国可能需要收紧气候政策。如以上所述，由于中国相对处于建立环境监管体系的初期阶段，在某种程度上可能比其不同政府机构拥有长期监管体系和实践的国家更容易建立协同控制机制。根据国际经验，James 和 Schultz (2011) 认为对中国最重要的启示如下：

*Institutional:* Although it is important for air and utility regulators to coordinate their respective long-term plans, even more critical is **the need for air regulators to develop power sector expertise that goes beyond their traditional knowledge of boiler design and operation.** As utility regulators discuss the next steps in power sector structure and topics such as regional transmission plans, the participation of air regulators in these exercises will show how closely linked environmental and energy policies are. It will show, for example, to what extent energy policies such as renewable portfolio standards and energy efficiency resource standards are also environmental policies, and will help air regulators consider a variety of policy measures that could be more cost-effective than solely relying on end-of-pipe technologies to reduce emissions. **Government institutions should be designed to create stronger and more effective regimes for clean air and low carbon growth.**

*机构方面：*虽然空气监管部门和公用事业监管部门协调各自的长期计划很重要，但更加关键的是空气监管部门有必要培养超出其锅炉设计与操作传统知识的电力行业专业知识。当公用事业监管部门讨论电力行业结构方面的下一步行动以及区域输电计划之类的话题时，空气监管部门参与讨论这些专业知识会说明环境政策与能源政策之间联系得多么紧密。还会说明可再生能源配额标准以及能效资源标准等能源政策要到什么程度也是环境政策，并且会帮助空气监管部门考虑比仅仅采用末端技术更经济划算的种种政策措施来减排。政府机构的目的应当是为清洁空气和低碳增长建立更强大更有效的体制。

*Policy:* **The most effective policies are those that affect the root causes of emissions rather than deal with them solely through control efforts at the smokestack.** Affecting the root causes of emissions pushes the point of regulation farther upstream away from the smokestack, to **influence how energy is made and how it is consumed.** **Incorporating energy efficiency, renewables, and less polluting coal-fired generation technologies into air regulatory practices is a good starting point.** Equally important, **the price of coal and coal based electricity should increase to reflect its pollution and to let the polluter pay.** Innovative financing instruments have

been developed, such as the “recycling” of pollution permit revenues into energy efficiency and renewable energy programs. These can be combined with higher prices on polluting energy. There are all kinds of policy solutions across an array of sectors that demonstrate reducing local air pollution and global climate change emissions can be done simultaneously and cost-effectively.

*政策方面：*最有效的政策是那些触动排放的根本原因而不是仅仅通过烟囱上的控制工作来处理排放的政策。触动排放的根本原因把监管点推向离烟囱更远的上游领域，去影响能源的制造和消耗。把能源效率、可再生能源和污染较小的燃煤发电技术融入到空气监管实践中是一个好的起点。同样重要的是，应提高煤炭价格以及以煤炭作燃料的电的价格，以反映其污染，并且让污染者付费。开发了创新的融资工具，比如污染许可证收入“再循环”到能源效率和可再生能源计划里。这些融资工具可以和污染性能源提价相结合。各行各业有各种各样的政策解决方案。这些解决方案表明，减少局地空气污染排放和减少全球气候变化排放可以经济划算地同步进行。

*Technical:* More recently, the US and Europe have adopted integrated multi-pollutant approaches that address pollutants that the authorities want to control now and expect to control in the future. Such programs target, for example, particulate matter (PM), NO<sub>x</sub>, SO<sub>2</sub>, mercury, and, increasingly, CO<sub>2</sub>. **By setting goals for a broad range of pollutants, these approaches encourage industry to develop long-term financial and environmental plans to optimize investment in and configuration of pollution control equipment.** This is a primary objective of multi-pollutant strategies. **Such an approach offers better planning, greater certainty, lower costs, and more environmental benefits per dollar invested.** Such an approach also requires technical knowledge about how reductions of one pollutant will affect other pollutants, both from the perspective of government planning and that of enterprises.

*技术方面：*最近，美国和欧洲采用了针对有关部门目前想控制而且将来期望控制的污染物的一体化多污染物方法。这种计划要控制的对象是颗粒物（PM）、氧化氮、二氧化硫、汞等，而且越来越多地指向二氧化碳。通过设定多种污染物的目标，这些方法鼓励企业制定长期的财务计划和环境计划，优化污染治理设备的投资和配置。这是多污染物战略的主要目标。这种方法带来的好处是：更好的规划，更大的确定性，更低的成本，更大的环境效益。这种方法还需要政府规划者和企业掌握关于一种污染物减少对其他污染物有何影响的相关技术知识。

## 2.5.2 Summaries of case studies from Phase I

### 一期案例研究总结

Below are some short summaries of air pollution case studies from Phase I of the project. See Econ Poyry et.al. (2011) and Econ Poyry (2010) for a more detailed overview of the various cases.

下面是本项目一期空气污染案例研究的一些简要总结。各种案例较详细的综述见 Econ Poyry 等人（2011）和 Econ Poyry（2010）。

### Box 2.9 US Clean Air Act (CAA)

#### 框 2.9 美国《清洁空气法》（CAA）

Phase I of the project provided experiences from the CAA in the US and below we summarize the main points.

本项目一期提供了来自美国《清洁空气法》的经验，下面我们总结要点。

The main legal instrument to implement air pollution policies in the US is the CAA. The purpose of the Clean Air Act is to establish, implement and maintain standards for the nation's air quality. It requires the Environmental Protection Agency (EPA) to develop and enforce regulations to protect the public from airborne contaminants known to be hazardous to human health. The US Congress established much of the basic structure of the Clean Air Act in 1970, and made major revisions in 1977 and 1990. The revisions were designed to improve effectiveness and tackle new problems like acid rain and the depletion of the ozone layer. The following tools have been applied:

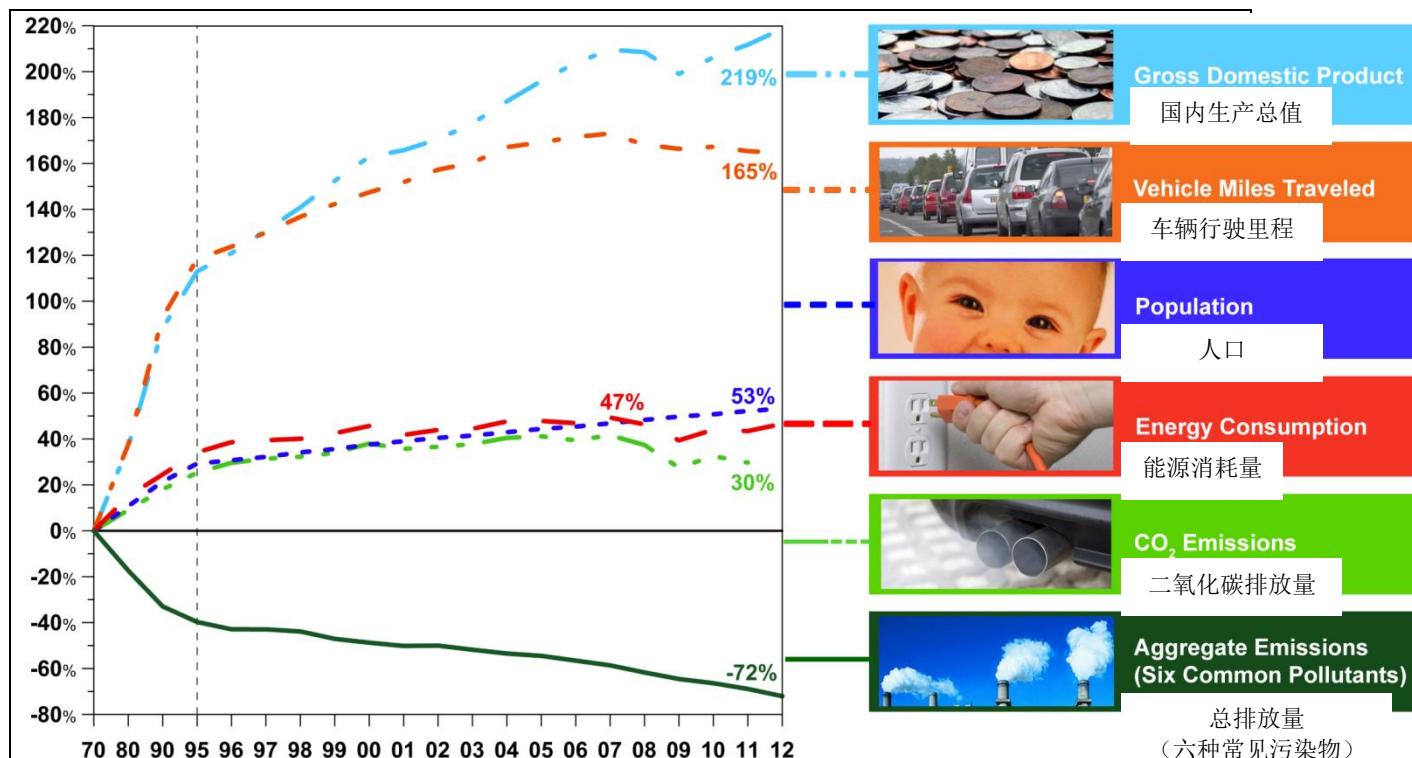
美国实施空气污染政策的主要法律文件是《清洁空气法》。《清洁空气法》的宗旨是建立、实施和维持美国的空气质量标准。它要求美国环保局（EPA）制定并执行法规，以保护公众，使其免受已知对人类健康有害的空气中悬浮污染物的危害。美国国会于 1970 年建立了《清洁空气法》的大部分基本结构，并于 1977 年和 1990 年进行了两次重大修正。修正案旨在提高有效性，并处理像酸雨和臭氧层变薄这样的新问题。利用了以下手段：

**Setting standards.** In order to reduce pollution from both stationary (industry) and mobile sources, the EPA has set air quality standards for six common "criteria pollutants": particulate matter (PM), ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and lead.

**设置标准。**为了减少来自固定污染源（工业）和流动污染源的污染，美国环保局设置了六种常见“标准污染物”的空气质量标准：颗粒物（PM）、臭氧、二氧化硫、二氧化氮、一氧化碳和铅。

Figure 2.19 Comparison of growth areas and emissions.

图 2.19 增长领域和排放量对比



Source: [www.epa.gov/caa/air](http://www.epa.gov/caa/air) 来源:

As we can see from Figure 2.19, the Clean Air Act has been largely successful in reducing air pollution. In the period since the law was passed (1970-2012), the emissions of the 6 common pollutants has been reduced by 72 percent. In the same period GDP has increased by 219 percent and energy consumption has increased by 47 percent. Thus, we can see the same pattern in growth in GCP/capita and emissions reductions as in Norway.

从图 2.19 我们可以看出,《清洁空气法》在很大程度上成功地减少了空气污染。在这部法律获得通过以来的时期(1970-2012 年),6 种常见污染物的排放减少了 72%。同期,GDP 增长了 219%,能源消耗量增长了 47%。因此,我们可以看出与挪威相同的人均 GCP 增长和减排模式。

**Evaluating impacts.** The EPA has to carry out a cost-benefit analysis of the CAA program. This goes to show that CBA is not only valid for engineering projects, but also for policies/regulations/laws. The CBA takes into account impact on the public health, economy and environment. The EPA also does an Economic Impact Analysis that focuses on the size and distribution of economic impacts among specific groups in society.

**评价影响。**美国环保局进行了《清洁空气法》计划的成本效益分析。这说明成本效益分析(CBA)不仅对工程项目有效,而且对政策/法规/法律也有效。CBA 将对公众健康、经济和环境的影响纳入考虑。美国环保局还进行经济影响分析,主要分析经济影响的规模已经在社会特定群体中的分布情况。



The CBA follows what we can call the traditional impact pathway approach, i.e. changes in emissions from the different sectors are derived from scenarios, and air quality modelling is used to estimate the population exposure and health effects, which are then subject to economic valuation. The first stages of the cost-benefit analysis develop projections of what would happen with action versus non-actions. The next stages deal with estimating physical and economic impacts of policies and measures. Finally, the benefits and costs are compared.

《清洁空气法》的成本效益分析采用传统影响路径方法，也就是由设想情景得出不同行业排放量的变化，并通过建立空气质量模型来估算人群暴露和健康影响，然后对其进行经济估值。最初几个阶段的成本效益分析可以预测采取行动和不采取行动会发生什么。后面几个阶段的分析可以估计政策和措施的物质影响和经济影响。最后，对比效益和成本。

**Clean air act and climate change.** In the absence of federal legislation, much of the federal activity on climate change is taking place under the existing authority of the CAA. The EPA is using its CAA authority to regulate mobile sources as well as major new or modified stationary sources of GHGs.

**清洁空气法与气候变化。**在缺乏联邦立法时，联邦政府在气候方面的活动大多根据《清洁空气法》授予的职权开展。美国环保局利用《清洁空气法》授予的职权对温室气体的流动源以及新的或者经过改造的主要固定源进行监管。

There is a growing amount of research on the topic of the CAA and emissions of GHG. According to the EPA they are taking a common-sense approach to developing standards for greenhouse gas emissions from mobile and stationary sources under the Clean Air Act. Including efforts to cut GHG emissions and fuel use from new cars, ensure that a minimum of transportation fuel sold in the US is renewable, reduce carbon pollution from power plants amongst other things.

关于《清洁空气法》和温室气体排放话题的研究越来越多。据美国环保局表示，他们正在根据《清洁空气法》采用一种常识性的方法来制定流动源和固定源的温室气体排放标准。所做的努力包括：削减新汽车的温室气体排放和燃料使用，确保最低量在美国出售的运输燃料是可再生的，减少来自发电厂的碳污染等。

## Box 2.10 The European Unions' National Emission Ceilings (NEC) Directive

### 框 2.10 欧盟的《国家排放上限（NEC）指令》

Phase I of the project provided experiences from the EUs NEC Directive and below we summarize the main points.

本项目一期提供了来自欧盟《国家排放上限指令》的经验，下面我们总结要点。

Since air pollution travels across borders, there is a need for EU policy to limit individual sources but also national totals of atmospheric emissions. The NEC Directive, adopted in 2001, sets a ceiling for total emissions from each member state by 2010 and 2020 for



the four air pollutants sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), volatile organic compounds (VOCs) and ammonia (NH<sub>3</sub>). The directive to a large degree leaves it to the nations to decide how to cut their emissions. The aim of the NEC is protection of human health and environment through stepwise reduction of the four pollutants.

由于空气污染会跨越边境，因此欧盟政策有必要在限制个别污染源的同时还要限制大气排放的国家总量。2001 年通过的《国家排放上限指令》设置了每个成员国到 2010 年和 2020 年二氧化硫（SO<sub>2</sub>）、氮氧化物（NO<sub>x</sub>）、挥发性有机化合物（VOC）和氨（NH<sub>3</sub>）四种空气污染物的排放总量上限。该指令在很大程度上让成员国来决定如何减排。《国家排放上限》的目的是通过逐步减少四种污染物来保护人类健康和环境。

The EU is acting at many levels to reduce air pollution: through EU Directives, through work at the international level to reduce cross-border pollution (e.g., through protocols like the Convention on Long-Range Transboundary Air Pollution (CLRTAP) protocol), through co-operation with sectors responsible for pollution, through national and regional authorities, through NGOs, and through research. The NEC is overlapping with the CLRTAP, but involves stronger legal responsibilities.

欧盟正在从很多层面上采取行动来减少空气污染：通过欧盟指令、通过国际层面减少跨境污染的工作（如通过《远距离跨境空气污染公约》（CLRTAP）协议）、通过与污染责任行业的合作、通过国家和区域有关部门、通过非政府组织和通过研究。《国家排放上限》与《远距离跨境空气污染公约》有重叠部分，但它规定的法律责任较强。

The GAINS computer model was used in the process of developing the emission ceilings in the NEC Directive. Experts from member states, as well as from other stakeholders (including industry and environmental NGOs) were consulted in the process. The GAINS model includes indicators that are used to calculate emissions and environmental risks. It also includes cost data for abatement options in each country. The model calculates the least-cost solutions based on the indicators and data. The bottom-up estimates have been subject to scientific debate and political negotiations, until agreement is reached about emissions ceilings. It is a cost effective approach and an alternative to using cost benefit analysis. This is because of uncertainties in the relationship between deposition and effects.

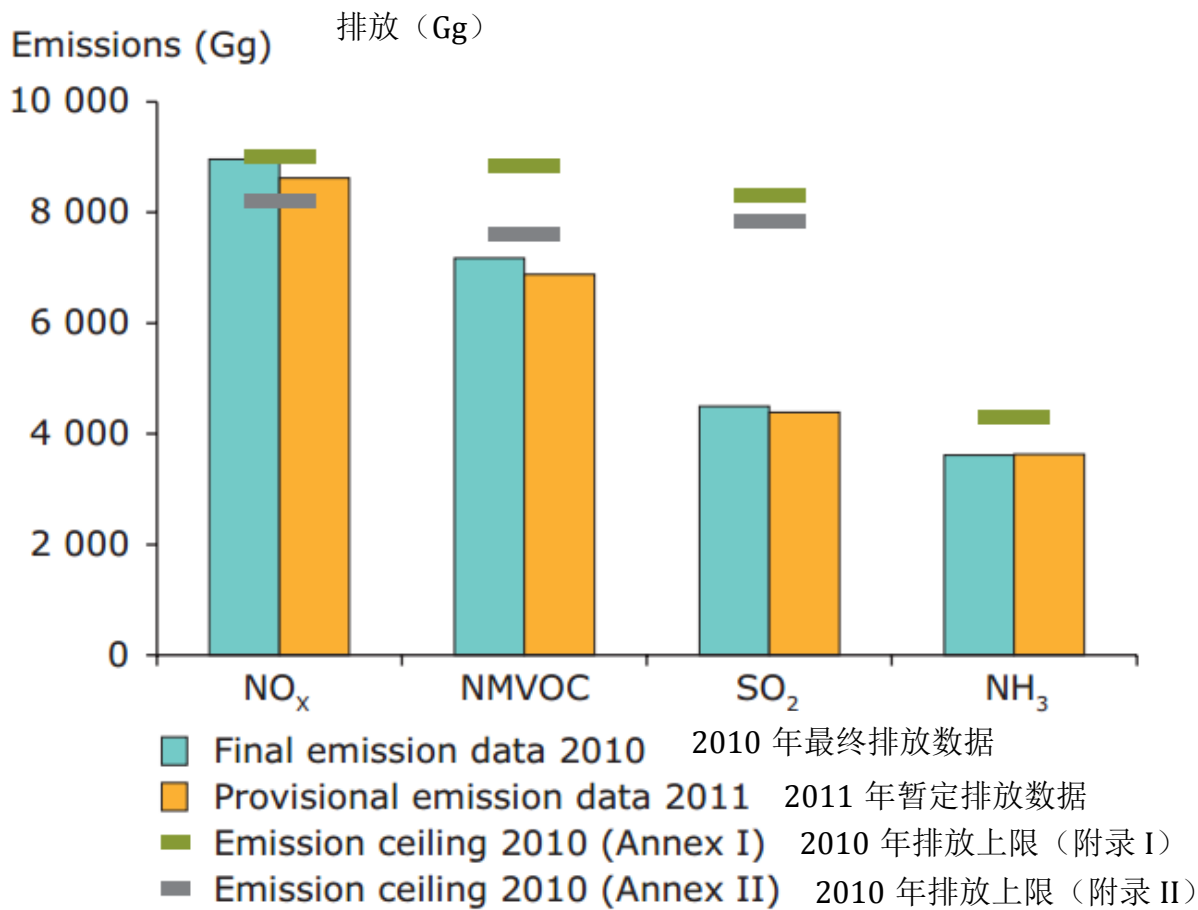
在制定《国家排放上限指令》排放上限的过程中，采用了 GAINS 计算机模型。在此过程中咨询了来自成员国以及其他利益相关方（包括工业和环境非政府组织）的专家。GAINS 模型包括用来计算排放量和环境风险的指标，还包括每个国家减排方案的成本数据。该模型根据指标和数据计算成本最少的解决方案。自下而上的估算经过了科学辩论和政治协商，直到排放上限达成一致。这是一种成本效益方法，并且是成本效益分析法的一个替代方法。这是因为沉降与影响之间的关系具有不确定性。

Member states shall each year report their national emission inventories and their emission projections.

成员国应每年报告其国家排放清单和排放预测。

**Figure 2.20 Progress of the EU-27 in meeting the emission ceilings defined in NECD Annexes I and II**

**图 2.20 欧盟 27 国满足《国家排放上限指令》附录 I 和 II 中规定的排放上限的进展情况**



Source: EEA (2013)来源：EEA (2013)

Figure 2.20 shows that the member countries have been able to cut their emissions and stay under the ceiling, except for NO<sub>x</sub> emissions that are not meeting the stricter Annex II requirements. The majority of the EU Member States report considerable emission reductions of the four NECD pollutants since 1990.

图 2.20 表明，成员国减少了排放，并且排放量在规定的上限以下，除了氮氧化物（NO<sub>x</sub>）排放量未满足附录 II 较严格的要求之外。大多数欧盟成员国报告，自 1990 年以来《国家排放上限指令》规定的四种污染物的排放量大幅减少。

**Box 2.11 European experiences - UNECE CLRTAP and air pollution legislation in the EU**

**框 2.11 欧洲经验：联合国欧洲经济委员会《远距离跨境空气污染公约》（CLRTAP）和欧盟的空气污染立法**

Phase I of the project provided experiences from European air pollution control, including UNECE CLRTAP and air pollution legislation in the EU, and below we summarize the main points.

本项目一期提供了来自欧洲空气污染治理的经验，包括联合国欧洲经济委员会《远距离跨境空气污染公约》和欧盟的空气污染立法，下面我们总结要点。

Air pollution was considered a local problem in Europe for a long time, but the realization that it was a regional concern lead to the establishment of the The United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (CLRTAP). The aims of the CLRTAP is to set a limit and gradually reduce and prevent air pollution, including long range transboundary air pollution, through scientific collaboration and policy negotiation. The Convention entered into force in 1983. It currently has 51 parties including most European countries, USA, Canada, and the Central Asian countries Kazakhstan and Kyrgyzstan. Parties develop policies and strategies to combat the discharge of air pollutants through exchanges of information, consultation, research and monitoring.

空气污染长期以来被认为是欧洲的局地问题，但认识到它是一个区域问题之后，就建立了联合国欧洲经济委员会（UNECE）《远距离跨境空气污染公约》（CLRTAP）。CLRTAP 的目的是设置一个限值，并通过科学合作与政策协商逐渐减少并防止空气污染，包括远距离跨境空气污染。《公约》于 1983 年开始生效，目前有 51 个缔约国，包括多数欧洲国家、美国、加拿大和中亚国家哈萨克斯坦和吉尔吉斯斯坦。缔约国制定政策和策略，通过信息交换、协商、研究和监测治理空气污染物的排放。

The Gothenburg Protocol (of the CLRTAP) sets emission ceilings for 2010 for four pollutants: sulphur, NO<sub>x</sub>, VOCs and ammonia. These ceilings were negotiated on the basis of scientific assessments of pollution impacts and abatement options and costs. Thus, a bottom-up assessment was the starting point for negotiating targets, in which both emissions, the pollution load, the sensitivity of ecosystems, and the abatement costs in each country were taken into consideration.

（CLRTAP 的）《哥德堡协议》设置了四种污染物 2010 年的排放上限：硫、氮氧化物、挥发性有机化合物和氨。这些上限是在科学评估污染影响及减排方案和成本的基础上议定的。因此，自下而上的评估是谈判目标的起点，在评估过程中考虑了每个国家的排放量、污染量、生态系统的敏感性和减排成本。

The RAINS (and its successor GAINS) model has been the main tool in the CLRTAP assessments and the concept of Critical Loads and Critical Levels were the main effect indicators. Basically, RAINS/GAINS assists in estimating national emissions, their dispersion including chemical reactions, and the harm they cause to the environment and human health. The model includes cost data for abatement options at a country level. More about the RAINS/GAINS model can be found in Econ Poyry (2010).

RAINS（及其后续 GAINS）模型是 CLRTAP 评估中的主要工具，“临界负荷与临界水平”概念是主要的效应指标。RAINS/GAINS 模型主要用于帮助估算国家的污染物排放量、污染物扩散，污染物化学反应，及其对环境和人类健康造成的危害。该模型包

括国家层面减排方案的成本数据。更多关于 RAINS/GAINS 模型的信息可在 Econ Poyry (2010) 里找到。

However, the convention is only part of the picture. The EU is acting at many levels to reduce exposure to pollution: through EU legislation (the Directives), through work at the international level to reduce cross-border pollution (e.g., through the CLRTAP protocols), through co-operation with sectors responsible for pollution, through national, regional authorities and NGOs, and through research.

然而，该公约只是事实的一个方面。欧盟正在从很多层面上采取行动来降低污染风险：通过欧盟立法（欧盟指令）、通过国际层面减少跨境污染（例如通过《远距离跨境空气污染公约》（CLRTAP）协议）、通过与污染责任行业的合作、通过国家和区域有关部门和非政府组织以及通过研究。

Air pollution policies and instruments in Europe target air pollution by means of three main approaches:

欧洲空气污染政策和文件用三种主要方法规定空气污染指标：

- 1) Total emission control (via CLRTAP for all of Europe and the NEC (National Emissions Ceiling) Directive for EU member countries); 排放总量控制（对整个欧洲用 CLRTAP 来控制，对欧盟成员国用《NEC（国家排放上限）指令》来控制）
- 2) Emission control and standards for specific sources, including industry and vehicles (via EU Directives related to point sources and vehicles); and 特定污染源的排放控制和标准，包括工业和车辆（对点源和车辆用欧盟指令）；和
- 3) Air quality standards and targets (via the EU Air Quality Directives). 空气指令标准与目标（用《欧盟空气质量指令》）。

The member countries' governments are responsible for implementing the EU Directives, monitoring of environmental quality and health surveillance. In addition to the national environmental agencies, research institutions etc. involved in these activities, the European Environment Agency (EEA) of the European Union and other environmental bodies funded by EU are also involved.

成员国政府负责实施欧盟指令、监测环境质量和监护健康。除了国家环境部门、研究机构等参与这些活动之外，欧盟的欧洲环境署（EEA）和欧盟投资的其他环境机构也参与这些活动。

The Air Quality Directive sets targets and time-tables for the air quality objectives. Regarding limit values for ambient air pollution concentrations, EU's Air Quality Directive sets limit values that are 1) long-term objectives equivalent to the World Health Organisation's guidelines, and 2) interim target values which are established in accordance with the targets and time tables of the National Emissions Ceiling Directive. The emission ceilings in the NEC Directive as well as in the CLRTAP Protocol are negotiated using results from the RAINS/GAINS model mentioned above.

《空气质量指令》设定目标和空气质量目标的时间表。关于环境空气污染浓度的限制，欧盟的《空气质量指令》设定的限值是：1）相当于世界卫生组织导则的长期目标，2）根据《国家排放上限指令》的目标和时间表确立的暂定目标值。《国家排放上限质量》以及《CRLTAP 协议》中的排放上限是利用上述 RAINS/GAINS 模型得出的结果议定的。

The Air Quality Directive also set so-called ‘information thresholds’ and ‘alert thresholds’ for some components. In case these thresholds are exceeded the Directive requires Member States’ authorities to, respectively, disseminate information to the public on the risks of exposure and to take urgent short-term action to reduce exposure. Notwithstanding the time-tables set, the Directive opens up of postponing the deadline for complying for zones and agglomerations where conditions are particularly difficult. Any postponement for a given zone or agglomeration should be accompanied by a comprehensive plan to be assessed by the Commission to ensure compliance by the revised deadline.

《空气质量指令》还为有些成分设置了所谓的‘信息阈值’和‘警示阈值’。超过这些阈值的，《指令》就要求成员国有关部门分别向公众传播暴露风险信息，并采取紧急短期行动来减少暴露。尽管规定了时间表，但是对条件特别困难的地区和城市群，《指令》允许达标截止日期延后。在对特定地区或城市群延迟截止日期时，应附有综合计划，由欧盟委员会进行评估，以确保遵守修改后的截止日期。

A range of models and tools, including GAINS, are currently used for analyzing air pollution policies in the EU. Models are used to simulate the future evolution of emission-generating activities as a function of economic development, to estimate the resulting emissions, and to assess the physical and economic impacts and benefits of emission control measures on a wide range of environmental and health endpoints.

欧盟目前采用一系列包括 GAINS 在内的模型和工具来分析空气污染政策。模型被用来模拟产生排放活动的未来演进对经济发展的作用，估算所产生的排放量，评价物质影响和经济影响以及各种排放控制措施在不同环境端点和健康端点上的效益。

The Impact Pathway Approach (also denoted damage function approach) is a general term for a bottom-up quantitative method used to quantify the marginal external costs of air pollution. The Clean Air for Europe (CAFE) programme provides an example of how the impact pathway approach has been applied to support air quality policies in the EU.

影响途径分析法（又称损害函数法）是自下而上量化方法的一个通用术语，用来量化空气污染的外部边际成本。欧洲清洁空气（CAFE）计划提供了一个例子，说明了影响途径分析法在欧盟是如何被用来支持空气质量政策的。

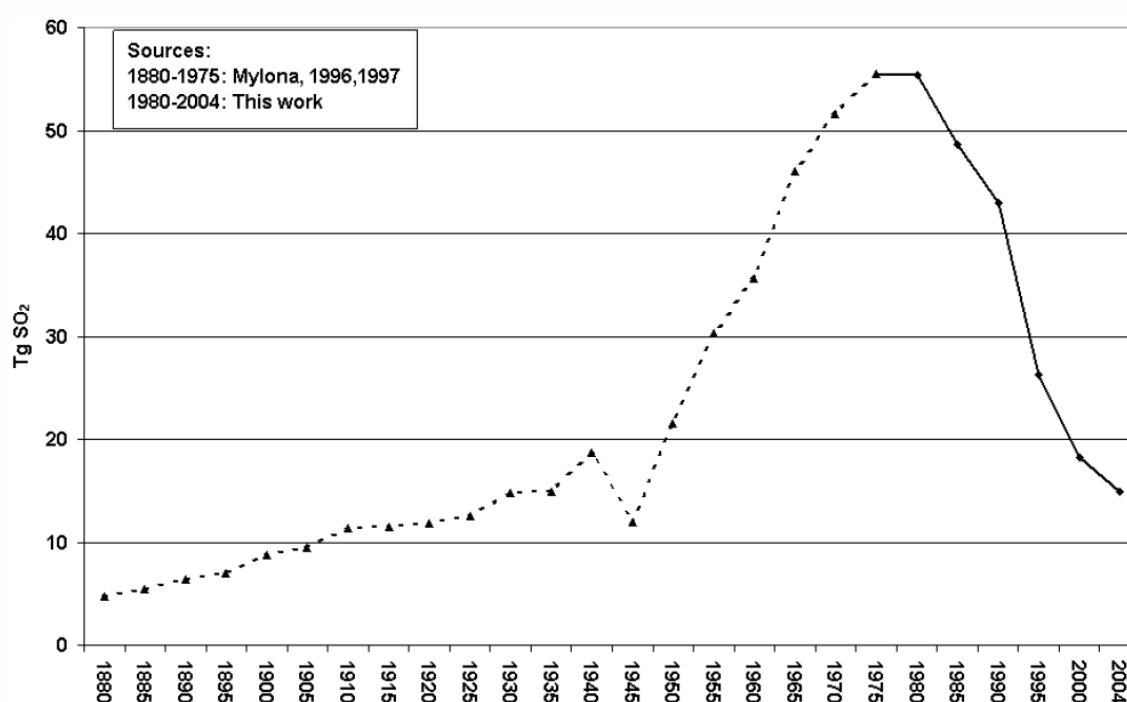
The single most important model tool applied in development of European air pollution policies is the RAINS model and its successor the GAINS model (Greenhouse Gas and Air Pollution Interactions and Synergies). Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) are also used in Europe both enforced through their respective directives, in order to evaluate projects, plans and programs. In addition to the systems and requirements for EIA and SEA, the European Commission’s

Impact Assessment (IA) system was introduced in 2003, integrating all sector assessments of direct and indirect impacts of proposed measures into one global instrument.

在制定欧洲空气污染政策过程中采用的最重要的工具是 RAINS 模型及改进后的 GAINS 模型（温室气体和空气污染相互作用与协同效应）。环境影响评价（EIA）和战略环境评价（SEA）也通过各自的指令在欧洲强制执行，以评价项目、规划和计划。除了 EIA 和 SEA 系统和要求之外，2003 年还引入了欧盟委员会的影响评价（IA）系统，将所有对建议措施的直接和间接影响的部门评价全部纳入一个全球文件里。

**Figure 2.21 Historical development of SO<sub>2</sub> emissions in Europe (Unit: Tg SO<sub>2</sub>)图**

**2.21 欧洲二氧化硫排放历史发展（单位：Tg SO<sub>2</sub>）**



Source: Econ Poyry (2010)来源：Econ Poyry (2010)

Figure 2.21 shows that SO<sub>2</sub> emissions in Europe have fallen sharply since 1990. (The same pattern is illustrated for Norway in chapter 1). The reduced emissions of air pollutants is a result of the combined merits of international treaties on air pollution (e.g. the multi-component Gothenburg Protocol under the ECE Convention on Long-range Transboundary Air Pollution, CLRTAP), EU legislation (e.g. the Framework Directive on Air Quality and the national emission ceilings (NECs) Directive, emission limits and fuel quality standards, national implementation schemes for complying with EU and international treaties, and a range of local measures, e.g. in CAFE context, addressing pollution peaks and permanent hot-spots.

图 2.21 表明自 1990 年以来欧洲的二氧化硫排放急剧下降。（第 1 章显示了挪威的同样模式）。空气污染物排放减少是国际空气污染条约（例如欧洲经济委员会《远

距离跨境空气污染公约》（CLRTAP）下的多组分《哥德堡协议》）、欧盟立法（例如《空气质量框架指令》和国家排放上限（NEC）指令、排放限值和燃料质量标准、为了遵守欧盟和国际条约的国家实施计划）和一系列地方措施（例如在 CAFE 背景下，解决污染高峰和永久热点问题）联合作用的结果。

The CLRTAP Protocols include statements about policy, e.g. they call for using emission standards, promoting energy efficiency measures and renewable energy, and typically recommend the use of BAT (Best Available Technology).

CLRTAP 协议包括政策声明，例如他们呼吁采用排放标准、推广节能措施和可再生能源，并且通常建议采用 BAT（最佳可行技术）。

In case of *non-compliance* with EU law, e.g. breach of an EU Directive, the European Commission may initially send final written warnings to the member country not complying. Unsatisfactory responses to these warnings could lead the Commission to use its power to ask the European Court of Justice to impose fines on the country.

若不遵守欧盟法律，例如违反某项欧盟指令，欧盟委员会可向违规成员国发出最终书面警告。若对这些警告的答复不符合要求，欧盟委员会可利用其权力请求欧洲法院对该国家处以罚金。

## Box 2.12 How Air Quality Guidelines and Standards are set

### 框 2.12 空气质量准则值和标准是如何制定的

In 2006, The World Health Organisation (WHO) released a set of guidelines that would “address all regions of the world and provide uniform targets for air quality.” Known as the Air Quality Guidelines (AQG), these suggested limits served to direct national policymakers to create acceptable air quality standards. To aid in the attainment of the WHO AQG, WHO also created the WHO-Interim Targets (WHO-IT 1, WHO-IT 2, and WHO-IT 3) to provide flexibility for developing countries to move towards more stringent standards at their own place.

2006 年，世界卫生组织（WHO）发布了一系列“针对世界所有地区并提供统一空气质量标准”的准则值。这些建议限值又称为空气质量准则值（AQG），用来指导国家政策制定者制定可接受的空气质量标准。为了帮助达到世界卫生组织的 AQG，世界卫生组织还制定了 WHO-过渡时期目标值（WHO-IT 1、WHO-IT 2 和 WHO-IT 3），使发展中国家可以灵活地以自己的步伐迈向较严格的标准。

Based on the WHO guidelines and interim targets, individual governments develop their own standards. These are usually created in collaboration of the international organizations, scientific communities and government authorities taking into consideration the country’s current pollutant levels, meteorological and topographical conditions, technological and managerial capabilities, and their people’s socio-economic status.

各国政府根据世界卫生组织准则值和过渡时期目标值制定自己的标准。这些标准通常通过与国际组织、科学团体和政府机构的合作来制定，并考虑本国当前的污染水平、气象条件和地形条件、技术能力和管理能力以及人民的社会经济状况。

Standards vary between regions, but the main pollutants (also called criteria air pollutants) are generally the same (Particulate Matter: PM<sub>10</sub> and PM<sub>2.5</sub>; oxides of Nitrogen (NO<sub>x</sub>); oxides of Sulfur (SO<sub>x</sub>); ozone (O<sub>3</sub>), carbon monoxide (CO), and lead (Pb). These pollutants have significant effects on health and environment as determined by the extent of distribution and the length of exposure.

空气质量标准因地区而异，但主要污染物一般是相同的（颗粒物：PM<sub>10</sub> 和 PM<sub>2.5</sub>；氮氧化物（NO<sub>x</sub>）；硫氧化物（SO<sub>x</sub>）；臭氧（O<sub>3</sub>）、一氧化碳（CO）和铅（Pb）。这些污染物对健康和环境有重大影响，由分布范围和暴露时间决定。

Guidelines and standards are defined in terms of concentration and averaging time. The basis for the WHO Guidelines are relative risk estimates from epidemiological, clinical and toxicological studies, i.e. knowledge about how the frequency of various effects increases in a population, subpopulation or in a laboratory setting, as pollution exposure increases. For some pollutants, relative risk estimates and corresponding guidelines and standards are established for both short-term exposures (e.g., hourly or daily) and long-term exposures (e.g. annual or longer). The short-term standards are designed to protect against acute, or short-term, health effects, while the long-term standards are established to protect against chronic health effects. Most countries in Asia base their standards on the WHO AQG (WHO, 2005), United States Environment Protection Agency (US EPA) National Ambient Air Quality Standards (NAAQS) (US EPA Website, 2010), and the European Union (EU) Air Quality Standards (AQS) (see <http://ec.europa.eu/environment/air/quality/standards.htm> ).

准则值和标准以浓度和平均时间来规定。WHO 准则值的依据是来自流行病学、临床和毒理学研究的相对风险估计值，也就是对以下问题的了解：随着污染暴露的增加，各种影响的频率在人口、分组人口或在实验室环境中是如何增大的。对于有些污染物，制定短期暴露（例如每小时或每天）和长期暴露（例如每年或更长时间）的相对风险估计值和相应的准则值与标准。**短期标准旨在防范突发性或短期健康影响，而长期标准则旨在防范慢性健康影响。**亚洲多数国家的标准以世界卫生组织 AQG（WHO, 2005）、美国环保局（US EPA）《国家环境空气质量标准》（NAAQS）（US EPA 网站，2010）和欧盟（EU）《空气质量标准》（AQS）（见 <http://ec.europa.eu/environment/air/quality/standards.htm>）为基础。

Air quality standards may distinguish between protection of different types of recipients. For instance, the US EPA NAAQS established two types of air quality standards. The Primary standards set limits to protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. The Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

不同的空气质量标准可以保护不同类型的受体。例如，美国环保局 NAAQS（《国家环境空气质量标准》）制定了两类空气质量标准。初级标准设定了保护公众健康的限值，包括气喘患者、儿童和老年人等敏感人群的健康。次级标准设定了保护公共福利的限值，包括防止能见度下降，防止动物、农作物、植被和建筑物受到损害。

<http://cleanairinitiative.org/portal/airqualitystandards>



### Box 2.13 Haze and air pollution – wu mai

#### 框 2.13 霾与空气污染——雾霾

In China, the level of particulate air pollution has been exceptionally high during winter episodes in recent years. As a consequence there has been an increasing attention to the phenomenon and the term wu mai 雾霾 is now frequently seen as the term for air pollution causing low visibility in China. The term is composed of two characters:

在中国，近年来冬季期间的微粒空气污染水平异常高。因此，这种现象越来越受到人们关注，而“雾霾”一词如今在中国常常被视为导致能见度低的空气污染的名词。这个词由两个字组成：

wu 雾: fog, mist

mai 霾: haze, dust in the air, covered by dust, buried

雾：尘雾，薄雾

霾：阴霾，空气中的灰尘，“被灰尘覆盖”，“埋”

Wu mai is not found in common dictionaries and encyclopedias (it was, however, used as a scientific term for ‘haze’ in a technical dictionary from 1985). The two characters re-enter the Chinese discourse in 2004, but is not yet a stable term for particulate air pollution. Wu mai appeared as a term for ‘smog’ or ‘haze’ in 2006, more frequent from 2010, and became very frequent in 2013 (Svarverud, 2014, pers.comm.). Although photochemical oxidants may contribute to the phenomenon, the main constituents of wu mai are primary and secondary PM<sub>2.5</sub>.

“雾霾”在普通字典和百科全书里找不到（但在一本 1985 版的技术字典里，它被用作‘霾’的科学术语。）2004 年这两个字重新进入中国话，但还不是微粒空气污染的固定术语。2006 年，“雾霾”作为‘雾’或‘霾’的术语出现，从 2006 年开始出现得比较频繁，2013 年变得非常频繁（Svarverud, 2014, pers.comm.）。虽然光化学氧化剂可能是雾霾现象的促因，但雾霾的主要成分是原生和次生 PM<sub>2.5</sub>。

### 3 Part 3: Examples of balancing the economic development

#### and environmental protection 第三部分：平衡发展与环境保护的例子

In this chapter we present examples of sites, areas and countries that successfully have applied some of the policies and principles outlines in Part 1 and 2. This covers the risk management tool Apell, how environmental, health and safety issues are handled in chemical industrial parks in the EU, the environmental and water management of the river Rhine and surrounding rivers in Central Europe, and how EU has managed to reduce the exposure to hazardous pollutants.

本章我们介绍成功应用第 1 部分与第 2 部分中所概述的个别政策、原则的所有场地、区域及国家的成功案例。其中包括风险管理工具 Apell，相关欧盟化学产业园处理环境、健康、安全问题所采取的措施，莱茵河及中欧周边河流的环境与水资源管理，以及欧盟设法减少接触危险污染物所采取的措施。

#### 3.1 APELL – Awareness and preparedness for emergencies at local level

##### APELL - 地区级紧急事故意识和准备

##### 3.1.1 Introduction 引言

In late 1986, following various chemical accidents<sup>61</sup>, United Nations Environmental Program (UNEP) suggested a series of measures to help governments, particularly in developing countries, to reduce the occurrence risk and harmful effects of technological accidents and emergencies caused for instance by fire, explosions, spills or release of hazardous substances. One of these measures was to **institute a programme enabling governments, in co-operation with industry, to work with local leaders to identify the potential hazard risks in their communities and to prepare measures to respond and control emergencies which might threaten public health, safety and the environment**. At UNEP's 14th Governing Council in June 1987, the secretariat was requested to continue these efforts with governments, the United Nations system and world industry and trade, taking into account work already undertaken in this area by

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<sup>61</sup> Examples were the dioxin-containing release in Seveso in 1976, the propane explosion in Mexico City in 1984, the release of methylisocyanate at Bhopal in 1984, and the fire and discharge of contaminated waters in the Rhine in 1986 from a warehouse in

Basel. 例如 1976 年在塞维索发生的二氧气体泄漏；1984 年在墨西哥城发生的丙烷爆炸事件；

1984 年在印度博帕尔发生的异氰酸毒气泄漏事故；1986 年巴塞尔一个仓库发生的火灾事故使受污染水排入莱茵河

other international organizations, and in close co-operation with them (UNEP, 2014). APELL is part of a broad cleaner and safer production programme that UNEP has launched with the objective of promoting worldwide sustainable production and consumption patterns (UNEP, 2014)<sup>62</sup>.

1986 年末，针对各类化学事故，联合国环境规划署（UNEP）提出了一系列措施，旨在帮助相关国家，特别是一些发展中国家，降低由火灾、爆炸、有害物质的泄露或释放而导致的技术事故、突发事件的发生可能及潜在不良影响。其中一项措施是制定一个方案，使政府能够在企业的配合下与地方领导联手确定其区域的潜在危险，并准备应对和控制可能对公众健康、安全与环境造成威胁的突发事件的相关措施。1987 年 6 月，第 14 届联合国环境规划署理事会要求其秘书处将其他国际组织在该领域已开展的相关工作考虑在内并与这些组织密切合作，同时在此基础上，与相关政府、联合国系统以及世界工贸行业继续合作（UNEP, 2014）。APELL 是 UNEP 所发起的一个涵盖面广且更清洁、更安全的生产项目的一部分，该计划旨在促进全球可持续生产和消费模式的发展（UNEP, 2014）。

Industries all over the world, particularly the International Council of Chemical Associations (ICCA) and International Council on Mining and Metals (ICMM), have co-operated with UNEP in supporting the application of APELL<sup>63</sup>. Major inter-governmental APELL partners are:

全球企业，尤其是国际化工协会联合会（ICCA）、国际采矿及金属协会(ICMM)，通过与 UNEP 进行合作，共同支持 APELL 的应用。主要政府间 APELL 缔约方包括：

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<sup>62</sup> The two programmes in addition to APELL are the **Flexible Framework Initiative for Chemical Accident Prevention and Preparedness** and the **Responsible Production approach for chemical Hazards Management**. The first operates at a national level and provides guidance for governments wishing to develop their chemical accident prevention and preparedness programmes, whereas the latter operates at a sector level particularly focusing small and medium sized enterprises (SMEs) providing guidance and tool for SMEs aimed at engaging all stakeholders along the supply-chain in improved safer production, risk communication and emergency preparedness practices.除APELL外的两个计划分别是**化学事故预防与准备框架计划**和**化学危险管理生产方法**。前者是在国家层面为希望制定化学事故预防与准备计划的相关政府提供指导，后者针对行业领域，特别是中小型企业(SME)，为致力使供应链所有利益相关方参与改善安全生产、风险沟通及应急准备实践的中小型企业提供指导与工具。

<sup>63</sup> For an overview of APELL initiatives, see 'APELL Worldwide. Examples of APELL application around the world' Available <http://www.unep.org/resourceefficiency/Portals/24147/scp/sp/publications/brochures/pdf/APELL-Worldwide.pdf> 有关APELL计划的概述，见'APELL全球应用示例'网址：<http://www.unep.org/resourceefficiency/Portals/24147/scp/sp/publications/brochures/pdf/APELL-Worldwide.pdf>

- EC – European Commission EC——欧洲委员会
- ECE – Economic Commission for Europe ECE——联合国欧洲经济委员会
- IAEA – International Atomic Energy Agency IAEA ——国际原子能机构
- ISDR – International Strategy for Disaster Reduction ISDR ——联合国国际减灾战略
- IMO – International Maritime Organization IMO——国际海事组织
- OCHA – Office for the Coordination of Humanitarian Affairs OCHA——联合国人道主义事务协调办公室
- OECD – Organization for the Economic Cooperation and Development OECD——经济合作与发展组织
- PAHO – WHO – Pan American and World Health Organizations PAHO – WHO——泛美卫生组织与世界卫生组织

In addition, there are **governmental partners, in the case of China the Ministry of Environmental Protection (MEP), as well as a range of institutions involved in APELL activities. The APELL concept has been introduced in more than 30 countries and in over 80 industrialized communities worldwide:** in Latin America (i.e., Brazil, Colombia, Chile, Argentina), in Asia (i.e., China, India, Thailand, Indonesia, and Korea) and in the Middle East. The guiding principles of the APELL process for emergency planning are also practiced in the United States and Canada, through programmes of the American Chemistry Council. In Europe, a mechanism has been established for cross-border emergency coordination in the arctic region based on APELL. Following disastrous floods in 2002, the Czech republic requested UNEP to help establish an APELL demonstration at one of the major refineries in the country, and use this also as a way of implementing the public communication provisions of the Seveso II Directive of the EU. Croatia has incorporated the APELL process into its national disaster legislation. There are also various local processes applying the APELL approach, or APELL-like processes, in the EU.

此外，还包括一些政府合作伙伴，中国的环境保护部以及一些参与 APELL 活动的机构组织。APELL 这一理念目前已经传播至全球 30 多个国家及 80 多个工业园区：拉丁美洲（如巴西、哥伦比亚、智利、阿根廷）、亚洲（如中国、印度、泰国、印度尼西亚、韩国）、中东。通过美国化学理事会（ACC），APELL 应急预案流程指导原则在美国、加拿大同样得到了应用。就欧洲而言，其基于 APELL 在北极地区建立了一种跨境应急协调机制。继 2002 年特大洪灾之后，捷克共和国请求 UNEP 帮助其在国内一家主要炼油厂建立 APELL 示范基地，并将此作为欧盟塞维索二号指令（Seveso II Directive）中公众传播规定的一种执行方式。克罗地亚也将 APELL 流程纳入了其国家级灾难立法。此外，欧盟内部也存在各种采用 APELL 或类似 APELL 的局部流程。

APELL tools are provided directly from UNEP webpage<sup>64</sup> but a more updated and comprehensive overview of relevant tools and resources are provided through the UNEP/OCHA Environmental Emergency Centre<sup>65</sup> (OCHA: Office for the Coordination of Humanitarian Affairs). The Environmental Emergencies Centre (EEC) is an online preparedness information resource designed to enable an effective response to environmental emergencies. The EEC, founded in 2012, is an initiative of the Joint UNEP/OCHA Environment Unit, developed in close coordination with the Advisory Group on Environmental Emergencies. The EEC is a tool for everyone, communities and governments alike, seeking assistance through training, knowledge, experience and good practice sharing to increase their preparedness to be able to effectively respond when disasters strike.

APELL 工具直接来自于 UNEP 网页，而有关相关工具与资源的最新全面概述则是由 UNEP 或 OCHA（联合国人道主义事务协调办公室）进行提供。环境应急中心（EEC）是一个在线提供防范信息资源的机构，旨在对于环境突发事件做出有效响应。EEC 创立于 2012 年，为 UNEP/OCHA 环境事务联合机构同环境紧急事故咨询小组（AGEE）通过密切协作所提出的一项计划。与此同时，EEC 也为所有寻求培训、知识、体验和经验分享的个人、群体和政府提供帮助，提高其灾难应急能力。

### 3.1.2 Principles APELL 原则

**The strategy of the APELL approach is to identify and create awareness of risks in an industrialized community, to initiate measures for risk reduction and mitigation, and to develop coordinated preparedness between the industry, the local authorities and the local population.** Because the risks, capabilities, stakeholders and regulatory situation of a community will vary from place to place, the process is designed to be adaptable to local conditions. The basic approach to meeting APELLs goal of preventing loss of life and property is **to increase knowledge in the community about the possible risks and hazards in the area and, on the basis of this information, to develop coordinated emergency response plans.** While most industrial accidents can be contained within the boundaries of the industrial plant, there will be cases where impacts extend beyond and affects the plant neighborhood, which can have adverse short- and long-term consequences for the community. In the worst case, cascade (domino) effects, where an accident in one facility damages an adjacent facility, causing a loss of containment and additional accidents, can have devastating impacts in a broader area (Mudavanhu et al., 2013). Also, events may occur where a natural hazard triggers or worsens an industrial accident. Often, the actions of the first responders to the emergency are of crucial importance for the final extent and severity

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<sup>64</sup><http://www.unep.org/resourceefficiency/Business/CleanerSaferProduction/SaferProduction/APELL/APELLProcess/WhatisAPELL/tabid/78884/Default.aspx>

<sup>65</sup> <http://www.eecentre.org/About-EEC.aspx/lan/en-US>

of the emergency (UNEP, 1988). **APELL is a tool for bringing people together to allow effective communication about risks and emergency response. The process of dialogue should help to reduce risk, improve effectiveness of response in the case of an accident happening, and allow ordinary people to react appropriately during emergencies.**

**APELL** 方法策略在于识别并提高工业园区内的风险意识，启动风险降低、缓解措施，同时提升行业、地方政府与当地居民间的协调应急准备能力。由于不同区域的风险、能力、利益相关者及监管情况存在差异，因此该流程适应于地方情况。APELL 实现避免生命财产损失这一目标的根本方法在于**增加区域内有关地区潜在风险与危害方面的知识，并在此基础上，制定相应的应急响应计划**。尽管绝大多数工业事故发生在工业厂房内，但是事故所产生的影响仍有可能蔓延至工厂附近区域，进而在短期和长期内对区域产生不良后果。最糟糕的情况可能是发生连锁反应，即一种设施所引发的事故对周边设施造成损害，由此失去控制，引发新的事故。这可能会在更广泛的区域内产生破坏性的影响（Mudavanhu et al., 2013）。同样地，自然灾害可能会引发工业事故或者使情况变得更为糟糕。通常来说，突发事件的第一批响应者所采取的措施对于事件的最终影响范围及严重性起着至关重要的作用（UNEP, 1988）。作为一种工具，**APELL** 使得人们联合起来，就风险及应急响应进行有效沟通。沟通过程应有助于降低风险，提升应急响应效率，同时使得普通人在突发事件期间做出适当反应。

Although APELL targets preparedness and response at the local level, local action in isolation may not be sufficient for avoiding disasters. On the contrary, state and federal governments are fundamental in setting national goals, priorities and regulatory measures, and providing any support and resources the local communities need. The APELL process is designed to build on possibly existing emergency plans to create a single coordinated local plan. For instance, there may be national government emergency plans in place but still there is the need for an effective structure at the local level. Industrial facilities may have on-site emergency plans, and local authorities and rescue services may have plans to deal with the consequences of major emergencies. Moreover, local hospitals may have their own "major accident plans" for dealing with large numbers of seriously injured people. **The core idea of the APELL process is that all existing plans contribute to the overall integrated, co-operative plan, and if non-existent, coordinated emergency plans are developed.**

尽管 APELL 的对象是地方层面的应急准备及响应，但是独立的地方措施可能还不足以避免灾难。相反，州政府与联邦政府对于设定国家目标、优先等级、监管措施以及提供地方社区所需的支持、资源方面起着至关重要的作用。APELL 流程的目的在于基于可能存在的应急计划制定单一协调性地方计划。例如，可能已经制定了国家政府的应急计划，但是还需要制定地方层面的相关有效内容。工业企业可能已经制定了现场应急计划，地方政府与救助服务机构可能也制订了相关计划，用于应对重大突发事件所造成的后果。此外，地方医院可能拥有内部“重大事故应急计划”，以期救助大批重伤人员。**APELL** 流程的核心理念在于所有现有应急计划均应为整体综合合作计划的实现做出贡献；如果不存在此类计划，则应制定协调性应急计划。

### 3.1.3 Approach 方法

#### Content of APELL : APELL 内容

APELL is a modular, flexible methodological tool for preventing accidents and, failing this, to minimize their impacts. This is achieved by **assisting decision-makers and technical personnel to increase community awareness and to prepare coordinated response plans involving industry, government, and the local community, in the event that unexpected events should endanger life, property or the environment** (UNEP, 2014). **APELL sets out a structured process for the development of an emergency response plan involving local communities, governments, emergency responders and others.** Communication is often between the three main groups of stakeholders - **company, community, and local authorities.** Discussion on hazards usually leads to the **identification of risk reduction measures.** Structured communication between emergency response bodies (public and company) is meant to result in a better-organized overall emergency response effort. The programme provides a common-sense approach to accident prevention and response and **can apply to any risk situation, whether industrial or natural.** It can be initiated by any party, although companies can be expected to take the lead. It can be facilitated by governments, or by industry associations. APELL can be applied in developed and developing countries and in remote or urban areas.

APELL 系一种模式化且灵活的方法工具，旨在预防事故发生，如若不能，则最大限度地减少其影响。这主要是通过，在突发事件可能危及生命、财产或环境的情况下，协助决策者及技术人员提高群体意识并制定涉及工业、政府与地方社区的协调应急计划来实现的（UNEP, 2014）。**APELL 为制定涉及地方社区、政府、应急响应机构及其他相关方的应急响应计划设定结构化流程。**通常情况下，沟通主要在企业、社区及地方政府这三大主要利益相关者群体之间进行。应急响应主体（公众与企业）间有组织的沟通有助于更好地实现综合应急响应。该计划为事故预防及响应提供了一种常识性方法，**能够应用于任何工业或自然风险。**该计划可以由任何相关方发起，相关企业有望率先发起。政府或行业协会均可促进其发展。APELL 可应用于发达国家与发展中国家以及城市与偏远地区。

**The establishment of a multi-stakeholder Coordinating Group is the core of the APELL process and crucial to increasing community preparedness.** Relevant stakeholders include industry representatives; government agencies responsible for emergency services, public health, and environmental protection; local residents and businesses; and technical specialists such as engineers, geologists, and scientists. While being inclusive it is also important that members of the Coordinating Group and the leadership of the group are able to commit to the group and have the authority and legitimacy to represent their constituency.

建立多方参与的协调小组是 APELL 流程的核心所在，对提升社区应急准备能力起着至关重要的作用。利益相关者包括行业代表，负责应急服务、公共健康及环境保护的政府机构，当地居民和企业，以及包括工程师、地质学家、科学家在内的技术专家。与此同时，协调小组成员与小组领导层应对小组做出承诺，并拥有合法权力代表其选民。

The ten-step process outlined in APELL is as follows:

APELL 规定的“十步法”具体如下：

1. Identify the emergency response participants and establish their roles, resources, and concerns. 确定应急响应参与者及其任务、可用资源与所关注问题
2. Evaluate the hazards and risks that may result in emergency situations in the community. 针对可能导致社区突发情况的危害、风险进行评估
3. Have participants review their own emergency response plans to ensure a co-ordinated response. 要求参与者审核自身应急响应计划，确保做出协调响应
4. Identify the required response tasks not covered by existing plans. 识别现有计划中未涵盖的必要响应任务
5. Match these tasks to the resources of the identified participants. 将上述任务与已知参与者的可用资源进行组合
6. Make the changes necessary to improve existing plans, integrate them into an overall community plan, and gain agreement. 进行必要调整，完善现有计划，将相关调整内容纳入社区综合计划，并达成一致
7. Commit the integrated community plan to writing and obtain approval from local governments. 编制书面社区综合计划并获得地方政府批准
8. Educate participating groups about the integrated plan and ensure that all emergency responders are trained. 就综合计划对参与群体进行教育，确保所有应急响应机构接受培训
9. Establish procedures for periodic testing, review, and updating of the plan. 针对计划的定期测试、审核及更新建立规程
10. Educate the community about the integrated plan. 就综合计划对大众进行培训

While building on the common strategy and process, separate APELL guidelines have been developed for emergencies in industry (fixed installations, port areas and mining), dangerous goods transport, and for natural disasters. Recently a so-called Training Kit addressing comprehensive emergency planning from a multi-hazard viewpoint was published. The Training Kit provides a summary of the most important principles and steps in improving emergency preparedness, as well as some of the most common hazards found worldwide (UNEP, 2010). A brief introduction to some APELL Guidelines considered particularly relevant to China is given in the following.



尽管 APELL 独立指导方针基于常用策略及方法而建立，但其目的在于应对行业（固定装置、港口区域及采矿业）突发事件、危险品运输以及自然灾害。近期出版了一本“培训教程”，该教程从多危险角度提出了相关综合应急计划。教程中就提升应急准备能力最为重要的原则与步骤以及世界各地最为常见的一些危害进行了概述（UNEP, 2010）。APELL 指导方针中有一些特别符合中国的现状，以下章节中对这些指导方针进行了简短介绍。

### 3.1.4 Tools

#### *APELL Handbook for Industries* APELL 行业手册

This is a training package conceived principally to help trainers prepare a seminar, workshop, or extended course. It is not a course per se. The package contains suggestions and hints for effective training; a short background to the subject, drawn from other existing publications; material to introduce and illustrate the main ideas; case studies and situation reports and scenarios drawn from actual experience; supplementary technical information to supportsome work exercises; work exercises and questions; appendices with further information about UNEP and its programmes. Trainers are encouraged to extend the packageby adding their own case studies and exercises, and expanding the subject coverage into new topics. For example, trainers in environmental health may wish to add some modules on occupational safety and ecotoxicity by building on the chemical information already presented (UNEP, 1996).

本手册是一个教学包，主要用于帮助培训师为研讨班、讲习班或深度培训课程进行准备，与课程本身无关。该教学包涵盖了有关有效培训的相关建议；摘自其他现有出版物的简短背景介绍；介绍、说明主要观点的相关材料；案例研究、情况报告以及从实际情景介绍；用以支持一些工作实践的补充技术信息；工作实践与存在问题；以及有关更多 UNEP 及其相关计划信息的所有附录。培训师可以通过添加自身案例研究与实践并在原主题基础上创建新主题对该培训计划进行拓展。例如，环境卫生培训师可能希望在已有化学信息基础上补充一些涉及职业安全与生态毒性的模块（UNEP, 1996）。

#### *APELL Handbook for Mining* APELL 采矿手册

Several major mining companies have upgraded their emergency preparedness procedures after the publication of APELL for Mining. The International Council on Mining and Metals (ICMM) has included APELL as a high priority in its forward work programme for member companies.

一些主要采矿公司在《APELL 采矿手册》出版之后，对其应急准备程序进行了升级。国际矿业与金属理事会（ICMM）将 APELL 作为优先考虑事项，纳入了其会员公司的未来工作计划。

The APELL for Mining Handbook provides a framework for the preparation of an Emergency Response Plan that can be used by mine risk management, emergency

response agencies, government officials and local communities. It introduces the generic objectives and organizational framework of the APELL programme, covers risk factors specific to the mining industry, and describes how APELL can be applied to the mining industry. Case studies illustrating the consequences of mining accidents are also presented, underscoring the vital nature of sound preparedness for emergencies. The Handbook is meant to be of assistance to mining companies and communities in two ways. Firstly, based on previous accidents and known risks in the mining industry, it intends to raise awareness of the importance of preparedness for emergencies at local level, within both companies and communities. Secondly, it seeks to help companies, communities and emergency response providers to become thoroughly prepared for the work required.

《APELL 采矿手册》为应急响应计划的编制提供了一个框架，该计划可供矿山风险管理、应急响应机构，政府官员及地方社区进行使用。手册中对 APELL 计划的一般目标与组织结构进行了介绍，其中涵盖了采矿业的特定风险因素并就如何将 APELL 应用于采矿业进行了描述。此外，该手册中还涉及一些案例研究，对采矿事故的后果进行了说明，强调了充分准备对于突发事件的重要性。该手册对于采矿公司及社区的辅助作用主要体现在两方面。第一，在采矿业以往事故及已知风险的基础上，其目的在于在企业及社区内提高地方层面对于突发事件中准备能力之重要性的意识。第二，力图帮助企业、社区及应急响应供应商为所需工作做好充分准备。

#### *APELL for Dangerous Goods Transport APELL 危险品运输*

The Guidance for Dangerous Goods Transport Emergency Planning In a Local Community (TransAPELL) takes APELL guidance beyond the risks associated with fixed facilities to include those arising from the shipping, distribution and transport of dangerous goods. TransAPELL is thus applicable to all land transport of dangerous goods by road, rail and pipeline, as well as to the handling of such goods at interfaces with other modes of transport, e.g. ports and airports. TransAPELL is intended to supplement the provisions of national and international law and regulations, not to replace or interfere with them.

《地方社区危险品运输应急计划导则》(TransAPELL) 采用 APELL 指导固定设施以外的风险，将危险品装运、分配、运输中存在的风险纳入其中。因此，TransAPELL 适用于危险品运输的所有陆路运输方式，包括公路运输、铁路运输及管道运输，同时也适用于与其他运输方式相配合的运输，如港口运输、空中运输。TransAPELL 的目的在于对国家及国际法律法规进行补充，而并非取代或干预此类法律法规。

Planning for risks arising from the transport of dangerous goods is regarded even more complex as for fixed facilities but, for the following reasons: Transport routes normally have a considerable geographical extension. As an emergency can occur anywhere along the route, emergency risk planning must be very flexible. For historical or practical reasons, many routes pass through densely populated areas, along river valleys or along

the shores of inland lakes, etc. There may, therefore, be many threatened objects (people, property or the natural environment) in the vicinity of possible accident locations. Hazard identification is more complex as many hazardous materials are transported several times during their product lives. This means that, in most cases, planning has to cover a greater variety of hazardous materials than is the case for a fixed facility. When a transport emergency arises, there may well be delay in ascertaining what substances are involved. The number of stakeholders is generally greater than for fixed installations. Transport industries, particularly the road haulage industry, typically involve a large number of small and medium sized enterprises (SMEs). Many of these or other stakeholders may not have offices or other representation in communities concerned. An accident involving dangerous goods may happen in transit through a community that does not have any fixed chemical installations. Its emergency services are, therefore, unlikely to be equipped or trained to tackle emergencies involving unfamiliar and possibly unidentified chemicals. Finally, the population at large is likely to be more ignorant of the hazards and of how to act in an emergency. Nearby residents, people in private cars or passengers in halted trains could all be affected. It will be more difficult to produce and disseminate adequate public information.

基于如下原因，对由危险品运输所产生的风险进行规划比固定设施更为复杂。运输路线一般存在相当大的地域扩展可能性。由于突发事件可能发生在运输途中的任何地方，因此风险应急计划必须具备一定的灵活性。由于历史或实际原因，一些运输路线途径人口稠密区、河流峡谷区或是内陆湖泊海岸，因此，在潜在的事故地点附近可能存在一些易于受到威胁的对象，例如人、财产或是自然环境。一些危险物品在其生命周期内可能会被运输若干次，这就使得危险识别变得更为复杂。同时，这也意味着绝大多数情况下应急规划应涵盖固定设施以外更多种类的危险物品。交通运输突发事件发生时，往往会延迟确定相关物质。此外，利益相关方的数量通常也多于固定设备的数量。运输业，特别是公路运输行业，通常涉及大量中小型企业。一些此类企业或是其他利益相关方可能未在风险区域设立办公场所或其他办事处。运输过程中途径未设立任何固定化工装置的社区时，同样可能会发生由危险品所引发的事故。在此情况下，对于未知的或尚未识别的化学药品，不太可能及时提供相关应急服务或进行相关培训，大多数人对于危险因素或是如何应对突发事件可能都一无所知。附近居民、乘坐私家车的人群或是停运的列车上的乘客均有可能因此受到影响。这些都使得为公众提供、宣传相关公共信息变得异常困难。

#### *APELL Multi-Hazard Training Kit*    *APELL 多危险培训教程*

It also provides a Multi-Hazard Risk Matrix system which is a simple tool that can be used for initial community self-assessment of existing risks. The approach proposed in the Multi-Hazard Matrix is a simplified version of the methodology used in the more advanced Community Risk Profile (CRP) Tool developed for UNEP (UNEP 2008) and visually presents information on various risks within the community. Each hazard source identified in the area is assessed using ten different risk criteria, and assigned a number between 1 and 5 for each risk criterion. A 1 is assigned for a favourable

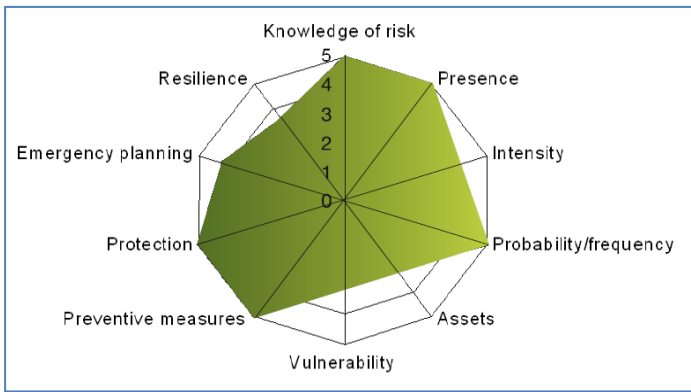
situation (such as a low hazard, low level of vulnerability, or a sufficient level of risk control), and A 5 is assigned for an unfavourable situation (such as a frequently occurring hazard, or lack of protective measures). The risk criteria are presence of risk, knowledge about the hazard source, intensity (possible extent of damage and area impacted), frequency/probability of event, exposed assets (human, economic, environmental), vulnerability of population/other assets, preventive measures in place, physical protection in place, emergency plans in place, and resilience (capacity to recover after an accident).

该教程中同时还提供了一种多危险风险矩阵系统。这是一种简单的工具，可供社区进行有关风险的初始自我评估。多危险矩阵中所提出的方法为社区风险预测（CRP）工具中所用研究方法的简化版。社区风险预测（CRP）工具系一种更为高级的工具，专门针对 UNEP（UNEP 2008）而研发，可直观地呈现各类区域风险信息。区域内所识别的每种危险源均采用十种不同的风险标准进行评估，同时针对每一种风险标准，为每一种危险源指定 1-5 之间的 1 个数字。数字 1 代表有利条件（如低危害、低水平易损性或足够的风险控制水平），而数字 5 则代表不利条件（如危险频发或缺乏保护措施）。上述风险标准涉及存在的风险、有关危险源的相关知识、强度（可能损坏的程度及可能受影响的区域范围）、事故频发性或发生的可能性、外露资产（人力资产、经济资产、环境资产）、人本身或其他资产的易损性、现有预防措施、现有人身保护措施、现有应急计划及恢复力（事故后的恢复能力）。

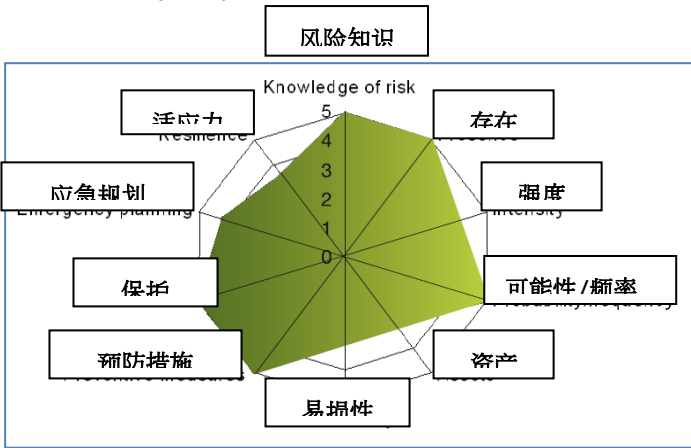
After completing the multi-hazard matrix, a graph can be prepared for each hazard source that visually represents the level of risk criteria (**Feil! Fant ikke referansekilden.3.1**). The graph is prepared using the numbers assigned during completion of the multi-hazard matrix, and the larger the surface area of the graph, the higher the risk and necessity to take prevention and mitigation measures. The graph is divided into three areas. The upper right part of the graph corresponds to the characteristics of the hazard (the presence, intensity, and probability/frequency). The lower part of the graph corresponds to the vulnerability of the community, including the assets exposed to the risk and the community's ability to resist or survive the hazard. The left hand side of the graph represents the risk reduction and control measures that a community can undertake. Assessment of the graphs for various hazards can help decision makers identify and prioritize risk prevention or mitigation measures.

多危险矩阵完成后，可针对每种危险源绘制多危险矩阵图，直观显示风险等级的不同等级（图 3.1）。多危险矩阵图采用多危险矩阵完成期间所使用的数据进行绘制，图中表面区域越大，则风险等级越高，越有必要采取风险预防和减缓措施。该图共分三个部分。右上方对应的是危险特征（存在性、强度及事故频发性或发生的可能性）。图表下部对应的是社区易损性，包括易受风险影响的资产以及社区抵御危险或免受危险影响的能力。图表左边显示的是社区可采取的风险降低措施、风险控制措施。针对各类危险对该图进行评估有助于决策者确定风险预防或缓解措施并决定其优先等级。

Figure 3.1 Multi-Hazard Matrix graph 图 3.1 多危险矩阵图



Source:UNEP(2010).



来源：UNEP（2010）

3.1.5 Lessons and suggestions for China

APELL in China APELL 在中国的应用

In China, the frequency of sudden environmental pollution accidents has increased with the increasing social and economic development as well as regional industrialization and urbanization. In the past decade, there have been a series of environmental accidents, and about 80% of the chemical accidents occur at SMEs. According to a national environmental risk survey conducted by the Ministry of Environmental Protection of China, the environmental safety situation in the country is serious and developing an enforcing environmental emergency management has become an urgent task (Shao et al, 2013).

随着社会经济以及区域工业化、城镇化的不断发展，中国面临着环境污染突发事件不断频发的严峻形势。过去十年中发生了一系列环境事故，其中 80% 的化学事故均发生在中小型企业。一项由国家环保部开展的全国环境风险调查显示，中国目前面临着严峻的环境安全挑战，开展强化环境应急管理因此变得尤为迫切(Shao et al, 2013)。

Recognizing the need for improvement, the Chinese government is introducing new environmental management tools, and Chinese industrial estates are exploring various tools as a means to mitigate environmental factors. Policy directives in China now encourage companies to individually tackle environmental management by implementing systems such as ISO 14001 Environmental Management Systems and procedures for cleaner production. At the enterprise level, there are currently several projects attempting to retrofit their industrial parks as eco-industrial parks. Eco-industrial parks are supposed to offer strategies that achieve greater efficiency through “economies of systems integration”, where partnerships between businesses meet common service, transportation, and infrastructure needs. ISO 14001 is becoming more attractive as an advanced tool for environmental management in industrial parks across China, and several industrial parks across China have already been certified (Geng and Hengxin, 2009).

认识到调整的必要性后，中国政府目前正在引入新型环境管理工具，与此同时，国内产业园区也开始研发各类减轻环境影响的工具。此外，国家颁布的各类政策性指令也鼓励企业通过执行 ISO 14001 环境管理体系，清洁生产的相关程序，独立进行环境管理。在企业层面，目前有一些项目正在尝试将其工业园区升级为生态工业园区。生态工业园应通过“经济系统集成”提供可大幅提高效率的相关策略。“经济系统集成”有利于企业通过合作实现其共同的服务、运输及基础设施需求。作为一种高级环境管理工具，ISO 14001 环境管理体系在国内工业园区中日益得到广泛应用。目前中国的一些工业园区已通过相关认证（Geng and Hengxin, 2009）。

Starting in 2006, Dow Chemical (Zhangjiagang) Company Ltd. took the initiative to form a partnership between UNEP, the Chinese Ministry of Environmental Protection (MEP) and the Company, under the APELL programme. The focus was on safer production and emergency preparedness for the chemical sector in China. The program officially ran from 2008-2010. A pilot project was implemented in Yangtze River International Chemical Industry Park in Zhangjiagang City, Jiangsu province, containing more than 80 companies. In addition to a coordinated effort to outreach to local companies in the Park, the Steering Committee of the pilot project also organized an international seminar in Beijing in 2009, and hosted a study visit to Houston in 2010 to learn from US safety management and emergency preparedness systems in place at Dow Chemical's site in Freeport, Texas. The first training workshop took place in Zhangjiagang in 2010, attended by approximately 80 participants from across the region. Panelists provided presentations on current capacities in China, including examples of best practices. The workshop provided in depth sessions on drill planning and preparation. The project is regarded as a success and UNEP is replicating it in other locations in Asia, Latin America

and Africa<sup>66</sup>. Researchers from Tsinghua University Responsible Production and APELL Center (UNEP) Department of Chemical Engineering, Tsinghua University were involved in the pilot project, as well as researchers from Renmin University.

自 2006 年开始，陶氏化学（张家港）有限公司率先在 APELL 计划之下与 UNEP 及中国环保部建立了合作关系。其核心在于确保中国化工行业的安全生产与应急准备能力。该项目自 2008 年正式启动，2010 年顺利完成。试点项目在位于江苏省张家港市的扬子江国际化工园区进行，总共涉及 80 多家企业。除协助相关企业与园区内当地企业建立联系外，试点项目工作委员会还于 2009 年在北京组织了一场国际研讨会，并于 2010 年举办了一次前往休斯顿的考察访问，向位于德克萨斯州弗里波特市的陶氏化学学习美国现有的安全管理及应急准备体系。首届培训研讨会于 2010 年在张家港市举行，整个地区约有 80 人参加了此次会议。与会专家针对中国目前所具备的相关能力进行了介绍，包括一些最佳实践案例。此外，研讨会还就应急演练计划及其准备进行了深入讨论。作为一个成功案例，该项目被 UNEP 复制到亚洲、拉丁美洲及非洲的相关地区。参与该试点项目的人员还包括来自清华大学化学工程系，清华大学负责生产与 APELL 中心（UNEP）以及人民大学的相关研究人员。

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<sup>66</sup> Dow Private Sector & Aid for Trade Case Study: Promoting Safer Operations & Emergency Preparedness in the Value Chain of the Chemical Sector

<http://www.oecd.org/aidfortrade/48367173.pdf> 陶氏企业与贸易援助案例研究：促进化工行业价值链安全运营与应急准备 <http://www.oecd.org/aidfortrade/48367173.pdf>

## 3.2 Industrial parks: Risk management in European chemical parks 工业

### 园欧洲化工园区的风险管理

In this case we see how European chemical parks have been organized and handle the issue of risk management, and what the challenges are compared to a traditional industry site operated by a single company. The text is based on EPSC (2004).

在这个案例中我们将了解欧洲化工园区的组织模式、风险管理方式以及其与单一企业运营之下的传统工业基地相比所面临的挑战。该文本的内容基于 EPSC (2004) 而编制。

A chemical park could be defined as a site accommodating several chemical companies which are legally separate entities. The infrastructure and a variable range of services are provided by the largest chemical company on the site (the major user) or by one (or more) independent infrastructure companies. A chemical park is similar to an industry park, but an industry park also consists of companies from other industry sectors.

化工园区可以被定义为一个可容纳若干独立的化工企业法律实体的场所。由该场所内规模最大的化工企业（主要使用者）或由一个或多个独立的基础设施企业负责提供相关基础设施及一系列相关服务。化工园区类似于园区，但是工业园区同时还包括来自其他行业领域的相关企业。

### 3.2.1 Introduction 引言

#### 3.2.1.1 From traditional chemical sites to chemical parks 从传统化工场地至化工园区

From their beginnings in the mid-19th century through to the middle of the 20th century, the development of chemical sites has been characterized by a tendency towards increasing size. This is because larger sites offer:

从 19 世纪中期开始一直到 20 世纪中叶，化工场地发展中最为显著的一个特点在于其规模一直在不断地扩大。这是因为规模较大的场所可以确保：

- Economies of scale 规模经济
- The ability to make optimal use of energy by bringing several production facilities together 通过联合若干生产企业实现能源最优利用
- The opportunity to share materials, make optimal use of the byproducts of chemical reactions, and set up shared treatment and disposal facilities for waste gases, waste water and solid waste 资源共享，实现化学反应副产品最优利用，以及针对废气、废水、固体肥料建立集中处理设施的可能性
- Reduced land use and optimal transport connections. 减少土地利用并优化运输连接



For these reasons, numerous large chemical sites grew up around the world. Generally, they were each owned by a single company. They were self-sufficient in terms of the services required for their core chemical production activities.

基于上述原因，世界各地建立起了大量的大型化工产业基地。通常来说，这些产业基地分别归单一企业所有。其核心化工生产活动所需的相关服务均为自给自足。

The concept of a site run by a single company was largely retained when chemical companies began to adopt a more decentralized strategy in the 1970s and 1980s. There was a trend towards the formation of largely independent business units. This trend became more pronounced as globalization took hold during the 1990s. In many instances, service functions were outsourced or handed over to independent companies. Sites which had previously been owned by one company and operated under a single management structure became chemical parks. In some cases, this progression was actively driven. In others, it was accepted as a side effect of outsourcing, and sometimes it went completely unnoticed (EPSC, 2004).

当化工企业自 20 世纪 70 年代至 80 年代开始采用更为分散的策略之后，由单一企业运营化工场地的这一理念在很大程度上保留了下来。当时很大程度上独立的业务单位正在形成。20 世纪 90 年代全球化占主导地位，由此使得这一趋势变得尤为凸显。在许多情况下，相关服务功能外包或移交给独立的企业。以往由单一企业所有，处于单一管理结构运营之下的化工场地转变为化工园区。在一些案例中，这一演变是积极推动的产物。而在其他一些案例中，这被看作是外包所产生的负面影响，有时未被注意到 (EPSC, 2004)。

### 3.2.1.2 Many benefits from gathering chemical companies in parks 化工园区内企业的优势所在

The benefits of chemical parks are particularly relevant when it comes to matters of safety, security and emergency management. However, the transition from one owner who is responsible for the entire site to several companies which are legally independent but closely linked in terms of their use of premises, materials and energy can be challenging.

化工园区的优势与安全与应急管理问题尤其相关。然而，从负责整个基地的唯一业主转型为法律上独立但实际上在办公场所、资源及能源使用方面存在密切联系的若干企业本身面临着严峻的挑战。

The environmental planning strategy of relocating plants and/or gathering them in industrial parks can have large beneficial effects. By organizing an industrial park more like an ecosystem, where materials are reused or recycled for other purposes, the park reduces its environmental impact further. This is the idea behind so-called eco-industrial parks (e.g. Kalundborg in Denmark). What makes this environmental strategy especially interesting is the fact that it can also be economically profitable. This is one of the most

important requisites for detangling economic growth from environmental damage (sustainable development).

厂房迁移与将其统一安置于产业园区内这一环境规划策略可以产生巨大效益。通过将工业园区作为生态系统进行规划，对资源进行重复利用或回收利用，用于其他目的，园区进一步降低了其对环境的影响。这就是所谓的生态工业园区（如丹麦的凯隆堡）所蕴藏着的深层理念。使得这一环境策略变得如此耐人寻味的原因即在于其潜在的经济效益。这是从环境损害中识别经济增长趋势（可持续发展）最为重要的必需品。

A wide range of different chemical parks has been developed as a result of their differing histories and the different entrepreneurial concepts applied by operators. Today, chemical parks in Europe cover the entire spectrum between (but not including) sites operated by a single owner and public industrial or trading complexes. This makes it difficult to come up with a good definition of a chemical park. One thing common to all chemical parks is the fact that they accommodate several chemical facilities in close proximity to one another. These facilities have different owners but share infrastructure which is usually provided by a third party, and they are usually fenced in.

基于各自不同的历史以及运营者所采用的不同的创业理念，各种不同的化工园区建立了起来。目前，欧洲化工园区覆盖了（但不包括）单一拥有者与公共工业、贸易中心运营之下的园区之间的整个区域。这就使得对化工园区的准确定义变得尤为困难。对所有化工园区而言，其共同特征在于-企业之间能够适应彼此需要的化工设备。这些企业从属于不同的所有者但共享着通常由第三方提供的基础设施，通常用围栏围起来。

More generally, an industrial park is an area that is zoned and planned for the purpose of industrial development. Moving plants and gathering them in industrial parks can have several beneficial effects. By gathering plants in a designated area, it is possible to concentrate the necessary infrastructure. This reduces business expenses and attracts new firms. Industrial parks are often located at a distance from residential areas in order to limit the environmental and social impact from the industry. By concentrating plants in one area it might also be easier to limit the environmental damages from the industry.

一般来讲，工业园区是为促进某一产业发展而分区、规划的特殊区位环境。将厂房统一迁移至工业园内可带来一些积极影响。将厂房统一迁移至一个指定区域有利于实现必要基础设施的集中管理。由此不仅可以减少企业开支还可吸引更多新的企业。工业园通常会与居民区保持一定的距离，以此限制其对环境、社会所造成的影响。此外，将所有厂房统一集中到一个区域也更易于实现相关环境损失的最小化。

There are also organizational benefits from gathering firms together. The clustering of firms can have a synergetic effect. This means that the firms will improve their performance because they learn from each other, cooperate and find solutions they

would not have if they were operating separately. The short “mental distance” between the firms is one of the reasons they are able to cooperate and continue to develop linkages between the firms.

除此之外，将企业集中起来对于组织层面也有一定的积极影响。企业集群这一模式有助于实现协同效应。这意味着企业可以通过互相学习，相互协作，并寻求解决方案而不断提升自身业绩。而这些解决方案是其独立运营所无法实现的。企业间不断缩短的“心理距离”是确保他们进行合作并不断建立联系的原因之一。

By collaborating in an industrial park companies can co-organize their efforts. This shift in focus can be very fruitful because the emphasis is placed on the combined effectiveness of all the processes involved, instead of the effectiveness of a single process. This focus at the system level is part of what makes industrial parks effective. The companies have developed large and stable waste streams between industrial processes, and in that way minimized transaction costs of discarding and supplying products in another manner.

通过在工业园内进行协作，各企业能够更好地发挥各自的作用。这一重心转移具有特别重要的意义，原因在于其强调的是所有流程的整体效率而非某个单一流程的效率。将重点放在系统层面，是促进工业园有效运营的部分原因。企业在两种工业流程之间建立了大规模且稳定的废物流，并在此基础上降低产品报废与产品供应所产生的交易成本。

The move to make industrial parks more environmentally friendly will give the businesses a better reputation. There is a lot of literature on the effects of branding. Promoting and building a brand for the company is an important part of a successful business. By joining an eco-industrial park, the companies gain a better reputation. By improving their environmental practice they also improve their standing in the public eye.

建立环境友好型工业园这一举措将为企业赢得更好的声誉。市场上有大量的关于品牌化影响的著作。推广并建立品牌是成功企业的一个重要组成部分。加入生态工业园，企业将有机会获得更好的声誉。同时，通过完善其环境实践，企业也可提升自身在公众心目中的地位。

### 3.2.1.3 Various types of parks 各类型园区

It can be distinguished between four types of chemical parks: 化工园区可分为以下四类：

- Major user parks 主要使用者园区
- Closed parks 封闭式园区
- Open parks 开放园区
- Regional clusters 区域集群

#### Major user parks 主要使用者园区

Parks of this type have a single company operating large parts of the production facilities and the infrastructure. This company is often also the owner of the land. The “major user” plays a dominant role, particularly in matters relating to environment, health and safety (EHS), and sets most of the rules on the basis of its economic strength. The other user(s) has/have to follow these rules as a condition for using the site.

此类园区中，由一个单一企业负责管理绝大多数生产设施及基础设施。该企业通常为土地所有者。“主要使用者”起主导作用，尤其是在涉及环境、健康与安全（EHS）的问题上，同时负责基于其经济实力制定绝大部分规则。其他使用者必须依据这些规则对场地进行利用。

In terms of EHS management, this park model is very similar to that of the traditional site, although there are some clear legal differences because of the presence of at least 2 different operators. This model is often also the first step when a traditional site is opened up to become a chemical park.

就 EHS 管理而言，该园区模式非常类似于传统化工场地的管理模式——尽管由于涉及至少 2 个不同的运营方，使得两者之间存在一些明显的法律差异。通常来说，这一模式也是建立传统化工场地，将其转变为化工园区的首要步骤。

### **Closed parks 封闭式园区**

Closed parks are managed by an infrastructure company which is legally independent of the users of the chemical park. What distinguishes a closed park from a major user park is the fact that none of the companies operating in the park exert a dominant influence on the infrastructure company or on the management and development of the park as a whole. The infrastructure company usually coordinates cooperation between the companies operating in the park, and this cooperation is particularly strong in the area of EHS. There is a shared risk management strategy, the perimeter of the park is fenced, and access by third parties is controlled.

封闭式园区由一个基础设施企业负责管理。该企业与化工园区使用者在法律上是独立的。非公开园区与主要使用者园区的区别在于园区内的企业均不会对上述基础设施企业或是园区整体的管理与发展产生显著影响。上述基础设施企业通常负责协调园区内企业间的合作关系，此类合作在 EHS 领域尤为密切。非公开园区确立了一种共享风险管理策略，对园区覆盖范围进行了划分，不允许任何第三方擅自进入。

The infrastructure company performs its services in a more competitive environment than in the major user park model. However, some of the services provided by the infrastructure company have to be taken up by all park users. This applies in particular to emergency management, security, waste water treatment (including the sewage system), pipe networks, power supplies, and the like. The infrastructure company therefore has a relatively strong position and sometimes takes on the role of site manager in relations with the outside world.

与主要使用者园区模式相比，上述基础设施企业在非公开园区内履行其职能更具有挑战性。由该企业所提供的一些服务必须由园区内所有使用者共同分享。这主要涉及应急管理、安全、废水处理（包括污水系统）、管道系统、供电等等。因此，该企业拥有相对重要的地位，有时作为园区管理者负责与外界进行联系。

### Open parks 开放式园区

Open parks are characterized by the fact that cooperation between the various companies operating in the park and the infrastructure company is comparatively loose. There are relatively few rules applying to the park as a whole. As a result, the individual operators have greater freedom but also greater responsibility. In contrast to a public industrial complex, there is a private infrastructure company (sometimes several). However, these companies see themselves as service providers rather than site managers. In this type of park, major elements of EHS, such as emergency response and security, are no longer managed centrally but are instead handled by the individual companies.

开放式园区的特征在于，园区内各类企业与基础设施企业间的合作相对松散。园区整体上所采用的规则相对较少。因此，个体经营者在拥有更多自由的同时也肩负着更大的责任。与公共工业中心相反，开放式园区包括一家私营基础设施企业（有时为若干家）。但是，这些企业将自身视为服务提供商而非园区管理者。在此类园区中，诸如应急响应与安全一类的关键 EHS 元素不再集中管理，而是由私营企业负责管理。

### Clusters 集群

In some regions (e.g. Rotterdam), favorable framework conditions such as transport routes, water and power supplies have led to the formation of clusters of chemical sites, some of them more closely integrated than others. These clusters are not chemical parks in the strict sense of the term. However, some sites within the cluster may well qualify as chemical parks. The more closely infrastructures are shared, the more these clusters resemble chemical parks. They are an option for infrastructure companies to make specific use of the economy of scale. However, they are even more akin to public industrial complexes than are the “open” parks.

对一些地区（如鹿特丹港市）而言，良好的框架条件如运输路线及水电供应有利于形成化工场地集群，其中一些集群的联系要更为紧密。严格意义上讲，这些集群并不是化工园区。但是，集群内的一些基地足以被称之为化工园区。基础设施共享越紧密，则这些集群同化工园区间的差异就越小。对基础设施企业而言，这些集群为规模经济的充分利用提供了可能。同公开园区相比，集群更类似于公共工业中心。

#### 3.2.2 Principles 原则

Large chemical sites with many potentially hazardous facilities operating in close proximity to one another and interconnected by pipe networks **constitute an overall risk which may be greater than the sum of the hazards presented by the individual**

**facilities** (EPSC, 2004). Thus, this contains an element of **regional risk**, see chapter 1. **In chemical parks, there is nobody with direct responsibility for this overall risk.** The responsibility lies with all the companies operating in the chemical park. They have to **find ways of replacing the single management structure of the traditional site with appropriate cooperation arrangements between themselves.** The decisive issue at stake here is not whether the overall risk presented by a chemical park can be managed, but how the necessary cooperation should be organized. The legal framework conditions are a particularly important consideration here, since statutory EHS legislation in Europe does not recognize chemical parks as such.

一些彼此邻近且存在潜在危险的设施，通过管道系统相互连接，拥有此类设施的大型化工场地，其所构成的综合风险可能大于各个单独设施的各类危险的总和（EPSC，2004）。因此，这里涉及一种区域风险元素，见第 1 章。在化工园区内，不存在对此类综合风险直接负责的人员。园区内的所有企业共同对此进行负责。他们必须寻求相关解决方案，彼此间签订合理的合作协议，从而代替传统化工场地的单一管理结构。关键的决定性问题不在于能否对化工园区内存在的综合风险进行管理，而在于如何实现必要的合作。由于欧洲法定 EHS 立法中未将化工园区纳入此类情况，因此法律框架条件在这里构成了一个极为重要的因素。

The main difference between the traditional site and the chemical park is the fact that the site has a single operator, while the chemical park always has several (and often many) operators. It is to these operators legislation in both Europe and the US is addressed. Responsibility for the individual risks posed by the facilities on the site and for the overall risk now lies with several companies rather than just one.

传统化工场地与化工园区间的主要区别在于前者涉及一家经营者，而后者往往涉及多家（通常较多）。欧洲及美国的相关立法就是针对上述经营者而制定的。由此，由现场设施所产生的个体风险以及综合风险均由几家企业共同负责而非一家企业独立负责。

In some chemical parks installations owned and managed by separate companies may have a common control room etc. and might be run by operators from only one of the companies (possibly only during the night and weekend). Both for legal as for organizational matters such situations have to be recognized under national law. **It must be absolutely clear for the authorities and the operators who is responsible for the safe operation.**

一些由几家企业共同所有并管理的化工园区建立了共同的控制室，这些装置可能由上述企业中一家企业的经营者负责管理（可能仅在夜间、周末运行）。由于组织问题必须合法，因此这类情况必须依据国家法律进行确认。必须向负责安全运营的有关部门及经营者就此进行明确。

The common-sense principle whereby the party with actual control of a facility is the responsible operator generally allows responsibility to be clearly divided between the

companies present in the parks. However, individual cases must be assessed with reference to national law to examine the extent to which responsibility is carried through to the relevant parent companies. The clear assignment of all legal obligations to the individual operators means that their cooperation is particularly important, especially when it comes to managing the overall risk posed by the park. The EU Seveso II Directive offers some guidance on this matter, see below.

相关方在常识性原则的基础上对设施进行实际控制，这一原则为：责任经营者通常应允许在园区内企业中明确划分责任。但是必须依据相关国家法律对个别案例进行评估，考核相关母公司的职责范围。对个体经营者法律义务的明确分配意味着合作的重要性，这一重要性尤其体现在管理园区内综合风险的过程中。欧盟 Seveso 二号指令就此提供了一些指导性建议，具体见下文。

Operators of hazardous facilities may entrust an infrastructure company with obligations which they themselves have with regard to the overall risk posed by the site. A prime example of this is cooperation on emergency management.

危险设施经营者可将其涉及园区综合风险的相关义务委托给基础设施企业。其中一个典型范例就是针对应急管理进行合作。

In spite of this fragmentation of responsibilities in a chemical park, the individual operators do have some clear obligations when it comes to managing the overall risk posed by the site. **The key responsibilities of an operator include evaluating the risks which his facility may pose to its neighbors and the risks which neighboring facilities may pose to his own.** For both aspects the operator has to rely on information about or given by his neighbors. This makes cooperation between the companies operating in the chemical park unavoidable. Thus, considerable account is taken of the close proximity of chemical facilities, as is typical of chemical parks. The European Seveso II Directive specifically regulates this issue for facilities considered to be at higher risk (socalled “Domino-effect”, see below).

尽管化工园区存在职责的分散分配问题，但当需要对园区综合风险进行管理时，个体经营者仍对此负有明确说明的义务。经营者的主要职责包括对其企业可能会给其邻近企业带来的风险以及邻近企业可能给经营者企业本身带来的风险进行评估。就上述两方面而言，经营者均必须基于邻近企业自身的相关信息或邻近企业所提供的相关信息确定。这促使化工园区内的企业不可避免地进行合作。因此，必须高度重视化工设施间的邻近关系，这是化工园区的典型特征。欧盟 Seveso 二号指令中针对存在高风险的相关企业就这一问题做出了专门规定（“多米诺效应”，见下文）。

### 3.2.3 Approach方法

#### 3.2.3.1 The Seveso Directive and chemical parks Seveso指令与化工园区

The Seveso II Directive (see chapter 2) introduced the notion of the “establishment”. This is defined as *“the whole area under the control of an operator where dangerous*

*substances are present in According to article 8, “the competent authority ... identifies establishments or groups of establishments where the likelihood and the possibility or consequences of a major accident may be increased because of the location and the proximity of such establishments, and their inventories of dangerous substances”. If this is the case, the operators of these establishments are obliged to inform each other and cooperate with one another.*

Seveso 二号指令（见第 2 章）对“企业”这一概念进行了说明。指令中将这一概念定义为“经营者控制之下的存在危险物质的整个区域。依据第 8 条，‘主管部门.....识别企业或企业群体，由于此类企业所在的位置、与邻近位置关系及临近企业的危险物质的详细目录，其发生重大事故的可能性可能会增加，事故后果的风险也可能会增加’”。在这种情况下，这些企业的经营者有义务相互通知并相互合作。

Seveso II especially addresses **the domino effects (i.e. an accident in one plant starting a chain of accidents in neighboring plants)**, and requires that such risks, which are particularly important in industry parks, should be specified. The same holds for **developments that could increase the possible consequences of accidents or domino effects**. If the risks of domino effects are high, the concerned establishments are obliged to cooperate and exchange information. If any changes in the information provided occurs (i.e. an increase or decrease in the quantity of the dangerous substances or permanent closure), the operator of the establishment should make the responsible national authorities aware of these changes.

Seveso 二号指令专门用于处理连锁反应（如发生在一家工厂的事故引发临近工厂的一系列意外事故），并要求对工业园区内尤为重要的此类风险进行说明。这同样适用于可能增加事故或连锁反应潜在后果严重性的开发区。如果连锁反应风险等级较高，则相关开发区有义务进行合作并交流相关信息。如果所提供信息发生任何改变（如危险物质数量增加或减少，或信息永久失效），企业经营者应就相关调整内容通知有关国家监管部门。

The Seveso II Directive **does not specify exactly how the required cooperation between the companies operating in a chemical park is to be organized**. Companies should be strongly encouraged to conclude clear contracts between themselves, particularly when it comes to cooperation in the field of EHS.

Seveso 二号指令未明确说明如何实现化工园区内企业间的必要合作。应大力鼓励企业相互订立条款明确的合同，特别是涉及 EHS 领域的相关合作时。

### 3.2.3.2 Other regulatory approaches 其他监管方法

Provisions governing emissions control are in place in all chemical parks to protect neighbors outside the site. The protection of workers within the site from emissions of noise, odors and hazardous substances is separately regulated in occupational safety & health legislation. While emissions protection of third parties begins outside the fence of a traditional site, **neighboring companies in a chemical park may also qualify as**



**third parties in the legal sense of the term.** Extending the protective provisions which apply to “external neighbors” to “internal neighbors” would not be practicable in many chemical parks. Ideally, there should be a system whereby limit values for emissions of noise, pollutants and the like make a distinction between the employees of a company and its (external) neighbors. The assumption behind this system is that employees of a company are better able to deal with these hazards than external neighbors because they have personal protective equipment, are part of the emergency management system and have been given appropriate training. This situation can be replicated in chemical parks by making the appropriate protective equipment available to employees who need it, involving people in the emergency management system and training staff, including those from “nonhazardous” companies.

目前所有化工园区均已颁布了排放控制监管方面的规定，以此保护园区以外的邻近企业。为使区域内员工免受噪音、气味及危险物质排放的影响，单独制定了职业安全与健康法。尽管对第三方的排放保护首先针对的是传统化工场地围栏外的企业，但是从法律意义上讲，化工园区内的邻近企业也可以被看作是第三方。然而，将上述保护性规定从“外部邻近企业”扩展至“内部邻近企业”可能不适用于一些化工园区。理想情况下，应该建立一种体系，使噪音、污染物排放等限值在企业员工与（外部）邻近企业间区别开来。在这一体系之下，与外部邻近企业相比，企业员工能够更好地应对这些危险，原因在于他们拥有个人防护设备，是应急管理体系的一部分，同时还接受了相应的培训。化工园区可以复制这一模式，为相关员工配备一定的防护设备，将员工纳入应急管理体系并对其进行培训，包括来自“非危险”企业的员工。

As is the case with solid waste, one of the main advantages of both traditional sites and chemical parks is the fact that waste water from production processes can be treated in shared facilities. On a chemical site, the same company usually generates and processes the wastewater. In a chemical park, on the other hand, the waste water is usually generated by a different company than the one which treats it. Since the input of the various companies into the shared waste water treatment facility has a major influence on the performance of this facility and thus on the quality of the treated waste water, it is **very important to check that the correct licenses have been obtained from the authorities and that the contractual relationships between the companies generating the waste water and those treating it are appropriate.**

同固体废物一样，传统化工场地与化工园区共同的主要优势之一在于生产过程中产生的废水可以通过共享设施得到处理。就化工场地而言，同一企业通常在制造废水的同时又对其进行处理。另一方面，对化工园区而言，制造和处理废水的企业通常不是同一家。由于各类企业对共享废水处理设施的投入极大地影响着该设施性能的优劣，因此，应确保已处理的废水已通过有关部门的相关认证，且废水制造企业与废水处理企业间建立了相应的合同关系。这一点非常重要。

**Intrusion into chemical plants by unauthorized persons constitutes a potential major accident scenario.** In Europe, some countries have regulated this area specifically when transposing the Seveso II Directive into their national legislation. The

new shape of the threat of terrorism highlights the importance of dealing with the issue. Responsibility for preventing unauthorized access lies with the individual company. In closed chemical parks, this responsibility can be delegated to the company responsible for the security of the park.

未经允许进入化工园区的所有人员可能引发重大事故。一些欧洲国家在将 Seveso 二号指令纳入其国家立法中时，均对这一领域做出了具体规定。新形式的恐怖主义威胁强调了应对此类问题的重要性。由单独企业负责阻止外来人员未经许可进入园区。就封闭式化工园区而言，可以委托负责园区安全工作的企业履行这一职责。

When different chemical companies are networked in close proximity to one another on the same site, **it can be difficult to ascertain who is responsible if any contamination of the soil or groundwater is detected.** This fact must be borne in mind in any environmental assessment prior to moving into a chemical park and when concluding contracts between the individual companies, the infrastructure company and the owner of the land.

当同一园区内不同化工企业的办公场所呈网状分布时，在检测到土壤或地下水遭受污染时，很难确定相关责任人。因此，迁入化工园区前，私人企业、基础设施企业与土地所有者在签订合同时所做的任何环境评估必须将这一内容考虑进去。

Some regulations make use of safety distances to mitigate the consequences of process safety incidents, especially fire and explosion (see chapter 2 on the Seveso Directive). Usually, these distances have been determined to protect “external neighbors”. They may only partly or not at all be applicable inside the site, where other means to protect the workers are possible. As shown above these **safety distances may now be applicable to the “internal neighbors”, which may cause great problems in existing chemical parks.**

一些法规中设定了安全距离，以此减轻工艺安全事故的后果，尤其是火灾、爆炸所造成的后果（见 Seveso 指令第 2 章）。通常来说，安全距离的主要目的在于保护“外部邻近企业”。这种距离规定可能部分适用于化工园区或完全不适用，化工园区可通过其他方式对其员工进行保护。如上所述，此类安全距离规定目前可能适用于“内部邻近企业”，这些企业可能会对现有化工园区造成极大的负面影响。

When traditional sites become chemical parks, many services which were in the past performed internally are now provided by third parties. In legal terms, the service company is considered to be a third party company. This has consequences in terms of liability law, and may also have labor law implications. It must also be borne in mind that, unlike the various departments of one company on a traditional site, **the different companies operating in a chemical park can all be held fully liable for any consequences of major accidents and the like to other chemical park tenants.** It may be possible to limit this liability through private law arrangements, but the issue should in any case be discussed with the relevant authorities.

传统化工场地升级为化工园区后，以往的一些内部服务开始由第三方负责提供。在法律条款中，服务型公司被定义为第三方企业。就责任法而言，这一举措可能会产生一定的后果，也有可能触及劳动法。必须明确的是，不同于传统化工场地内企业的各部门，化工园区内的不同企业均可能需要就因重大事故及其他突发事件而对园区内的其他承租人所产生的任何后果承担全部责任。可以通过私法安排对此类责任进行限制，但是这一问题必须与相关部门进行协商讨论。

### 3.2.4 Tools 工具

Many years of experience with chemicalsites in Europe has shown that **such sites can be operated safely, in spite of the close proximity of and links between many potentially hazardous chemical facilities** (EPSC, 2004). The important issue is to pay careful attention to the legal framework conditions and in particular to conclude clear and robust agreements governing the required level of close cooperation between the partners in a chemical park.

尽管一些存在潜在危险的化工企业极其邻近或彼此间存在一定联系，但是欧洲化工场地的多年管理经验表明此类基地可安全运行（EPSC，2004）。关键在于时时关注法律框架条件，特别要签订明确且强有力的协议，对化工园区内企业间密切合作应达到的水平进行管理。

#### 3.2.4.1 Safety management安全管理

For safety management systems there could be a **conflict between the interests of global companies in particular and those of the site**. Global players, for whom EHS issues today often are very important, often put great emphasis on having a uniform global safety management system. They will normally only accept limitations to this if national legislation forces them to do so. However, **they usually try to design their global systems so that they comply with virtually all national requirements and rather attain higher standards than national laws demand** (EPSC, 2004).

就安全管理体系而言，跨国公司与园区内企业之间可能存在一定的利益冲突。当今的跨国企业通常都非常关注 EHS 相关问题，也十分重视全球性统一安全管理体系的建立。他们通常只在国家立法强制要求时，才会接受此类限制。但是，他们通常会设法建立相关全球体系，事实上，这些体系符合其所有相关国家规定，在满足国家法律要求的同时达到了更高的标准（EPSC，2004）。

The operators of a chemical park and the companies operating in it, on the other hand, are very keen that **the safety management systems of the chemical park partners should be as similar as possible**, and should at the very least be compatible. This is particularly the case in closed parks. These conflicting objectives are often solved by an analysis to determine which elements of the safety management system are more heavily company-related and which are more heavily site-related.

另一方面，化工园区经营者及园区内所有企业都认为园区内各合作伙伴所建立的安全管理体系应尽可能地相似，至少应该具备一定的兼容性。对封闭式园区而言，

尤应如此。这类目标冲突通常是通过分析来解决的，分析安全管理体系的哪些元素与企业的关系较为密切，哪些元素又与园区本身存在着密切联系。

### 3.2.4.2 Process safety 流程安全

Process safety is today strongly rooted in the culture of most companies and depends heavily on the technology it uses (EPSC, 2004). In many cases, global companies organize process safety at central rather than local level. **Different process safety management systems** are therefore often in place in chemical parks where various companies operate. Such differences **mostly cause no problems that cannot be dealt with.**

目前，流程安全在很大程度上取决于多数企业的文化以及这一过程中所采用的相关技术（EPSC，2004）。多数情况下，跨国公司选择在中央层面而非地方层面确保流程安全。因此，通常会针对各类企业所集中的化工园区制定不同的流程安全管理体系。这类差异所引发的问题通常来说都是能够得到处理的。

A problem would arise if there were differences in safety standards. Chemical park users with (apparently) lower safety standards would be called upon by the public and the authorities to achieve the (apparently) higher standard of other users. An incident caused by one chemical park company would bring all the chemical park users into difficulties, either directly because of the consequences of the incident on neighboring facilities, or indirectly because the public often fails to distinguish between “good” and “bad” chemical park partners in such cases. Although avoiding adverse reactions by the media is not the prime focus of process safety, it should be considered that an incident could therefore also deal a hefty blow to the image of the “good” companies (EPSC, 2004).

安全标准方面的差异有可能导致一些问题的产生。公众及相关部门会要求安全标准级别（明显）较低的化工园区使用者达到其他使用者所设定的级别（明显）较高的相关标准。由一家园区企业所引发的安全事件会使得所有园区使用者陷入困境，这可能涉及由事件波及邻近企业而产生的直接影响，或由于公众无法判别所有园区使用者的好坏而产生的间接影响。尽管流程安全的重点不在于极力避免因媒体所带来的不良影响，但是还应考虑到此类安全事件可能使得企业的良好形象遭受沉重打击（EPSC，2004）。

This shows that **there are no uniform safety standards imposed in the chemical industry, but rather a “best practice” that is being developed and implemented over time through daily practice.** It also shows the **importance of public awareness and inspections by the authorities** to push safety standards towards best practice.

这表明化工行业不存在强制性统一安全标准，只存在通过日常实践日积月累而形成的“最佳实践”。同时也体现了公众意识及权威监管部门的重要性，是他们促使安全标准不断发展成为最佳实践。

This again demonstrates that chemical park partners need to have intensive contact in the area of process safety. In addition to the information exchange requirements regarding process risks and safety measures laid down for e.g. “domino establishments”, such contact also promotes an exchange of experience and ultimately should bring overall process safety management up to a higher level. Companies which operate in several chemical parks would be well positioned to evaluate this additional input on a cross-site level.

此外也表明化工园区内合作伙伴有必要就流程安全事宜进行密切合作。除已确立的有关流程风险与安全措施的信息交流要求外（如多米诺设施），这类合作也有利于促进经验交流，最终将使综合流程安全管理达到更高水平。而且，这也有助于同时在多个化工园区进行运营的企业实现正确定位，从跨园区角度对这一额外投入进行评估。

### 3.2.4.3 Emergency management应急管理

Contrary to process safety, **emergency management is heavily site related**. In principle, **responsibility for minimizing the effects of major accidents lies with individual operators**. Thus, in the first instance, all operators of facilities in a chemical park need to create an appropriate emergency management system for themselves. **If the domino effect provisions apply to them, they have to coordinate their risk prevention measures together**. If these provisions do not apply and/or the operators do not cooperate on a voluntary basis, the obligation to ensure coordination in the event of major incidents affecting more than one operator lies with the public emergency response body. This creates numerous interfaces between different organizations which are difficult to manage in an emergency (EPSC, 2004).

与流程安全相反，应急管理主要取决于园区本身。原则上，由个体经营者负责尽可能地减少重大事故的影响。因此，首先，化工园区内所有设施运营者需要各自建立合理的应急管理体系。如果连锁反应规定对其适用，则他们必须相互协调风险预防措施。如果上述规定对其不适用或经营者不愿进行合作，则当重大事故发生且影响到一个以上的经营者时，由公共事件应急响应机构负责进行协调。这使得不同组织间的联系日益紧密，在突发事件发生时难以进行管理（EPSC，2004）。

**The majority of chemical parks with a hazard potential above a certain level have therefore developed a shared emergency services**. This is often drawn up by the infrastructure company. **At the heart of this system lies a site fire brigade responsible for the entire chemical park**. As well as eliminating many interfaces, a shared emergency service for a chemical park is considerably more efficient and cost effective than having several emergency services paid for by different companies. **The emergency response is improved because of far shorter response times and emergency services which know the premises perfectly**. There is also observed a fall in the cost of fire protection equipment and insurance premiums because of a shared emergency service.

为此，绝大多数存在潜在危险（超过一定等级）的化工园区开发出了相应的共享应急服务。这些服务通常由基础设施企业负责提供。这一体系的核心在于其纳入了园区消防队这一概念，园区消防队负责整个化工园区的火灾防控。与多家企业共同为一些应急服务项目买单相比，化工园区内的共享应急服务除了能降低沟通成本外，还会更为高效且更具成本效益。通过极力缩短应急响应时间并确保应急服务更好地适用，应急响应水平得到了提高。与此同时，共享应急服务也使得消防器材与保险费的成本降低。

For higher risk (“upper-tier”) establishments as defined under the EU Seveso II Directiveshared emergency services is useful to handle the coordination work required to avoid domino effects. **Smaller or less hazardous chemical parks may rely partly or completely on the emergency services of a nearby municipality.** In this case it is important to clearly define the interfaces between public emergency services and the chemical park. The preferred option is to maintain a joint emergency management for all chemical park partners.

对欧盟 Seveso 二号指令中定义的较高风险（较高级）企业而言，共享应急服务有助于其处理必要的协调工作，避免发生连锁反应。小型化工园区或是危险等级较低的化工园区可能在一定程度上依赖于或完全依赖于周边市区所提供的应急服务。在这种情况下，则很有必要明确定义公共应急服务与化工园区之间的接口。其中一个首选措施就是保持园区内合作伙伴间的联合应急管理。

All in all, it can be concluded that **the overall risk posed by a chemical park can be managed by a shared emergency service in more or less the same way as it can in a traditional site.** Deviations from these best practice arrangements may be legally permissible.

总而言之，可以得出这样的结论：化工园区所构成的综合风险可以通过共享应急服务的方式进行管理，这种方式或多或少与传统化工场地相同。与上述最佳实践之间所存在的偏差是法律上所允许的。

#### 3.2.4.4 Security安全

Hazardous chemical facilities regulated by the EU Seveso II Directive need to be provided with **reasonable protection against unauthorized access.** Anyhow, **it is in the interests of every company to protect itself against criminal attack** such as theft, vandalism and illegal demonstrations. A chemical park with its various facilities, pipe networks and numerous transport operations is in any case a dangerous place for anyone present on the site without proper training. The various companies and activities in a chemical park will pose varying degrees of risk. In addition to chemical facilities, the site will usually feature administrative buildings, mechanical workshops, warehouses, canteens and the like.

对于欧盟 Seveso 二号指令中所规定的危险化工设施，应确保其在未经授权的情况下，严禁使用。无论如何，保护自身免受盗窃、破坏公物、非法示威活动等犯罪行为

为的影响符合所有企业的利益。总之，对园区内未经培训的任何人员而言，一个配备各种设施、管道系统且涉及众多运输业务的化工园区就是一个充满危险的场所。园区内的各类企业及其相关活动均可能构成各类不同等级的风险。除化工设施之外，园区内通常还建有行政大楼、机修车间、仓库、餐厅等建筑。

The security objectives could very well be achieved through decentralized measures such as fencing off the individual hazardous chemical plants, protecting workshops and office buildings from access by unauthorized persons and otherwise allowing access to the rest of the site. However, this solution, which is typical of public industrial estates, does not deal with the hazards posed by the pipe networks and road/rail transport operations usually found in a chemical park. Moreover, in many cases, such a system would considerably increase the security outlay.

通过采取分散式措施能够更好地实现相关安全目标，这些措施包括隔离存在危险隐患的化工厂，禁止未经授权的人员进入车间与办公大楼，允许进入园区内其他区域。但是，由于这一解决方案适用于公共工业园区，无法应对化工园区内由管道系统及公路、铁路运输业务所构成的危险。此外，在许多情况下，这一体系将使得安全经费大幅增加。

**A better solution is perimeter fencing of the site and controlled access through gates. Once a park is protected in this way, internal security measures need only be applied to a few particularly hazardous or sensitive areas,** such as safety-critical control rooms, areas where hazardous biological materials are used etc. A park sealed off in this way will be at least partially exempt from the strict legal provisions applying to the transportation of hazardous goods on the public roads.

较好的一个解决方案是在园区内修筑围栏并通过园区大门限制人员出入。通过采用这一方法对园区进行保护，就可以将内部安全措施专门应用于一些特别危险或敏感的区域，如关键安全控制室，涉及危险生物材料的区域等。通过这一方式封闭起来的园区将至少在一定程度上免受严格的公共道路危险品运输的相关法律条款的约束。

Moreover, companies which pose only a small potential hazard may not readily agree to apply heavy restrictions to their outside contacts. One solution may be to operate less strict external controls and to compensate for this by applying additional security measures to the most hazardous or vulnerable areas. **When chemical parks are planned it is a good idea to separate areas with different hazard levels.** Some of the chemical parks which have grown up over time do attempt to achieve this (EPSC, 2004).

此外，仅仅构成较低潜在危险等级的企业可能很难在严格限制其外部联系方面达成一致。其中一个解决方案可能就是放松外部控制并通过将其他安全措施应用于最为危险或最为脆弱区域对此进行弥补。对于已制定相关方案的化工园区而言，将各区域按不同的危险等级进行划分不失为一个好办法。一些不断发展起来的化工园区都在努力实现这一目标（EPSC，2004）。

### 3.2.4.5 The problem of “internal neighbors”“内部邻近企业问题”

The European regulations (e.g. the Seveso Directive) treat neighboring companies in a chemical park generally in the same way as neighbors outside the fence. This means that **safety buffer zones which have to be maintained for the protection of external neighbors under various legal provisions must in principle also be observed inside the chemical park.** This applies in particular to operations involving substances which present a risk of explosion, and also to emission limits for noise and hazardous chemicals.

欧洲法规（如 Seveso 指令）中，对待化工园区内邻近企业的方式基本上与对待园区外邻近企业的方式如出一辙。这意味着保护外部邻近企业的安全缓冲区必须被保留，原则上也必须在园区内部加以体现。这尤其适用于存在爆炸风险的相关物质的操作以及噪音、危险化学品的排放控制。

Safety buffer zones may be necessary to comply with noise emissions limits. They are also required to control exposure to hazardous chemicals when the effects of operating malfunctions cannot otherwise be contained with sufficient certainty. In these cases, the traditional site is at an advantage, since it can be safely assumed that all the employees of a chemical company, even if they work in offices or workshops, are subject to a single hearing protection and emergency management system and are therefore better able to cope with noise and emergencies than their neighbors on the other side of the fence. These conditions are also met by many chemical parks, which certainly undermine the reasoning for applying safety buffer zones in the same way as for external neighbors.

安全缓冲区有必要同噪音排放控制保持一致。当故障影响无法充分确定时，安全缓冲区应避免接触危险化学品。在这种情况下，传统化工场地具有一定的优势，原因在于其能够有把握地假定化工企业的所有员工（即使是在办公室或车间工作的员工）均配备了听力保护装备与应急管理体系，因此能够比围栏另一边的邻近企业更好地应对噪音影响与突发事件。一些化工园区也满足这些条件，这必定不利于外部邻近企业以相同方式申请安全缓冲区。

In chemical parks with a more “open” organizational structure and a greater mix of industrial sectors, it is more difficult to defend “normal” insite safety buffer zones. In the majority of chemical parks which developed out of earlier traditional industry sites, the distances between the individual companies are usually fixed and any changes would involve considerable and usually prohibitive expense. In such cases, **there is a need to work with the competent authorities to identify measures (such as a shared emergency management system) which can be implemented to compensate for non-compliant safety buffer zones.**

对于组织结构较为开放且涉及更多工业门类的化工园区而言，很难维持区域内安全缓冲区的正常运行。对于多数在早期传统工业场地上发展起来的化工园区而言，私营企业间的距离通常是固定的，任何改变都将导致大量的、通常令人望而却步的巨



额开支。在此情况下，需要与相关部门进行合作，确定相关措施（如共享应急管理体系），并在此基础上对不符合规定的安全缓冲区进行补偿。

#### 3.2.4.6 Inspections/Audits检查/审计

The inspections of hazardous facilities which the authorities are required to carry out (for example under Article 16 of the EU Seveso II Directive) **are primarily aimed at the individual operator**. However, operators may transfer a large proportion of their legal obligations to contractors, whom they must carefully select and monitor. In such cases the authorities will check that the operator's selection and monitoring of the contractors is acceptable and that the contractors fulfill the legal obligations with which they have been entrusted.

有关部门需要对危险设施进行检查（如欧盟 Seveso 二号指令第 16 条下相关条款），检查的主要对象为个体经营者。然而，此类经营者往往将其法定义务的绝大部分转移给相关承包商，经营者必须慎重选择承包商并对其进行监管。在此情况下，相关部门将确认经营者对承包商的选择及监管是否符合规定，承包商是否履行了相关法律义务。

In chemical parks **operators normally transfer a large number of tasks to the infrastructure company. It is therefore wise for the authorities and any other auditors to perform careful checks of the services carried out by the infrastructure company**, even if this company would not usually fall under the inspection rules. Checks on the operators (who are the actual subject of the inspection regime) would then be limited to ensuring that the various tasks given to the infrastructure company are properly regulated by contract, that the relevant interfaces are properly managed and that the operators are appropriately monitoring the services provided by the infrastructure company (EPSC, 2004).

化工园区内的相关经营者通常会将大量工作任务转移至基础设施企业。因此，相关部门及任何其他审计师最好能够对基础设施企业所提供的相关服务进行谨慎核查，即使该企业通常不在检查范围之内。随后对于经营者（检查制度下的实际对象）的检查将局限于以下几个方面：确保移交给基础设施企业的所有工作任务均在合同中做出了明确规定；相关联系均得到了妥善处理；经营者对基础设施企业所提供的服务进行了有效监管（EPSC, 2004）。

#### 3.2.4.7 Cooperation and decision-making structures in chemical parks化工园区的合作决策结构

Cooperation and coordination between chemical park users and the infrastructure company in managing overall risk and in ensuring the smooth day-to-day running of the park calls for coordination and rules for decision making. **It is not possible to run the chemical park properly without a minimum of common rules**. Such regulations are a fundamental condition for operating in a chemical park. **They should cover issues**

**such as safety and emergency management**, and should specify the services which have to be bought in from the infrastructure company.

只有有效的协调和决策规则方能确保化工园区使用者与基础设施企业就综合风险管理及确保园区正常、平稳运行进行协调合作。**最低限度的通用规则缺失，则化工园区就无法正常运行。**这类法规是运营化工园区的基本条件，其中应包括安全、应急管理等事项，同时还应该对必须向基础设施企业购买的相关服务进行详细说明。

Coordination and decision-making bodies are also required to deal with day-to-day issues and the ongoing development of the chemical park. The decision-making powers which these bodies have and the way that they arrive at decisions differ from park to park. Such bodies can also be a valuable forum for the exchange of experience in the area of EHS.

负责协调与决策的相关机构也需要处理化工园区内的日常事务以及与园区目前发展有关的相关事宜。这些机构所拥有的决策权及其决策的方式因园区而异。这类机构也可以被看作是一个重要的平台，用于提供 EHS 领域的经验交流。

### 3.2.5 Lessons and suggestions for China 对中国的启示和建议

China has for many years been embracing the idea of industrial parks in general and chemical parks in particular, and a growing number of new chemical parks are being set up. As the evidences from such parks in Europe prove, they can balance both economic development and environmental protection.

多年来，中国一直支持建立一般意义上的工业园以及具有特殊意义的化工园区，目前，中国正在建设越来越多的新型化工园区。来自欧洲园区的证据表明，化工园区能够确保经济发展与环境保护之间的平衡。

However, as have been illustrated above, there might be some **challenges when organizing these parks when it comes to taking care of environment, health and safety issues**. A special challenge in Europe has been that the regulations are focusing on traditional industry sites, and are generally not targeted at regulating industry parks. Even if the regulatory approach in China may be different, there should be some lessons to learn from the European experiences. Some lessons could be:

但是，如上所述，当涉及环境、健康与安全问题时，这类园区的建立可能会面临诸多的挑战。欧洲所面临的一个特殊挑战是：相关法规的重点不在于传统工业场地，其目的通常也不是为了对工业园进行监管。尽管中国的监管方法可能有所不同，但是仍然需要从欧洲的实际经验中吸取一些教训。这些教训可能包括：

- **Ensure that comprehensive risk assessments are carried out.** This is an important basis for considering what actions to take to reduce environmental

(and health & safety) risks (mostly acute risks), both for new and existing parks.

- **确保进行综合风险评估。**无论对于已有园区还是新型园区而言，这都是采取相应措施降低环境（以及健康与安全）风险（主要为严重风险）的重要依据。
- **Ensure clear rules and responsibilities for safety and emergency management.** This is utterly important for efficient handling of an incident or accidents like fire or explosion, and thus to reduce the damage risk.
- **确保安全与应急管理规则清晰，职责明确。**这对于有效应对火灾或爆炸等突发事件、从而降低损坏风险而言至关重要。
- **Ensure sufficient internal emergency preparedness to mitigate damages from accidents.** This will depend on the size and type of the park, the distance to residential areas, possibilities of cooperation with local, outside emergency systems like fire brigades etc.
- **确保做好充分的内部应急准备以减轻事故危害。**这取决于园区的规模与类型，与居民区之间的距离，与地方、外部应急系统（如消防队）进行合作的可能性等。
- **Ensure safety distances to residential areas.** When developing new industrial parks these should be located in areas with a sufficient distance to residential and similar areas where people live and work, to minimize the damage risk if accidents should occur.
- **确保与居民区之间的安全距离。**建立新的工业园时，园区应位于与居民区或类似区域（人们生活和工作的区域）保持足够距离的相关区域，以便在事故发生时尽可能地降低损害风险。

The details in the organization and management of the industry park, including how to organize and run the EHS operations, should be left to the local management to decide. The authorities should ensure that systems and functions are properly taken care of. See also the Lessons and suggestions in chapter 2 under the sub-chapter on the EU Seveso Directive.

有关工业园组织与管理的细节，包括如何管理、运营相关 EHS 业务的相关事宜均应由地方管理部门负责决定。相关部门应确保对相关体系及功能进行有效管理。另请参阅欧盟 Seveso 指令分章下第 2 章中所涉及的经验教训和建议。

### **3.3 Integrated River Basin Management in the transnational Rhine River Basin – regional risk management and follow-up of the EU Water Framework Directive**      《跨国莱茵河流域综合流域管理》— 区域风险管理和《欧盟水框架指令》后续行动

#### **3.3.1 Introduction** 引言

The Rhine is one of Europe's longest rivers at about 1,233 km<sup>2</sup> and the Rhine river basin covers nine European countries. It is one of Europe's busiest and economically most important waterways. The Rhine begins in the Swiss Alps and flows north-northwest until it empties into the North Sea in the Netherlands (ref. map in figure 3.2), with an average annual discharge of more than 2,000 m<sup>3</sup>. The river catchment area covers about 200,000 km<sup>2</sup> in nine countries, with a population of 58 million. The Rhine mostly flows through Germany (it is the longest river in Germany), and parts of the central stretch of the river basin also cover France, Belgium and Luxembourg. In the upper part of the river basin, mountain rivers in Austria, Liechtenstein and Italy also feed into the river basin.

莱茵河是欧洲最长的河流之一，面积约为 1233 平方公里。莱茵河流域横跨欧洲九个国家，是欧洲航运最繁忙且经济上最为重要的水路之一。莱茵河发源于瑞士境内的阿尔卑斯山脉，流向西北，最后在荷兰附近注入北海（参考图 3.2 中的地图）。多年平均流量达 2000 立方米以上。莱茵河下游区域面积约为 20 万平方公里，覆盖九个国家，人口总数达 5800 万。莱茵河主要流经德国（是德国最长的河流），流域中央河段同时还流经法国、比利时、卢森堡。在流域上游，流经奥地利、列支敦士登及意大利的山区河流也同样流入了莱茵河流域。

The Rhine is one of the most important rivers in Europe, having been a vital and navigable waterway carrying trade and goods from the North Sea and deep into the centre of the European continent for the last two thousand years. Many castles and fortifications along the Rhine testify to its importance as a historic waterway. In the Middle Rhine, the Rhine Gorge is a stretch of the river known for more than 40 castles from the Middle Ages, vineyards and many quaint country villages. The Rhine Gorge became a UNESCO World Heritage Site in 2002. In the lower part of the river basin, the Rhine turns west and enters the Netherlands, where it merges with the rivers Meuse and Scheldt and forms the extensive Rhine-Meuse-Scheldt delta, one of the largest river deltas in Western Europe.

莱茵河是欧洲最为重要的河流之一。两千年来，一直作为重要的通航水道，将贸易和货物从北海一直输送到欧洲大陆中部。莱茵河沿岸的一些城堡及防御工事体现了它作为一条具有历史意义的航道的重要性。位于莱茵河中游的莱茵河谷段是莱茵河的一个河段，莱茵河以 40 多座中世纪城堡、葡萄庄园以及众多古朴的村庄而闻名。莱茵河谷于 2002 年被列入联合国教科文组织（UNESCO）世界遗产。在流域下流，莱茵河向西一拐，最终进入荷兰，与默兹河和斯凯尔特河汇合，形成泛莱茵河-默兹河-斯凯尔特河三角洲——西欧最大的河流三角洲之一。

The Rhine is used for navigation (with a navigable stretch of 825 km), hydropower production, industry (abstraction and discharge), municipal water management (wastewater treatment and rainwater), agriculture, drinking-water supply, flood protection and for leisure. The interventions of humans over the last 150 years to adapt the water and river systems to different user functions have had serious consequences for the ecological and hydro-morphological resilience of the river system. In the Upper Rhine alone (the stretch between Basel in Switzerland and Bingen in Germany), the loss of 88% of the floodplains between 1817 and 1970 significantly increased flood risk and the potential for related damage downstream (Huitema & Meijerink, 2009).

莱茵河的服务领域涉及航海（通航里程达 825 公里）、水力发电、工业（采掘与排放）、城市水资源管理（废水处理和雨水）、农业、饮用水供应、防洪以及休闲。过去 150 年间，人类通过人为干预使供水系统与河川系统适应于不同的用户功能，由此对河川系统的生态、水形态恢复力造成严重后果。仅就莱茵河上游（瑞士巴塞尔与德国宾根间的河段）而言，1817 年至 1970 年间损失了 88% 的洪泛平原，由此使得洪水风险以及下游相关潜在危害均显著增加（Huitema & Meijerink, 2009）。

One of the world's highest densities of plants and factories can be found along the Rhine, where we find six main industrial centres with chemical industry, petrochemical industry, refineries, cellulose industry, rubber industry, food industry, textile industry, electrical industry, metal- and car production, and shipyards. Industry has been a major source of water pollution in the Rhine since industrialization began. Most plants and factories are concentrated along the lower Rhine (North Rhine-Westphalia), where the river passes the major German cities of Cologne, Düsseldorf and Duisburg. This is the most important chemicals industry region in Germany, with more than 400 chemical plants (NRW, 2013). Duisburg is the home of Europe's largest inland port and functions as a hub to the Dutch seaports of Rotterdam, Antwerp and Amsterdam. The Ruhr River joins the Rhine at Duisburg. The Ruhr region is the largest urban area in Germany with a population of about 8.5 million and the third largest urban area in the EU. The Ruhr region was Germany's main industrial zone during the early 1900s, with heavy industry based on coal and steel leading to massive pollution to water and air until the mid-1980s. The Rhine was at that time known as "the open sewer of Europe" (ICPR, 2004).

莱茵河沿岸分布着世界上密集度最高的厂房和工厂，同时还有 6 个主要工业中心，覆盖化工、石油化工、精炼厂、纤维工业、橡胶工业、食品工业、纺织工业、电气工业、金属制造与汽车制造以及造船厂等领域。工业化以来，工业成为了莱茵河水

污染的主要来源。绝大多数厂房与工厂都集中在莱茵河下游（北莱茵-威斯特伐利亚），此处莱茵河流经德国的主要城市科隆、杜塞尔多夫、杜伊斯堡，是德国最为重要的化学工业区，有 400 多个化工厂（NRW, 2013）。杜伊斯堡拥有欧洲最大的内陆港口，是连接荷兰海港鹿特丹、安特卫普、阿姆斯特丹的枢纽。鲁尔河在杜伊斯堡汇入莱茵河，鲁尔河地区系德国最大的城区，人口约为 850 万，同时也是欧盟第三大城区。20 世纪初期，该地区为德国主要工业区，以煤炭和钢铁为基础的重工业导致大规模的水污染和空气污染，这一状况一直持续至 20 世纪 80 年中期。莱茵河在当时被称为“欧洲开放的下水道”（ICPR, 2004）。

The Sandoz chemical spill in Switzerland in 1986 became a wake-up call and raised awareness of severe environmental risks. A fire burnt down the Sandoz agrochemical storehouse in Schweizerhalle, releasing toxic agrochemicals into the air and 10-30 tons of pesticides into the Rhine, turning it red and killing most of the aquatic life downstream. Within two weeks after the spill, the Rhine countries unanimously adopted the Rhine Action Programme (1987-2000) to save the ecosystems of the Rhine River. The programme led to reduction of water pollution from industrial and municipal point sources and “resulted in an improvement of Rhine water quality nobody [had] imagined [to be possible]” (ICPR, 2001). In the Ruhr area a combination of stricter environmental controls, technological and process innovation in polluting industries, restructuring of industry towards service industries and high technology, and clean up measures (such as reforestation of brownfields) cleaned up the environment. The once heavily polluted Ruhr River today provides the region with drinking water. Smaller rivers in the Ruhr-area, such as the Emscher, are however still marked by the high-pollution industrial legacy of the region. In the Rhine river basin as a whole, the river today provides drinking water to about 30 million people (ICPR, 2009).

1986 年，瑞士山德士化学品泄漏事件敲响了警钟，提高了人们对于严重环境风险的意识。一场大火烧毁了位于史威查豪尔的 Sandoz 农用化学品仓库，使得有毒农药释放到空气中，10-30 吨农药流进莱茵河，使河水颜色变红，毒死了河流下游的大部分水生生物。泄漏事件发生后两周内，莱茵河沿岸国家一致通过了《莱茵河行动计划》（1987-2000），以此拯救莱茵河内的生态系统。该计划的实施降低了来自工业与市政的水污染，“使得莱茵河水质提高到令人难以想象的程度”（ICPR, 2001）。鲁尔河地区通过采取一系列措施，将较为严格的环境控制与工业污染、涉及服务行业与高科技的行业重组方面的技术与流程创新以及清理措施（如棕地的绿化）相结合，对环境进行清洁。往日污染严重的鲁尔河如今可以为这一地区提供洁净的饮用水。鲁尔河地区较小的河流如埃姆舍河现在仍然遭受着该地区高污染这一工业遗产所带来的严重影响。总体而言，莱茵河目前可为大约 3000 万人口提供饮用水（ICPR, 2009）。

International cooperation goes far back in the Rhine river basin. Already in 1815 an international agreement was made between the river basin countries to ensure free shipping, and a central committee with members from the different countries was established. As a response to increasingly unsustainable pollution, the International Commission for the Protection for the Rhine (ICPR) was established in 1950. Increasing

problems related to flooding, led to the creation in 1968 of the International Commission for Research on Floods on the River Rhine. In the following decades transnational cooperation was developed further under the framework of the European Union (with directives addressing different aspects of river basin management, ref. figure 2.1) and continued efforts at the river basin level. Inspired by the success of the Rhine Action Program, the Rhine countries in 2001 launched the “Rhine 2020” program with concrete targets for further improvement of ecosystems, flood prevention, water quality and groundwater. The program also included a list of measures to be implemented before 2005.

莱茵河流域的国际合作可以追溯到很久以前。早在 1815 年，流域沿岸国家就为确保免费船务而相互间签订了一份国际协议，与此同时还成立了一个中央委员会，其成员来自不同国家。为应对日益不稳定的污染形势，1950 年成立了保护莱茵河国际委员会（ICPR）。为解决日益严重的与洪水相关的问题，1968 年成立了莱茵河洪水研究国际委员会。随后几十年，跨国合作在欧洲联盟框架下进一步发展（有关流域管理不同方面的指令，参考图 2.1），并在流域层面做出了不懈努力。在《莱茵河行动计划》成功的启示下，莱茵河沿岸国家于 2001 年启动了《莱茵河 2020 行动计划》，提出了需要进一步完善的具体目标，其中涉及生态系统、防洪、水质与地下水。与此同时，项目还包含了一系列措施，计划于 2005 年前实施。

The Rhine ministers noted that the goal and scope of the “Rhine 2020” and the WFD requirements overlap and that the measures proposed will serve both targets at the same time. Since 2000, EU’s Water Framework Directive (WFD, ref. chapter 2 above) with mandatory environmental targets and a timeline and methodology of implementation, has provided the framework for integrated river basin management in the Rhine.

沿岸国家负责管理莱茵河的部长们注意到，《莱茵河 2020 行动计划》的目标及范围与 WFD 要求存在重复部分，而且所提出的措施可同时达到二者所设定的目标。自 2000 年起，《欧盟水框架指令》（WFD，参考前述第 2 章）就制定了莱茵河流域综合管理框架。该指令包括一些强制性环保目标以及实施期限、实施办法。

### **Box 3.1 Learning from Sandoz: Prevention of Accidents and Security of Industrial Plants**

### 框 3.1 从 Sandoz 化学品泄漏事件吸取经验：事故预防和工业工厂安全

The fire and chemical spill near Basel in Switzerland in 1986 for several days immobilised drinking water production plants and fishery along the Rhine right downstream to the Netherlands, a distance of more than 1 000 kilometres. The incident triggered the Rhine Action Programme and one of the first priorities was the handling of dangerous substances which, due to an accident, might get into water bodies, as well as the security of industrial plants (the cause of the fire was never established and there have been speculations about sabotage).

To begin with, the ICPR inventoried warehouses and production plants in the Rhine catchment and issued recommendations concerning the "Prevention of accidents and the security of industrial plants". This included **fire safety regulations**, designed to avoid fires, to prevent them from spreading by taking adequate measures of construction and to avoid resulting damage by providing storage facilities for fire extinction water. Concerning the **licensing process for plants in which accidents are liable to occur**, the ICPR recommended close cooperation between the authorities, applicants (industry), citizens concerned and associations, with a view to improving the prevention of accidents.

The recommendations included a number of requirements:

- All recipients receiving dangerous substances must be equipped with **overflow safety devices** which automatically interrupt the filling process or which trigger off an audible alarm.
- **Pipelines** receiving substances dangerous for the water environment must be impermeable and resistant and must be unmistakably identified.
- Industrial plants must construct **retention systems** including collection tanks etc. in case of leakage and accidents.
- Substances, a mixture of which can be dangerous (for example explosive), may **not be stored together**. Large amounts of burnable materials must be stored apart.
- **Waste water split flows** isolating industrial waste water, rain water and cooling water are recommended. Waste water should be avoided or minimized, e.g. with the help of closed circuits.
- During the **transfer of goods** from ships, lorries or railway carriages to warehouses or vice versa, dangerous substances must not be allowed to flow into water bodies.
- On site, the **surveillance of industrial sites** must allow timely detection if dangerous substances are accidentally released.
- **On site plans of alert** must contain a precise list of safety measures in case of accidental spills.

Links to the guidelines and the Warning and Alert Plan for the Rhine are provided in chapter 3.3.4. below.



1986 年瑞士巴塞尔附近的火灾和化学品溢漏事件造成莱茵河沿岸及下游至瑞士超过 1000 公里范围内的饮用水生产工厂和渔场停止运营数日。该事件引起《莱茵河行动计划》的通过，使得危险物质的处理成为一项重中之重的工作。危险物质由于事故可能污染水体并危害工业工厂安全（未确定火灾起因，有怀疑认为是人为破坏）。

首先，ICPR 盘点了莱茵河流域的仓库和生产工厂并发布“事故预防和工业工厂安全”的相关建议。这包括**消防安全法规**，旨在预防火灾，通过在建筑方面采取适当措施阻止火灾蔓延，以及通过提供灭火用水贮藏设备避免造成损害。对于事故易发的工厂的执照核发程序，ICPR 建议核发机构、申请人（工业）、有关市民和协会采取紧密合作，着眼于增强事故的预防。

建议包括一些要求：

- 所有受危险物质影响的人须配以**溢流安全装置**，以自动阻断扩散过程或引起音响报警。
- 受水环境危险物质影响的管道须牢固且不可渗透，不能出现辨认错误。
- 工业工厂须建**助流系统**，包括收集槽等，以防事故和泄漏
- 对于混合起来可能造成危险（比如爆炸）的物质，**不能将它们储存在一起**。大量可燃材料须分开储存。
- 建议使用将工业废水、雨水和冷却水隔离开的**废水分流**。废水应避免或减少，例如：通过封闭式水流。
- 在将船、卡车或火车车厢的货物转移到仓库或将仓库中的货物转移到船、卡车或火车车厢时，不能允许危险物质流入水体。
- 在现场，工业场地监督须允许**及时检查**以发现是否有危险物质意外释放。
- **在现场，警报计划**须包含一旦意外泄漏发生采取的安全措施的精确清单。

关于莱茵河的导则链接和《提醒和报警规划》在以下第 3.3.4 节会有介绍。

### 3.3.2 Principles**原则**

Over time the management of the Rhine River has gradually come to represent the principle of Integrated River Basin Management (also referred to as integrated water resource management). **Integrated river basin management including environmental targets is a form of regional environmental risk assessment and management, as it deals with a spatial scale that includes multiple habitats with multiple sources of stressors affecting multiple endpoints.** The Global Water Partnership (founded in 1996 by the World Bank, UNDP and SIDA) defines IRMB as “the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems.”

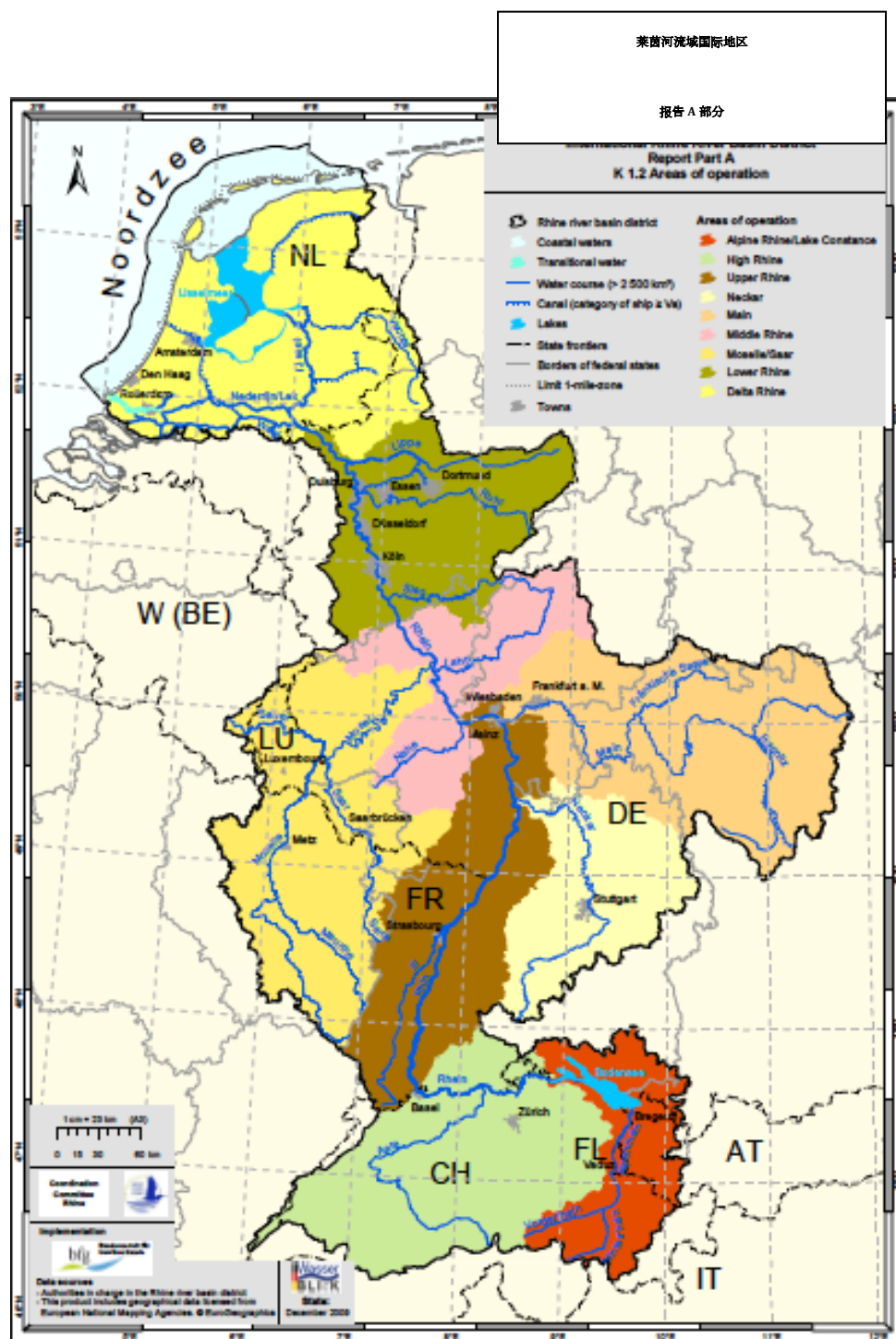
经过一段时间后，莱茵河的管理重心逐渐过渡到“流域综合管理”（也称作水资源综合管理）这一原则。包括环境目标在内的综合流域管理是一种区域环境风险评估和管理，因为它对包含多种栖息地的空间规模进行风险评估，在这些栖息地中压力源影响多个端点。全球水伙伴组织（1996年由世界银行、UNDP、SIDA共同创立）将IRMB定义为“在指定流域内跨行业协调水资源、土地及相关资源的保护、管理与发展的过程，在保护、恢复（必要时）淡水生态系统的同时，实现由水资源所带来的经济社会效益的最大化”。

Since 2000, the WFD has provided the framework for the coordinated effort of the Rhine countries, setting environmental targets and establishing a stepwise process to reach these targets. The principles of the WFD are described in detail in chapter 2 above.

自2000年以来，WFD已制定了莱茵河沿岸国家协调努力框架，设定了相关环境目标并建立了实现这些目标的分段步骤。有关WFD原则的详细内容，请参阅前述第2章相关内容。

Figure 3.2 Map of the 9 river basin districts within the Rhine river basin

图 3.2 莱茵河流域内 9 大流域地区区域图



Source: ICPR (2009)来源：ICPR（2009）

### 3.3.3 Approach方法

Implementing the WFD in a river basin of the scale of the Rhine river basin provided significant challenges related to coordination and distribution of work. On the positive side, international cooperation about river basin management already existed in the area and trust and shared successes (ref. the Rhine Action Programme) had already been established. In order to ensure a coordinated and consistent implementation of the WFD between the nine countries in the river basin, a Rhine Coordination Committee with representatives of the nine states was established to take the overall decisions required. The committee draws on The International Commission for the Protection of the Rhine (ICPR), which coordinates the practical work between the Rhine countries to ensure integrated and sustainable management of the Rhine river basin.<sup>67</sup>

在莱茵河流域这样一条颇具规模的流域实施 WFD，对相关协调分配工作提出了重大挑战。从积极方面看，这一区域早就有了有关流域管理国际合作的先例，同时也早已在这方面取得了可靠且可分享的相关成就（参考《莱茵河行动计划》）。为了确保 WFD 在该流域内九个国家间的协调、统一实施，成立了莱茵河协调委员会，该委员会由来自上述九个国家的代表共同组成，旨在就相关问题做出整体决策。同时，通过与保护莱茵河国际委员会（ICPR）合作，履行其相应职责。ICPR 主要负责协调莱茵河沿岸国家间的实际工作，以确保莱茵河流域的综合、可持续管理。

Due to the size and complexity of the river basin district, the Rhine Coordination Committee decided in one of its first meetings to split the management plan for the Rhine river basin into **two levels**: An Overriding Part A covering the whole river basin, and subordinate B parts with detailed plans for nine sub-basins of the Rhine river. The Overriding Part A of the management plan covers the main network of water bodies in the Rhine, defined as those with a catchment area of >2,500 km<sup>2</sup>. It is concerned primarily with the major water management issues that affect the entire river basin district, such as biological river continuity, reduction of pollution, and harmonisation of water uses (navigation, energy production, flood protection, regional land use planning) with environmental objectives. The Rhine Coordination Committee and representatives of all the states concerned draft this part jointly.

由于流域地区覆盖范围过大且存在一定的复杂性，因此莱茵河协调委员会在其首届委员会第一次会议中决定将莱茵河流域管理规划分为**两个部分**：A 最重要部分覆盖整个流域；B 从属部分详细列出了涉及莱茵河九大次流域的相关规划。管理规划 A

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<sup>67</sup> The ICPR website is available here: <http://www.iksr.org/index.php?id=192&L=3> Note that it also contains a video presentation of the Rhine and international cooperation with Chinese subtitles:

<http://www.iksr.org/index.php?id=376&L=3>

ICPR网址：<http://www.iksr.org/index.php?id=192&L=3> 需要说明的是以下网站中还包含了一个有关莱茵河与国际合作的视频演示（配有中文字幕）：<http://www.iksr.org/index.php?id=376&L=3>

最重要部分涵盖了集水区>2,500 km<sup>2</sup> 的莱茵河主要水体网络。主要集中在解决与水资源管理相关且可能对整个流域地区造成影响的重大问题，包括生物河流连续性、减少污染以及水资源利用（航海、能源生产、防洪、区域土地利用规划）与相关环境目标间的和谐。莱茵河协调委员会及其所有相关国家的代表共同起草了这一部分。

The B Parts of the management plan consists of nine plans, covering nine areas defined by natural features and in most cases covering territories of several countries. The nine areas are the Delta Rhine, the Lower Rhine, Moselle/Saar, Middle Rhine, Main, Neckar, Upper Rhine, High Rhine, and Alpine Rhine (ref. map in fig. 3.2). Each of the nine regional management plans are developed by representatives of the countries and institutions involved. Four of the regions are upstream regions (Moselle/Saar, Neckar, Main, Alpine Rhine), and management plans for these regions can thus largely be developed independently. For the downstream regions the situation is more complex as they need to take into account the influence from the upstream regions. Coordination at a detailed level is therefore often necessary between different regions and is facilitated by ICPR. In addition, the cooperation of all state parties in developing the overall management plan (the Overriding Part A management plan) also contributes to ensure coordination on overall issues. Different countries also have national management plans.<sup>68</sup>

管理规划 B 部分中共包含九大方案，涉及按自然地物定义的九个区域，多数情况下覆盖若干国家的领土。上述九个区域包括：莱茵河三角洲、下莱茵河、摩泽尔河/萨尔河、中莱茵河、美因河、内卡河、上莱茵河、高莱茵河以及阿尔卑斯莱茵河（参考图 3.2 中地图）。上述九大区域管理规划均由相关国家及机构的相关代表负责编制。由于其中四个地区为上游区（摩泽尔河/萨尔河、内卡河、美因河、阿尔卑斯莱茵河），因此有关这些地区的管理规划在很大程度上可独立进行编制。然而，下游区的情况就较为复杂，因为这些地区还需要将来自上游区的影响考虑在内。这就往往使得不同地区间有必要进行具体协调，ICPR 主要负责促进相关协调工作的开展。此外，所有缔约国就综合管理规划（A 最重要部分，管理规划）进行合作也有利于确保就整体问题进行协调。不同国家也相应制订了各自的国家管理规划。

### 3.3.4 Tools工具

The first requirement of the WFD was to make an **inventory** of the Rhine river basin (ICPR, 2004), in order to establish a baseline. The WFD sets the targets of Good

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<sup>68</sup> The overriding management plan, the nine regional management plans and the national management plans are all available here: <http://www.iksr.org/index.php?id=171&L=3> Note that with the exception of the overriding management plan, most of the management plans are only available in local languages such as German, French or Dutch.

有关最重要管理规划、九大区域管理规划以及国家管理规划的详细内容，请登录网址<http://www.iksr.org/index.php?id=171&L=3>需要说明的是，除最重要管理规划外，多数管理规划只是供当地语言版本，如德语、法语或荷兰语。

Ecological Status (for natural water bodies) or Maximum Ecological Potential (for artificial or heavily modified water bodies), which means that only a slight deviation from what may be considered a natural reference condition is allowed. In order to establish the natural reference conditions, the **typology** of the main stream of the Rhine was identified and extensively presented in a separate report (ICPR, 2005). Based on the inventory and the establishment of environmental targets, the **management plans** (ICPR 2009) were developed, with the aim to improve the status of water bodies in line with the goals of the directive.

WFD 的首要要求为列出有关莱茵河流域相关事项的**详细清单**（ICPR, 2004），以此建立基准线。WFD 针对“良好的生态状态”（针对天然水体）或“最大生态潜力”（针对人工或大幅度改造的水体）设定了相应目标，仅允许同自然参考条件存在轻微偏差。为了创立相关自然参考条件，对莱茵河干流类型进行了确定并将其完整地写入了另一份报告（ICPR, 2005）。由此，**管理规划**（ICPR, 2009）在上述详细目录及环境目标设定的基础上编制完成，目的在于依据相关指令目标改善水体状况。

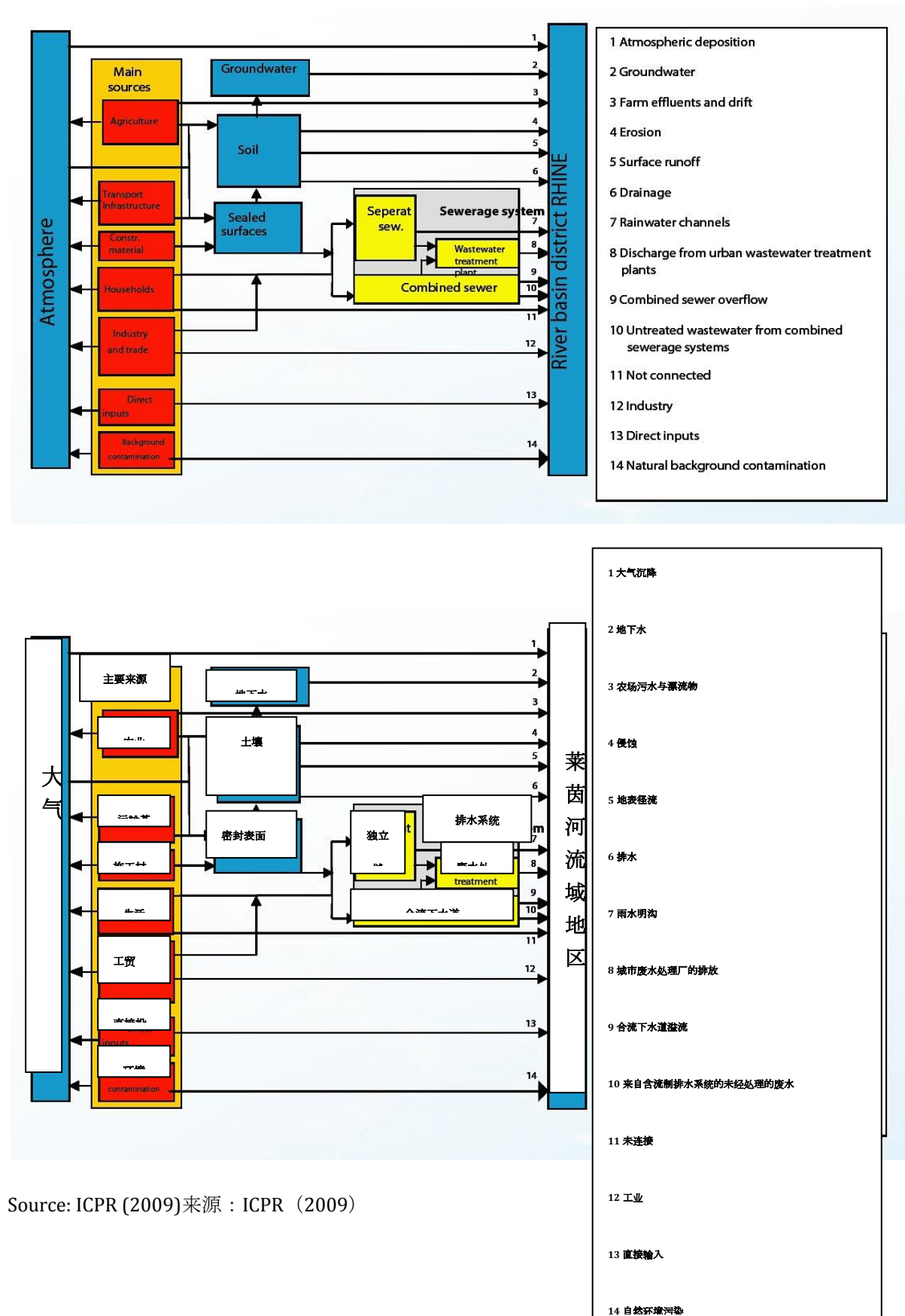
In accordance with the requirements of the WFD, the management plan provides a **general description of the characteristics of the river basin district in question, a summary of significant anthropogenic pressures, maps over relevant areas of special protection in the river basin (drinking water areas and Natura 2000 areas), a list of the environmental objectives for the different types of water bodies in the river basin district, a map of the relevant monitoring networks that are in place, and summary of the programmes of measures, including the ways in which the mandated objectives are thereby to be achieved.** This constitutes an example of regional environmental risk assessment. We can only here provide examples of the analyses made and have chosen aspects we believe are of particular interest in the Chinese context.

依照 WFD 相关要求，管理规划中对有问题流域地区的区域特征进行了整体描述，对相关重大人类活动压力进行了总结，针对流域内受到特殊保护的相关区域（饮用水区及 Natura 2000 自然保护区）绘制了地图与此同时还涵盖了流域内地区内不同类型水体的环境目标清单，现有监测网络地图，以及有关措施计划的总结，包括实现规定目标的途径。这包括一个区域环境风险评估的范例。在此，我们仅提供相关分析示例，选取了一些我们认为可能会对中国产生影响的方面进行阐述。

The inventory pointed at the need to still focus on reducing the influence of **pollution** agents and to address and reverse the “unnatural” character of large parts of the river.

依据上述详细目录，仍然需要将重点放在减少**污染**因子的影响，解决并扭转河流大部分区域当前的“非自然”状况。

**Figure 3.3 Emission pathways for determining the pollution pathways of surface water bodies** 图 3.3 决定表面水体污染方式的排放途径





Nitrogen pollution was not considered a limiting factor on a local scale, but plays an important role at the overall level as it is a significant source of coastal water pollution and thus affects the ability to reach environmental targets there. Only some of the 33 Priority Pollutants and 8 Other Pollutants<sup>69</sup> explicitly referred to in the WFD were found to be problematic in the Rhine: Phtalates, phenols, brominated diphenylethers, diuron, isoproturon, hexachlorobenzene, polycyclic aromatic hydrocarbons and tributyltin. These were considered to be largely remnant of former inputs or of diffuse origin.

就局部范围而言，氮污染不构成限制因素，但由于它是沿海水污染的一个重要来源，因此总体而言发挥着重要的作用，同时也对实现环境目标的能力产生一定的影响。就莱茵河而言，仅发现 WFD 中明确指出的 33 种优先控制污染物与 8 种其他污染物中的一些污染物存在问题，包括：邻苯二甲酸酯、酚类化合物、溴化二苯醚、敌草隆、异丙隆、六氯苯、多环芳香烃及三丁基锡。这些污染物主要是以往输入或面源的残余物。

The inventory noted that 88% of the water bodies of the Rhine River were heavily modified or artificial with the character of the river banks and its bottom, the interaction between the river and its alluvial area and free fish migration being “seriously affected”. Re-establishing more **natural conditions** and free fish migration, for instance with the help of fish ladders were considered crucial to improve the ecological state. The inventory also points to the loss of natural flood retention areas from straightening and diking the river (see figure 3.4 below), as increasing flood risks. In the inventory it is estimated that an extreme flood along the Rhine may cause damages of up to Euros 165 billion.

上述详细清单显示，莱茵河 88% 的水体为大幅度改造或具备河堤及其河底特性的人工水体，河流自身与其冲积区间的互相作用以及不受约束的鱼类回游均受到了“严重影响”。重新创造更为**自然的环境**并恢复鱼类回游（如采用鱼梯）对于改善生态状况起着至关重要的作用。此外，目录中也指出了由矫直河流、河流筑堤而导致的自然蓄滞洪区消失（见下图 3.4），将其看作是一种与日俱增的洪水风险。据估计，莱茵河沿岸的特大洪水可能造成的损失可达 1650 亿欧元。

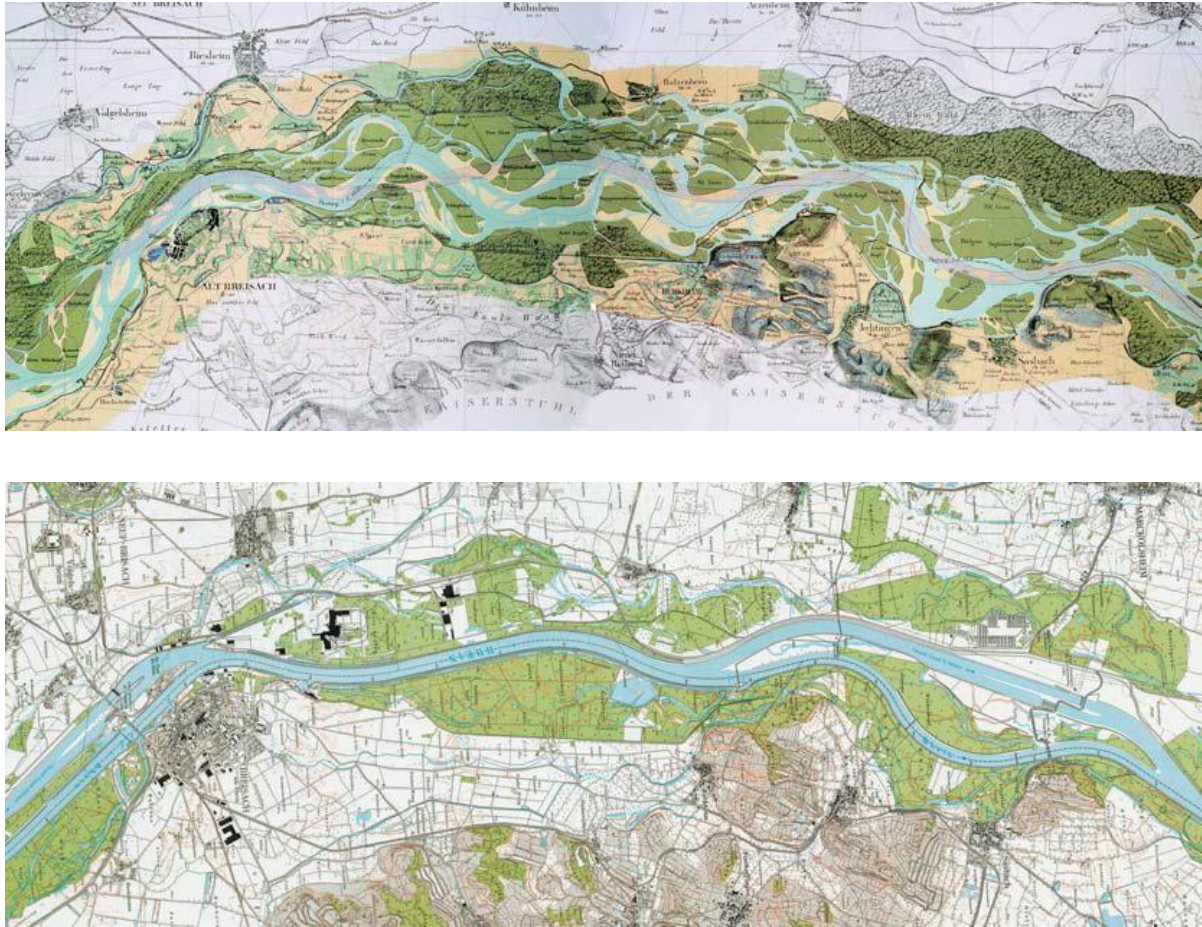
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<sup>69</sup> The full list is available here: [http://ec.europa.eu/environment/water/water-framework/priority\\_substances.htm](http://ec.europa.eu/environment/water/water-framework/priority_substances.htm) 完整清单地址 [http://ec.europa.eu/environment/water/water-framework/priority\\_substances.htm](http://ec.europa.eu/environment/water/water-framework/priority_substances.htm)



**Figure 3.4 The Rhine at Breisach, in 1838 (natural) and 1980 (modified)**

**图 3.4 1838 年（天然）与 1980 年（改造后）的 Breisach 段莱茵河**



Source: ICPR (2004). In 1838 the Rhine River still freely moved through the floodplain at Breisach, where it topped the banks and changed its river bed dynamically. Today it is forced into a fixed bed and deprived of its natural dynamics.

来源：ICPR（2004）。1838 年，莱茵河仍可自由地穿过位于布莱萨赫的泛滥平原，当时，在布莱萨赫，莱茵河地势高出河流两岸，使其河床发生了巨大的改变。而今，莱茵河被迫形成了固定的河床，也丧失了其往日自然的流动活力。

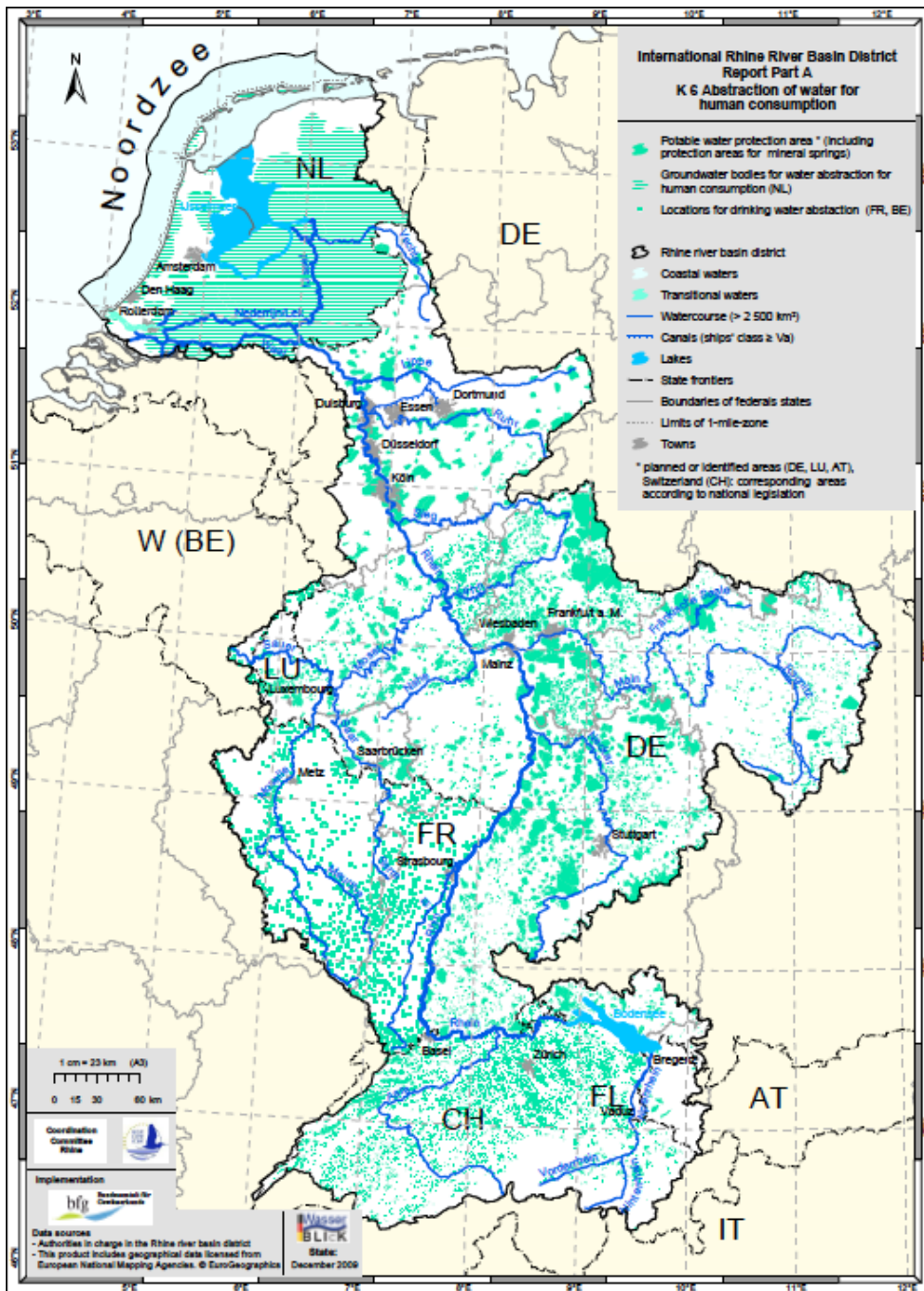
The management plan provided a **register of protection areas** in the river basin, with high resolution maps for the distribution of protected drinking water sources (ref. figure 3.5), as well as Natura 2000 areas for the protection of flora, fauna and birds (ref. chapter 2 about the Habitats Directive). This is especially important to address locally concentrated environmental risk. The total surface area of Natura 2000 sites in the Rhine river basin that are dependent on water was estimated to approximately 19,000 km<sup>2</sup> (about 10% of the total river basin).

管理规划提供了一份有关流域内各保护区的记录，其中包括涉及受保护饮用水源分布（参考图 3.5）以及 Natura2000 动植物、鸟类自然保护区分布（参考第 2 章中

《欧盟栖息地指令》相关内容）的高分辨率图。这对于应对局部地区较为集中的环境风险非常重要。据估计，莱茵河流域内依靠水源存在的 Natura 2000 自然保护区的总表面积大约达到 19000 平方公里（约为流域总面积的 10%）。

Figure 3.5 Water supply zones in the Rhine river basin

图 3.5 莱茵河流域供水区



莱茵河流域国际地区

报告 A 部分

Source: ICPR (2009)来源：ICPR（2009）

The management plan incorporates the requirements to fulfil EU's **Drinking Water Directive** (98/83/EC), concerning the quality of water intended for human



consumption. The Drinking Water Directive protects human health by laying down healthiness and purity requirements. Member States have the obligation to establish **water supply zones** and adequate monitoring programmes in accordance with the minimum requirements set in the directive (Article 7 and Annexes II and III).<sup>70</sup> The directive lays down the essential quality standards at EU level: A total of 48 microbiological, chemical and indicator parameters must be monitored and tested regularly. In general, World Health Organization's guidelines for drinking water and the opinion of the Commission's Scientific Advisory Committee are used as the scientific basis for the quality standards in the drinking water. The directive also requires providing regular information to consumers and in addition drinking water quality has to be reported to the European Commission every three years. The Commission assesses the results of water quality monitoring against the standards in the Drinking Water Directive and after each reporting cycle produces a synthesis report, which is made public.

此外，管理规划中还包含了履行欧盟《饮用水指令》（98/83/EC）的相关要求，主要涉及人类饮用水的水质问题。《饮用水指令》通过制定有关健康与水质纯净度方面的要求对人类健康进行保护。各成员国有义务依据指令中提出的最低要求（第 7 条以及附录 II、附录 III）建立**供水区**以及完整的监测程序。除此之外，指令中也列出了一些基本的符合欧盟规定的质量标准：必须定期对 48 种微生物、化学及指标参数进行监测、检验。一般来说，世界卫生组织有关饮用水的指导方针以及欧盟委员会科学咨询委员会所提供的相关建议均被看作是制定饮用水质量标准的科学依据。同时，指令还要求定期为消费者提供相关信息，必须每三年就饮用水水质向欧盟委员会汇报一次。欧盟委员会依照《饮用水指令》相关标准对水质监测结果进行评估，每个报告周期过后编写一份综合报告，并对外公布。

The management plan for the Rhine river basin (Overriding Part A) contains a program of measures for solving the major problems at the international level. (The nine river basin district plans and national management plans will address issues of more local importance.) The **programme of measures** at the river basin level (level A) focuses on restoration of biological river continuity with increase of habitat diversity and on further reduction of pollution from diffuse sources.

莱茵河流域管理规划（最主要 A 部分）包含了一个措施计划，主要用于解决国际重大问题（九大流域地区规划及国家管理规划主要用于解决一些地方问题）。流域

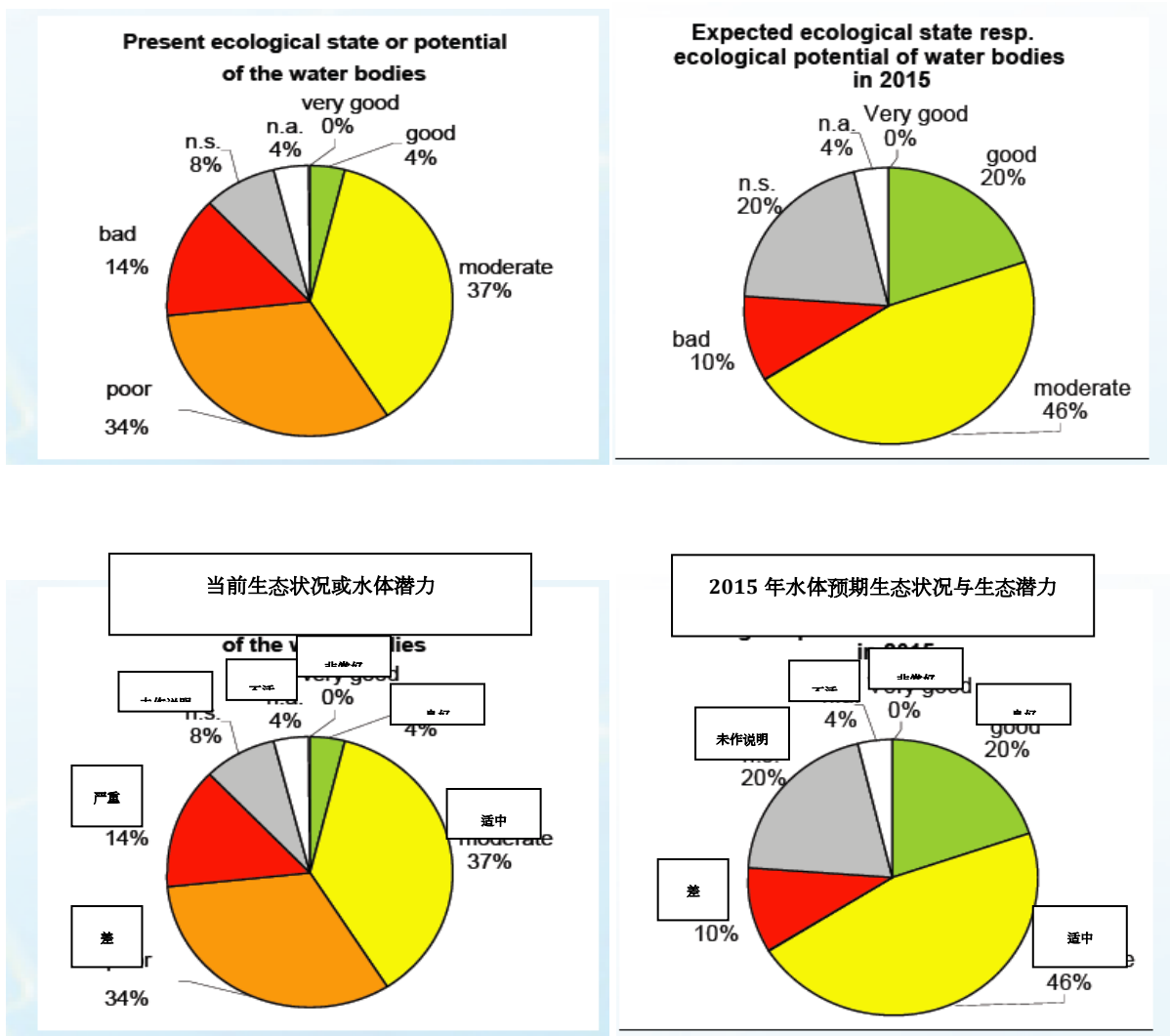
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<sup>70</sup> For more information about the Drinking Water Directive and drinking water management in the EU, see the European Commission web portal "Drinking Water": [http://ec.europa.eu/environment/water/water-drink/index\\_en.html](http://ec.europa.eu/environment/water/water-drink/index_en.html) 有关《水指令》与欧盟饮用水管理的更多信息，见欧盟委员会网站“饮用水”：[http://ec.europa.eu/environment/water/water-drink/index\\_en.html](http://ec.europa.eu/environment/water/water-drink/index_en.html)

层面（A 级）的**措施计划**的核心在于通过增加栖地多样性恢复生物河流连续性并进一步减少来自面源的污染。

**Figure 3.6 and 3.7 Present ecological status (2009) and expected status at end of first implementation period (2015)**

图 3.6、3.7 当前生态状况（2009）与首个实施期末（2015）预期状况



Source : ICPR (2009).来源：ICPR（2009）

The measures for restoring biological river continuity are based on a number of technical reports (ICPR 2006, 2009b) and separate plans, such as the Master Plan Migratory Fish Rhine (ICPR 2009c), eel management plans, and the programme for re-naturalisation of the river under the Rhine 2020 programme. The following serves as representative examples of the measures to reduce accumulated and acute and locally concentrated environmental risk.

恢复生物河流连续性所采取的措施是在大量技术报告（ICPR 2006, 2009b）以及一些独立规划（如《莱茵河洄游鱼类总体规划》（ICPR 2009c），鳗鱼管理规划以

及《莱茵河 2020 行动计划》下的河流重新自然化计划) 的基础上制定出来的。下面列出了有关这些措施的典型实例, 这些措施的目的在于降低累积环境风险、突发性环境风险以及局部集中环境风险。

The **Master Plan Migratory Fish Rhine** outlines how self-sustaining, stable populations of migratory fish can again be settled in the Rhine catchment area as far up as Basel (on the border of the Upper Rhine and the High Rhine), within reasonable time and at reasonable cost. The main activities are removing of transverse constructions where possible and constructing fish passages where infrastructure, such as sluices or hydropower stations, disrupts connectivity. The Rhine facilitates a large-scale fishery on yellow eel and silver eel, but eel (*Anguilla anguilla*) is a vulnerable species, has shown a strong decline all over Europe in the last decades and is considered critically endangered (IUCN, 2013). To protect the endangered eel populations the EU issued a regulation (EC No. 1100/2007) focussing on a reduction of eel mortality of anthropogenic origin, with the goal to secure 40% survival compared to the natural stock. By means of separate **eel management plans**, which are to be included in the river basin management plans, all EU Member States with natural eel stocks must ensure that when this survival rate of eels migrating downstream is not achieved, the eel stock is replenished. Measures to protect eels include restricting fishery, improving river continuity and stocking. The species diversity of a river mainly depends on the diversity of its morphological structures.

《莱茵河洄游鱼类总体规划》简要概述了为何自我维持且稳定的洄游鱼类种群能够在合理的期限内以合理的成本再次在莱茵河集水区栖息下来, 一直延伸至巴塞尔(接近上莱茵河与高莱茵河)。主要活动包括移走横断工事(可能的话)并在水闸或水电站等基础设施破坏连接性的地方构建鱼群通道。莱茵河使得黄鳗与银鳗等渔业大规模发展, 然而由于欧洲鳗鲡属于**易危物种**, 因此过去几十年间欧洲的鳗鱼数量急剧下降, 一度濒临灭绝的境地(IUCN, 2013)。为保护濒临灭绝的鳗鱼群, 欧盟颁布了一项法规(EC No. 1100/2007), 力图降低由人为原因导致的鳗鱼死亡率, 与自然存量相比, 确保 40% 的存活率。通过制定独立的**鳗鱼管理规划**(计划纳入流域管理规划), 所有拥有自然界鳗鱼存量的欧盟成员国必须确保当迁移至下游, 未达到这一鳗鱼存活率时, 必须对鳗鱼放养进行补充。保护鳗鱼的措施包括限制渔业、提高河流连续性以及放养。河流生物多样性主要取决于其形态结构的多样性。

An important point of the management plan is therefore to **increase and restore structural diversity** in the riverbed and along its banks. This will contribute to opening up further habitats to the flora and fauna living in the river, on its banks and on the floodplains. Within the Rhine 2020 programme (ICPR, 2001), 100 oxbow lakes will be reconnected with the dynamics of the Rhine by 2020, and former hydraulic and biologically effective connections between the river and its floodplains will be restored. Along suitable sections of the Rhine, the structural diversity will be increased along 800 km at a minimum, taking into account aspects of security for navigation and people.

因此，管理规划的重点之一就是**增加并恢复**河床及两岸的**结构多样性**。这将有利于进一步为栖息于河流中、河流两岸以及泛滥平原的动植物提供新的栖息地。依据《莱茵河 2020 行动计划》（ICPR, 2001），到 2020 年，将实现 100 个牛轭湖与充满活力的莱茵河的重新连接，与此同时，还将恢复以往莱茵河与其泛滥平原间的水力、生物有效性连接。就莱茵河特定区段而言，其结构多样性将至少沿 800 公里的河岸进行增加，同时将考虑航海安全与人员安全等方面的因素。

The measures to reduce pollution take into account OSPAR recommendations for reducing pollution levels in the North Sea (ref. chapter 2.3.1) and relevant EU directives addressing pollution, such as the Nitrates directive, the urban wastewater directive and the IPPC directive (ref. chapter 2.2.1 about the WFD). The Nitrates directive, for instance, requires Member States of the Rhine river basin to develop **nitrate action programmes**. At the time of writing the management plan (2009), 96% of the people living in the Rhine river basin were connected to a wastewater treatment plant and many big industrial plants or chemical parks had their own state-of-the-art wastewater treatment plants. The wastewater treatment situation was thus more or less under control, but further incremental improvements are expected as a consequence of the requirements of the urban wastewater directive. The IPPC directive set a deadline of 2007 for adapting existing industrial plants to the requirements of reducing environmental impacts by applying the best available techniques. (The IPPC has recently been incorporated into the new Industrial Emissions Directive, see chapter 1.) No further significant improvements of the Rhine water quality is expected from measures aimed at further reduction of direct inputs from industry. Table 3.1 below presents the inputs from agricultural acreage, wastewater treatment plants and industry in the state of the Rhine catchment area in 2000, in 2009 and the prognosis for 2015 (ICPR, 2009).

降低污染的相关措施还将参考 OSPAR 有关降低北海污染等级的建议（参考第 2.3.1 章节）以及涉及污染的相关欧盟指令，例如《硝酸盐指令》、《城市废水指令》以及《IPCC 指令》（参考第 2.2.1 章节中有关 WFD 的相关内容）。例如，《硝酸盐指令》要求莱茵河流域各成员国制定《**硝酸盐行动计划**》。当时编制管理规划（2009）时，莱茵河流域 96%的居民都与废水处理厂，许多大工厂或是拥有顶尖废水处理厂的化工园区有着一定的联系。废水处理状况因此而或多或少地得到了控制，但是依照《城市废水指令》的相关要求，还需要对其进行进一步完善。IPCC 指令预定到 2007 年通过采用最佳可行技术，使现有工厂达到减少环境影响的相关要求。（IPCC 近期已纳入最新《欧盟工业排放指令》，见第 1 章）进一步减少工业直接投入的相关措施预计无法使莱茵河水质得到显著改善。表 3.1（见下文）列出了莱茵河集水区 2000 年、2009 年在耕地面积、废水处理厂与工业等方面的投入以及对 2015 年的预测（ICPR, 2009）。

**Table 3.1 Nitrogen emissions from agriculture, wastewater treatment plants and industry in Rhine river basin and prognosis for 2015 (kilotons/year).**  
莱茵河流域农业、废水处理厂与工业氮排放量以及 2015 年预测（千吨/年）

Country	Emission 2000 (in kt)	Emission today (in kt)	Prognosis 2015 (in kt)
<b>Agriculture*</b>			
Austria	2	2	2
Switzerland**	12 (2001)	11 (2005)	11
Germany	113	113	99
France	23	14 (2006)	10
Luxemburg	3.7	3.1	n.s.
Belgium/Wallonia	n.s.	1.18	n.s.
Netherlands**	42	34 (2006)	31
<i>Rhine catchment area</i>	> 196	> 178	> 153
<b>Wastewater treatment plants (including diffuse urban)</b>			
Austria	0.8	0.6	0.5
Switzerland**	13 (12+1)	12(11+1)(2005)	< 11 (10+1) <sup>1</sup>
Germany	72 (63+9)	60	57
France	18 (15+3)	4 (2006)	3
Luxemburg	1.8	1.7	n.s.
Belgium/Wallonia	n.s.	0.06	n.s.
Netherlands	22 (20+2)	15 (2006)	13
<i>Rhine catchment area</i>	> 128	> 93	>85
<b>Industry</b>			
Austria	n.s.	0	0
Switzerland**	1	1 (2005)	< 1
Germany	15	15	14
France	5	5 (2005)	5
Luxemburg	0.007	0.003	n.s.
Belgium/Wallonia	n.s.	0.06	n.s.
Netherlands	3	2 (2006)	2
<i>Rhine catchment area</i>	> 24	> 23	> 22
<b>Total IRBD Rhine</b>	<b>&gt; 348****</b>	<b>&gt; 294</b>	<b>&gt; 260</b>

国家	2000 年排放量（千吨）	目前排放量（千吨）	2015 年预测值（千吨）
农业*			
奥地利	2	2	2
瑞士**	12（2001）	11（2005）	11
德国	113	113	99
法国	23	14（2006）	10
卢森堡	3.7	3.1	未作说明
比利时/瓦隆	未作说明	1.18	未作说明
荷兰**	42	34（2006）	31

## Tackling environmental risks with environmental planning: international experiences

### 通过环境规划解决环境风险：国际经验

莱茵河集水区	>196	>178	>153
<b>废水处理厂（包括分散在城市的处理厂）</b>			
奥地利	0.8	0.6	0.5
瑞士**	13 (12+1)	12 (11+1) (2005)	<11 (10+1) <sup>1</sup>
德国	72 (63+9)	60	57
法国	18 (15+3)	4 (2006)	3
卢森堡	1.8	1.7	未作说明
比利时/瓦隆	未作说明	0.06	未作说明
荷兰	22 (20+2)	15 (2006)	13
莱茵河集水区	>128	>93	>85
<b>工业</b>			
奥地利	未作说明	0	0
瑞士**	1	1 (2005)	<1
德国	15	15	14
法国	5	5 (2005)	5
卢森堡	0.007	0.003	未作说明
比利时/瓦隆	未作说明	0.06	未作说明
荷兰	3	2 (2006)	2
莱茵河集水区	>24	>23	>22
<b>莱茵河流域国际地区共计</b>	<b>&gt;348****</b>	<b>&gt;294</b>	<b>&gt;260</b>

Source: ICPR (2009)来源：ICPR (2009)

The EU Floods Directive (2007/60/EC) was adopted in 2007 and aims to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. The directive requires Member States to first carry out a preliminary assessment by 2011 to identify the river basins and associated coastal areas at risk of flooding. (The assessment shall be updated every 6 years.) The assessment includes a delimitation of the relevant catchments and sub-basins in the river basin, a description of flood events in the past and the probability of future floods, as well as an estimation of the potential negative consequences taking into account longer-term



developments such as the effect of climate change on floods. For the zones identified to be at risk, the directive requires Member States to draw up flood risk maps by 2013 and establish **flood risk management plans** focused on prevention, protection and preparedness by 2015. Implementation of the Floods Directive<sup>71</sup> shall be carried out in coordination with the Water Framework Directive, notably by flood risk management plans and river basin management plans being coordinated and through coordination of the public participation procedures in the preparation of these plans. The preliminary assessment for the Rhine (ICPR, 2013) showed ‘significant flood risk’ for most river sections along the main stream of the Rhine and its main tributaries. The measures in the management plan aimed to increase and restore structural diversity (ref. above), shall contribute to reducing the flood risks. Relocation of dikes and the deepening of river forelands regained 55 km<sup>2</sup> of former floodplains along the Rhine in the period 1997-2012 (ICPR, 2012).

《欧盟洪水指令》（2007/60/EC）于 2007 年通过，旨在降低洪水对人类健康、环境、文化遗产以及经济活动所构成的风险并对其进行管理。该指令首先要求各成员国到 2011 年进行一次初步评估，确定可能存在泛滥风险的相关流域及其相关沿海区域（上述评估每 6 年更新一次）。评估包括对流域内相关集水区以及次流域进行限定，对以往洪水事件的描述，未来洪水发生的可能性，以及基于长期发展对潜在负面影响的预估，如气候变化对洪水的影响。对于已确定存在风险的区域，指令要求成员国绘制 2013 年洪水风险图并制定 2015 年洪水风险管理规划，内容包括洪水预防、洪水控制以及应急准备。特别是通过协调洪水风险管理规划与流域管理规划以及协调上述规划制定过程中的公众参与程序，来协调实施《欧盟洪水指令》应该与《水框架指令》。莱茵河初步评估（ICPR, 2013）表明莱茵河干流的多数区段及其主要支流均存在着“重大的洪水风险”。管理规划中用于增加、恢复结构多样性（参考上文内容）的相关措施应有利于降低洪水风险。1997-2012（ICPR, 2012）年间，由于迁移堤坝并加深河前陆，莱茵河沿岸恢复了 55 平方公里的泛滥平原。

In order to **prevent accidents and ensure security of industrial plants** a document with recommendations was issued by ICPR after the major pollution incident in 1986<sup>72</sup> (see text box in chapter 3.3.1 above), and national regulations in the Rhine countries were adapted to correspond to these recommendations. ICPR in 1986 introduced a Warning and Alarm Plan (ICPR, 2014) to tackle acute risk due to water pollution and to detect and prosecute the originators of pollution incidents (discharges, accidents in

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<sup>71</sup> For more information about the Floods Directive, see the European Commission web portal “A new EU Floods Directive”:

[http://ec.europa.eu/environment/water/flood\\_risk/index.htm](http://ec.europa.eu/environment/water/flood_risk/index.htm) 有关《洪水指令》的更多信息，见欧盟委员会门户网站最新欧盟洪水指令：[http://ec.europa.eu/environment/water/flood\\_risk/index.htm](http://ec.europa.eu/environment/water/flood_risk/index.htm)

<sup>72</sup> A summary of the main content is available here:

<http://www.iksr.org/index.php?id=87&L=3> 主要内容的总结网址：<http://www.iksr.org/index.php?id=87&L=3>

industry or navigation). The plan involves seven international main warning centres in main cities along the main river collect and distribute the messages. When assessing an alarm, the international main warning centres and the competent authorities have a flow time model, a set of guidance values for “alarm-relevant” concentrations and loads, lists of experts, substance data banks and further means at their disposal. According to the Warning and Alarm Plan, the messages are passed onupstream (search messages) and downstream (information or warning) with standardised forms in three languages (German, French, Dutch).<sup>73</sup>

为预防事故发生并确保工厂安全，ICPR 在 1986 年重大污染事件发生之后颁布了一份文件，文件中还提供了一些建议（参照上文第 3.3.1 节文本框），此外莱茵河沿岸国家也通过了各自的国家法规，以期同上述相关建议保持一致。ICPR 早在 1986 年就已制定了《提醒和报警规划》（ICPR, 2014），目的在于应对由水污染导致的突发性风险，并对污染事件（排放物、工业或航海事故）的发起人进行核查、检举。该规划涉及主要河流沿岸主要城市的七个负责收集并发布信息的主要国际预警中心。对相关预警进行评估时，主要国际预警中心及有关部门所使用的工具主要包括：流量时间模型，一系列与主要预警领域及负荷有关的指导性价值标准，专家名单，物质数据库以及进一步的处理方式。根据《提醒和报警规划》，信息用三种语言（德语、法语、荷兰语）以标准形式通过上游（搜索信息）与下游（信息或警告）。

At the sub-basin and national levels basic (level B) principles of water pricing and the polluter pays principle were applied when working out **program of measures** and how to share the burden of implementation. A transparent and open process with all baseline data available to the public helped keeping up the pressure to act and hold the agents responsible for pollution accountability. Experience showed that **the process** of making an inventory of the baseline, setting local targets according to typologies, identifying emission pathways and identifying remaining problems and sources in an open manner was extremely important. It led to a better and **shared understanding** of the situation between all stakeholders, making stakeholders such as industry, agriculture and water transport companies aware of their role and stimulating them to address pollution issues in a constructive and pro-active manner, rather than merely reactively. Education, raising awareness programs and government support for difficult transition processes, are examples of **soft measures** used to enable a common effort. This model with transparency, developing a shared understanding and addressing accumulated and acute risk in a common and differentiated manner, is one of the main reasons for the success of efforts in the Rhine river basin. It has also contributed to the development of

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<sup>73</sup> The plan is available here:

[http://www.iksr.org/fileadmin/user\\_upload/Dokumente\\_de/Rheinkarten/WARNING-AND\\_ALARM\\_PLAN\\_RHINE\\_State\\_01.01.pdf](http://www.iksr.org/fileadmin/user_upload/Dokumente_de/Rheinkarten/WARNING-AND_ALARM_PLAN_RHINE_State_01.01.pdf) 规划的详细内容见网址 [http://www.iksr.org/fileadmin/user\\_upload/Dokumente\\_de/Rheinkarten/WARNING-AND\\_ALARM\\_PLAN\\_RHINE\\_State\\_01.01.pdf](http://www.iksr.org/fileadmin/user_upload/Dokumente_de/Rheinkarten/WARNING-AND_ALARM_PLAN_RHINE_State_01.01.pdf)

high environmental standards in for instance German chemicals industry, which has contributed to bolster competitiveness and global technological leadership in the industry. The example of the German chemicals industry along the Rhine River shows that besides the environmental benefits, the investment of industry to reduce environmental risks also may have long-term positive effects for the industry itself.

制定**措施计划**并确定如何共同分担实施压力的过程中，就次流域与国家层面采用了有关水价的基本（B 级）原则以及污染者负担原则。通过采用透明公开的流程，向公众提供所有基线数据，有助于继续施压确保顺利实施，使相关主体承担污染责任。经验表明，公开编制基线数据目录，依据类型学设定地方目标，确定排放途径以及遗留问题与来源**这一过程**有着极其重要的作用。这有助于所有利益相关方更好地了解当前状况并达成共识，能够使得包括实业公司、农产品公司以及水资源运输公司在内的利益相关方更好地了解自身的职责，同时也能促使他们积极有效地解决相关污染问题，而不是仅仅机械地解决这类问题。实现共同努力这一目标的“**软性**”**措施**包括：教育，提高意识项目以及针对转变过程存在的困难所给予的政府支持。这一透明模式确保了利益相关方间的共同意识，以一种共同但有区别的方式应对累积风险与突发性风险，是莱茵河流域成功案例的主要因素之一。与此同时，这也有利于高环保标准的制定，如德国化学品工业的相关标准，有利于增强竞争力，全球技术领先地位。德国化学品工业区位于莱茵河沿岸，这一案例表明，除环境效益之外，通过工业投资降低环境风险的这一做法对工业本身可能也会产生长期的积极影响。

**Figure 3.8 Photo of city and nature in harmony, in the Rhine delta.**

**图 3.8 莱茵河三角洲——城市与自然和谐共处（图片）**



Source: Ministry of Transport, Public Works and Water Management of the Netherlands (2009)

来源：荷兰交通、公共工程及水管理部（2009）

**Public participation** is ensured by making all data on river quality publicly available on communication platforms such as the internet ([www.iksr.org](http://www.iksr.org)), by the soft measures mentioned above and by staging open expert symposiums on different aspects of river basin management. Since 1998, non-governmental organisations (NGOs) have had an observer status with the ICPR with an opportunity for merit-based participation in working and expert groups. By participating in the work of the ICPR, representatives of environmental organizations, industrial federations, drinking water works and scientific associations contribute crucial information to the development of a common knowledge base and also develop a common understanding of challenges and a sense of ownership to decisions that are made.

确保**公共参与**的措施包括：在交流平台如互联网（[www.iksr.org](http://www.iksr.org)）上公开发布所有水质数据，前文所述的“软”措施，以及就流域管理的不同方面举行公开的专家研讨会。自 1998 年以来，非政府组织（NGO）凭借各自业绩，以 ICPR 观察员身份加入了相关工作小组及专家组。通过参与 ICPR 的相关工作，各环境组织、行业协会、饮用水工厂及科学协会的相关代表为共同知识库的发展提供了一些关键信息，同时还就相关挑战达成了共识，针对已做出的决定形成了一定的主人翁意识。

### 3.3.5 Results结果

International cooperation and coordinated river management has developed dynamically in the Rhine river basin since 1950 and with increased efforts since the mid-1980s, the Rhine river has gone from being the “open sewer of Europe” to becoming a living river and a model example internationally of integrated river basin management. A comprehensive and science-based system of policies, regulations and institutions (incl. emergency centres) is in place for integrated river basin management across the river basin and at different administrative levels with ambitious environmental goals (ref. the Water Framework Directive) ensuring continued efforts to further improve sustainable and economically optimal use of the Rhine river basin. The story of the Rhine river basin is a success story in many ways representing best practice for river management on a large scale, where environmental, social and industrial economic activity is balanced.

自 1950 年以来，莱茵河流域国际合作与河流协调管理蓬勃发展。20 世纪 80 年代中期起，通过不断加强合作与管理，莱茵河已不再是曾经的“欧洲开放的下水道”，而成为了一条“生命之河”，成为了流域综合管理领域的一个全球模型范例。目前，已建立了一个针对相关政策、法规、制度（包括应急中心）的科学性综合体系，确保整个流域以及不同管理级别的流域综合管理，同时设定了宏大的环境目标（参考《水框架指令》），确保通过持续努力，进一步完善莱茵河流域的可持续经济最优利用。就许多方面来说，莱茵河流域的发展是一个成功的例子，体现了河流规模管理的最佳实践，实现了环境、社会、工业经济活动的均衡发展。

The salmon is back in the Rhine River, a symbol of the positive development the last decades. But many challenges still remain in the Rhine river basin. As shown in figure 3.6 and 3.7 above, the percentage of water bodies with ‘good’ or ‘moderate’ status was



41% in 2009 and is expected to increase to 66% in 2015. There is still a significant way until the aquatic ecology of the Rhine river basin as a whole is restored to something akin to natural conditions. In some cases the ecological elements in the “restored” Rhine river are not the same as the original endemic ones, leading some biologists (NYT, 2006) to note that the Rhine is no longer a biologically German river but a biologically international river (the new salmon, for instance, being from Ireland, France or Scandinavia).

鲑鱼们又重新回到了莱茵河，这是过去数十年良性发展的结果。但是未来莱茵河流域仍然面临着许多的挑战。如上文中图 3.6、3.7 所示，2009 处于“良好”或“适度”状态的水体百分比为 41%，预计 2015 年将上升至 66%。莱茵河流域的水生生态要从整体上恢复到接近自然条件的状态仍然有很长的路要走。在某些情况下，“恢复后的”莱茵河，其生态要素与固有特征存在一定的差别，一些生物学家（NYT，2006）由此意识到：莱茵河已不再是一条生物德国河流，而成为了一条生物国际河流（如，鲑鱼新品种产自爱尔兰、法国或斯堪的纳维亚）。

Pollution continues to be a significant problem in the Rhine River, but today it is mainly from diffuse sources (ref. figure 3.3 above, showing emission pathways). In the river basin management plan of 2009, only 12% of the water bodies in the Rhine live up to the chemical quality criteria of the WFD. In most cases, the cause is that the polycyclic aromatic hydrocarbons (PAHs) exceed the environmental quality standards. As the PAH substance group mainly originates from combustion processes and constitutes a diffuse input into waters via the atmosphere, it is difficult to reduce and no improvement is expected by 2015. The legacy of the post-war era of heavy industry with few environmental restrictions is still felt in many places. The Emscher river, a smaller tributary to the Rhine in the Ruhr area is for instance still biologically dead as it was used as a open waste water canal for industry since the late 19<sup>th</sup> century. A sewage plant at the mouth of the Emscher today ensures that the river water enters the Rhine in an acceptable quality. A multi-billion Euro project to bring the Emscher back to a more or less natural condition has been progressing since the early 1990s and is to be finished by the year 2020.

污染仍然是莱茵河所面临的一个重大问题，但是，目前的污染主要来自面源（参考上文涉及排放途径的图 3.3）。2009 年流域管理规划中，仅有 12% 的莱茵河水体符合 WFD 化学制品质量标准。多数情况下，这是因为多环芳烃（PAH）含量超出环境质量标准要求。由于多环芳烃（PAH）物质群主要来源于燃烧过程，促使扩散源通过大气进入水域，因此很难降低 PAH 含量，而且这一状况到 2015 年也不会出现任何改善。战后重工业由于极少涉及环保限制而遗留的问题目前仍然反映在一些领域。例如，埃姆舍河为鲁尔地区莱茵河的一条较小支流，目前仍然不适于生物生存，原因在于自 19 世纪末起，这条河就成为了一条开放式工业废水排放通道。目前，埃姆舍河入口处建立了一座污水处理厂，能够确保流入莱茵河的河水水质符合相关标准。自 20 世纪 90 年代初期以来，启动了一项耗资数十亿欧元的项目，目的在于使埃姆舍河在一定程度上恢复到一定的自然条件，该项目预计将于 2020 年竣工。

### 3.3.6 Suggestions and recommendations for China 对中国的启示和建议

As noted in description of the Water Framework Directive (chapter 2.2 above), there are many potential learning points for China from the directive's principles, standards and structure for integrated river basin management with environmental goals. The WFD provides a framework and methodology for carrying out regional environmental risk assessments. We shall here comment more specifically on issues at the river basin level.

根据有关《水框架指令》（前文第 2.2 章节）的介绍，中国可以从该指令的相关原则、标准及其结构中借鉴很多涉及环境目标的流域综合管理经验。WFD 提供了一个施行区域环境风险评估的框架和方法论。在此，我们将对流域层面的相关问题进行更为详细的介绍。

As a natural effect of the intense industrialization process in China, the environmental status of Chinese rivers does not currently meet the requirements for sustainable socio-economic development and the situation resembles the situation in European rivers in the 1970s and 1980s (RBMP, 2011a). When looking at lessons to learn from the Rhine river basin, it thus seems that the experiences from 1985 until today are relevant. This includes experiences from three cycles of efforts:

伴随快速的工业化进程，中国河流的环境状况目前尚未达到社会经济可持续发展的相关要求，这与欧洲河流 20 世纪 70 年代至 80 年代的状况（RBMP, 2011a）极为相似。因此，有关莱茵河流域的经验教训，可以参考该流域自 1985 年至今的相关经验。主要包括三个方面：

- The Rhine Action Program (1987-2000), with a strong focus on reducing pollution from point sources. 《莱茵河行动计划》（1987-2000）：重点解决点源污染；
- The “Rhine 2020” program, which included a program of measures for the period 2001-2005, and increasingly focused on restoring aquatic ecology. 《莱茵河 2020 行动计划》：涵盖一项具体的措施计划（2001-2005），越来越多地关注水生生态的恢复问题；
- Implementation of the Water Framework Directive, addressing ecological as well as chemical status within the framework of joint management plans and regional environmental risk assessment. 实施《水框架指令》，解决联合管理规划框架内和区域环境风险评估的相关生态与化学状况问题。

It should be noted that river basin management plans in the EU can be viewed as Strategic Environmental Assessments (SEA) as they involve most of the steps in developing a SEA: scoping and establishing context, establishing baseline and reference scenario, identifying and assessing impacts, environmental reporting, monitoring and an process of consultation and participation (Vennemo et al., 2012). Regional environmental risk assessment and SEA also share many features. Experience with SEA

in China can thus be employed when developing river basin management plans and conducting regional environmental risk assessments. Cost-benefit analysis of alternative measures to be employed to reach environmental goals is also part of river basin management plan development, a methodology where experience from other sectors may be utilized (ref. Vennemo et al, 2012).

需要指出的是，由于欧盟流域管理规划涉及与战略环境影响评价（SEA）相关的诸多步骤，包括：确定范围并设置背景、建立基线与参考情景、确定并评估影响、环境报告、监测、咨询与参与（Vennemo et al., 2012）。区域环境风险评估和 SEA 也有很多共同特征。由此，中国可以在制定流域管理规划和施行区域环境风险评估时参考 SEA 的相关经验。此外，对相关替代措施进行成本效益分析，从而实现既定环境目标，也同样是流域管理规划发展的一部分。流域管理规划是一种允许参考其他行业经验的方法（参考 Vennemo et al, 2012）。

In China, water policy, enforcement and management are developing rapidly but challenges are huge and much work remains to attain environmentally, socially and economically sustainable water use. Traditionally, water management in China has focused on the use of water as a resource and flood prevention, which has led to over-extraction of water in many places, the use of rivers as a sewer, and physical modifications that impede the natural functioning and ecosystem services provided by the river (Boekhorst et al., 2010). Environmental risk management at a regional level, in the form of integrated river basin management involves a shift in mindset (Atkins 2010), from focusing on *using* water locally to *managing* water resources at a river basin level to ensure optimal functioning across environmental, social and economic dimensions. Since 2002, the principle of integrated water management has been recognized in China's water law, but to realize such management on the ground takes time. Since the 10<sup>th</sup> five year period (2001-2005), MEP also began to formulate and implement pollution control plans for key basins.<sup>74</sup>

对于中国来说，水资源政策、执行及管理持续快速发展，但是同时也面临着巨大的挑战，需要付出更多的努力，实现水资源的环境、社会及经济可持续性利用。通常来讲，中国的水资源管理重点在于水资源的利用以及防洪，由此导致多处水资源的过量开采，将河流当做下水道使用，以及物理变性，阻止自然生态系统的正常运行以及水资源提供的生态系统服务（Boekhorst et al., 2010）。以流域综合管理作为形式的区域级环境风险管理涉及思维方式的转变（Atkins 2010），从局部利用水资源转变为从流域层面管理水资源，以确保环保、社会及经济领域的最佳功能发挥。自 2002 年以来，水资源综合管理原则已纳入了中国法律，但是有效实施此类管理仍然需要一定的时间。自第十个五年计划实施期间（2001 至 2005 年）以来，MEP 也开始制定和施行重点流域污染控制计划。

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<sup>74</sup> References for pollution control plans for river basins can be found (in Chinese)

at <http://wfs.mep.gov.cn/swrkz/zhdly/lygh/index.htm>

Based on the experience from the Rhine river basin, a generic set of recommendations can be provided for regional environmental risk assessments related to water:

基于莱茵河流域的成功经验，对与水相关的区域环境风险评估方面的建议如下：

- Make sure a legal framework is in place committing relevant authorities and stakeholders to reduce environmental risk and reach environmental quality targets, with sanction mechanisms. 确保法规框架的制定，促使有关部门及利益相关方降低环境风险，实现环境质量目标，同时建立制裁机制；
- Make an inventory mapping the baseline situation for environmental risks, including emission pathways and current water uses, at sub-regional/provincial level and river basin level. 编制详细清单，反映环境风险的基线状况，包括分区/省级及流域层面的排放途径及目前水利用状况；
- Make a register of priority areas, such as environmental protection areas and drinking water sources, at sub-basin/provincial level and river basin level. 记录优先区域，如分区/省级及流域层面的环境保护区与饮用水来源；
- Set environmental targets for water bodies based on the typologies of water bodies, aiming to reach a close to natural condition and a healthy environment. 基于水体类型学为不同水体设定环境目标，创造接近自然的条件以及健康的环境；
- Assess the effect of current legislation and measures, and identify gaps between current measures and environmental targets. 了解现有立法与相关措施的影响，确定现有措施与环境目标间的差距；
- Identify measures that need to be carried out at a river basin level to tackle accumulated as well as acute risk, design a cost-effective program of measures in dialogue with major stakeholders, and set up coordination mechanisms. 确定流域层面的相关措施以应对累积风险、突发性风险，同主要利益相关方协商制定具有成本效益的措施计划，并建立相关协调机制；
- Identify measures that should be carried out at sub-river basin/provincial level to tackle accumulated as well as acute risk, design a cost-effective program of measures in dialogue with major stakeholders, and set up coordination mechanisms. 确定次流域/省级层面的相关措施以应对累积风险、突发性风险，同主要利益相关方协商制定具有成本效益的措施计划，并建立相关协调机制；
- Keep the process open and transparent, with all data made available to the public on public platforms such as the internet, and carry out a program of soft measures at all levels to develop common understanding and awareness. 确保流程公开、透明，将所有相关数据在公共平台如互联网上进行公布，在不同层面实施“软”措施以达成共识。

In China, integrated river basin management is encouraged through the creation of river basin authorities under the Ministry of Water Resources, such as the Changjiang Water Resources Commission for the Yangtze (which was re-established in 1950) and the



Yellow River Conservancy Commission.<sup>75</sup> The scale of Chinese river basins is often huge. The Yangtze river basin catchment area is 1,800,000 km<sup>2</sup>, and the Yellow River catchment area is 742,000 km<sup>2</sup>. Developing river basin management plans is challenging on such scales. The example of the Rhine river basin management plan, in which an overall river basin management plan covering the most important issues of common interest (level A) is supplemented by regional management plans (level B) and local management plans, may be a model that can be copied in the huge river basins in China.

就流域综合管理而言，中国政府很早就在水利部下设了流域管理机构，如长江水利委员会（1950 年重新建立）和黄河水利委员会。但中国河流流域的规模通常都很大，长江流域集水区面积达 180 万平方公里，黄河集水区面积达 74.2 万平方公里，对于规模如此之大的流域来说，编制流域管理规划是一项颇具挑战性的工作。莱茵河流域综合管理规划涵盖了许多利益相关方共同关心的最重要的问题（A 级），同时又通过区域管理规划（B 级）及地方管理规划进行补充，因此，可以将莱茵河流域管理规划作为一个成功范例，复制到中国的流域管理规划编制中。

EU-China expert missions has identified a number of river basin management issues where there is potential for cooperation and experience sharing. The fact-finding mission to the Yangtze river basin in 2011 (RBMP, 2011a), revealed that there is a Chinese interest in gaining a deeper understanding of the EU and EU Member State experiences with common water legislation, policies and implementation practices. The Vice-Commissioner of the Changjiang Water Resources Commission noted the following prioritized issues for future cooperation: Capacity building, monitoring and modeling of aquatic ecology and chemical status, protection of aquatic ecology, ecosystem restoration and monitoring, mechanisms for payment for ecosystem services, water allocation methodologies, flood risk management and mapping, forecasting and mitigating flash floods in mountain regions, as well as research on the regional river basin management policy development and institutional arrangements. The Rhine river basin is relevant for transfer of experience related to practically all these issues.

欧盟-中国专家团确定了一系列流域管理事项，为两国间的合作与经验分享提供了可能性。2011 年专家团对长江流域进行实情调查（RBMP，2011a），揭示了对欧盟及其成员国在共同水资源立法、政策及实施实践方面的经验进行深入了解，在一定

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<sup>75</sup> Developments in the Yellow River river basin show, for instance, that integrated management is increasingly taking place and showing results (Atkins, 2010). At the beginning of the century, the Yellow River would run dry every year due to overuse. The Yellow River Conservancy Commission studied and improved the understanding of the river's hydrology and worked out a system for allocating set amounts of water to each user in different provinces and regions, so that now the river runs all year long.

例如，黄河流域的发展表明，综合管理不断地普及，而且取得了良好的效果（Atkins，2010）。本世纪之初，由于过度使用，黄河每年都在变得干涸。为此，黄河水利委员会研究并完善了河流分水协议，并建立了一个体系，将一定数量的水资源分配至不同省份的所有使用者，使得黄河水目前终年流淌不息。

程度上是符合中国利益的。长江水利委员会副主任指出，未来合作中应优先考虑以下事项：能力建设，水生生态与化学状态的检测及建模，水生生态的保护，生态系统恢复及监测，生态系统服务支付机制，水资源分配方法，洪水风险管理及山区骤发洪水风险图的绘制、洪水风险的预测与降低，以及区域流域管理政策制定与制度安排方面的研究。莱茵河流域的成功经验几乎适用于上述所有问题。

In China, there has been increasing focus on international cooperation related to integrated river basin management (IRBM) over the last decade. This is exemplified by the +€100 million EU-China River Basin Management Programme (2006-2012) focusing on the sharing of EU experience and best practices, IRMB programs run by non-governmental organizations such as the WWF-HSBC Yangtze Programme (Boekhorst et al., 2010), as well as the on-going China-Europe Water Platform (CEWP) which promotes European and Chinese cooperation on water issues (and follows up on the EU-China River Basin Management Programme). The Ministry of Water Resources of the PR of China is the responsible institution on the Chinese side, in the cooperation with the EU. The China-Europe Water Platform (see [www.cewp.org](http://www.cewp.org)) facilitates cooperation and is also a dynamic resource hub for relevant information about EU experiences, the outcome of EU-Chinese joint fact-finding missions to Chinese river basins such as the Yangtze and the Yellow River, as well as relevant events and news.

过去十年，中国不断致力于流域综合管理（IRBM）领域的国际合作。这主要体现在耗资 1 亿欧元以上的欧盟-中国流域管理计划（2006-2012），该计划的重点在于分享欧盟经验及其相关最佳实践，非政府组织运营之下的 IRBM 项目，如世界自然基金会—汇丰银行长江项目（Boekhorst et al., 2010）以及正在实施的中国-欧洲水资源交流平台项目（CEWP），后者有利于促进欧洲与中国就相关水资源问题进行合作（参考欧盟-中国流域管理计划）。中华人民共和国水利部作为中国方面的主管部门，负责与欧盟的相关合作事宜。中国-欧洲水资源交流平台项目（见 [www.cewp.org](http://www.cewp.org)）在促进合作的同时，也是一个取之不竭的资源中心，负责提供有关欧盟经验的相关信息，欧盟-中国联合调查所取得的成就归功于相关中国流域（如长江与黄河）以及相关事件及其新闻。

### **Box 3.2 Reducing regional environmental risk in the Danube river: Context and tools**

#### **框 3.2 降低多瑙河区域环境风险：背景与工具**

Phase I of the project provided experiences from water management in the Danube river basin in the EU (ref. Econ Pöyry 2010, 2011), and below we summarise the main points.

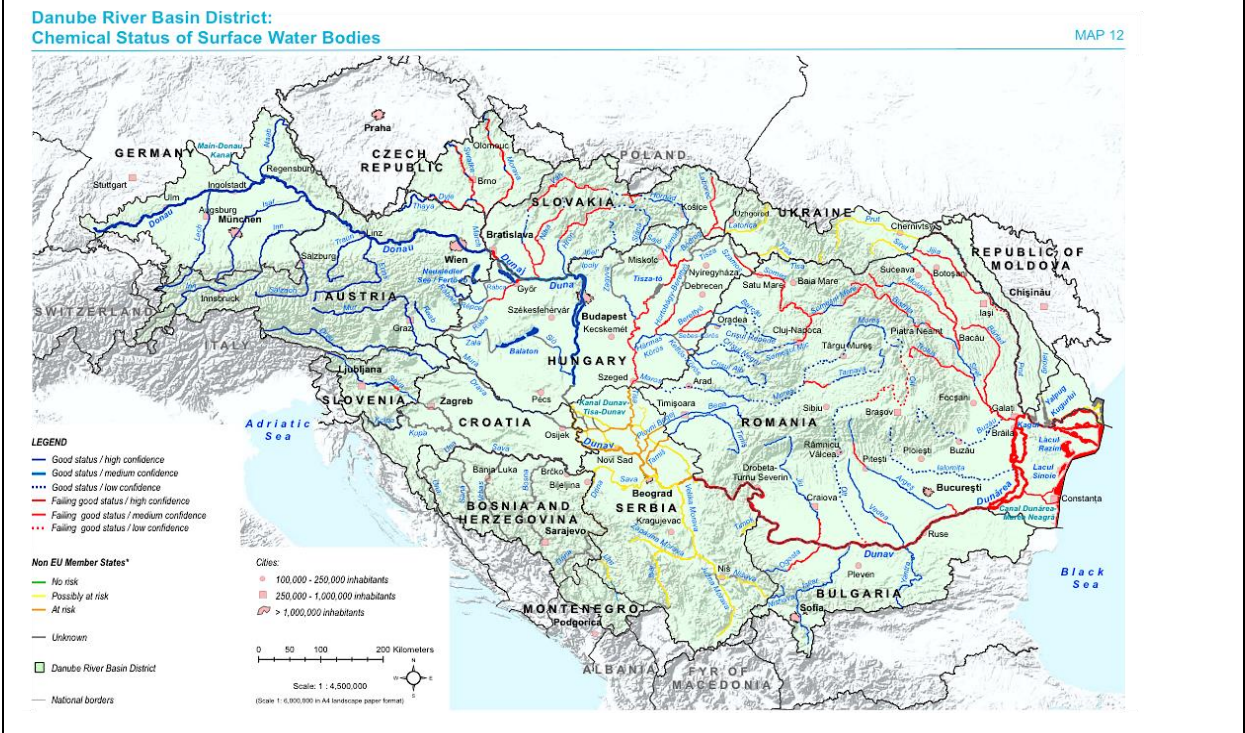
项目一期提供了欧盟多瑙河流域水资源管理（参考 Econ Pöyry 2010, 2011）方面的相关经验，以下对相关要点进行了总结：

The Danube river basin is the “most international” river basin in the world, covering territories of 19 countries (ref map below). 14 of these countries (the ones with at least 2,000 km<sup>2</sup> of territory within the river basin) cooperate in the International Commission

for the Protection of the Danube River (ICPDR), which was established in 1998. Since 2000, the cooperation has followed the principles and timeline of the Water Framework directive (see chapter 2).

多瑙河流域是世界上“最具国际化”的流域，覆盖全球 19 个国家（参考下文地图）的领土。其中 14 个国家（该流域覆盖这些国家至少 2000 平方公里的领土）通过多瑙河保护国际委员会（ICPDR）进行合作。ICPDR 于 1998 年创立。自 2000 年以来，这类合作一直遵循着《水框架指令》中所规定的相关原则以及时间表要求（见第 2 章）。

**Figure 3.9 The Danube River Basin, with chemical status for surface waters (2009)**  
图 3.9 多瑙河流域——地表水化学成分状况（2009）







Source: ICPDR (2013)来源：ICPDR（2013）

Due to the size and the complexity of the basin, the Danube countries and ICPDR decided to work at different geographic scales and in particular via sub-basins of the overall Danube basin. Cooperation on overall issues takes place through ICPDR and is represented in an overall management plan for the Danube river basin, addressing issues of common concern. In addition, there are regional management plans often involving several countries, as well as national plans that deal with local issues. This is similar to in the Rhine.

受流域规模及复杂性的限制，多瑙河沿岸国家及 ICPDR 决定基于不同地理尺度，尤其是通过整个多瑙河流域次流域开展相关工作。有关整体问题的合作主要通过 ICPDR 进行，这主要体现在了多瑙河流域综合管理规划中，以此解决相关利益方共同关心的问题。此外，也存在通常涉及几个国家的区域管理规划以及专门处理地方问题的国家规划。这与莱茵河的情况很相似。

In the following we highlight some tools used that we have not described in the Rhine case.

下文中，我们列出了莱茵河案例中未作介绍的一些工具。

- **Issue papers:** ICPDR used ‘issue papers’ to put focus on issues that need special attention in the Danube river basin, that require harmonisation of methods to ensure comparability of results and that need to be dealt with in the overall management plan for the river basin. The issue papers were developed by small drafting groups or

expert bodies of the ICPDR, and used when developing the inventory for the river basin and in the public participation process.

- **议题：**过去，ICPDR通常会通过议题将重点放在多瑙河流域内需要特别注意的问题上，需要借助调方去确保更具可比性的问题上，以及需要通过流域综合管理规划进行解决的问题上。议题由起草工作组或ICPDR内的专家机构负责编制，在流域详细目录以及公共参与过程中使用。
- **Questionnaires and templates:** Questionnaires were used to achieve a consistent overview of special issues that require detailed technical knowledge. E.g. for the establishment of a Danube GIS it was necessary to collect detailed information on the GI systems in use in the different Danube countries and on the availability of the data, i.e. it included legal aspects such as ownership of data. Templates were used for the preparation of the reports to be used in the development of the overall management plan. Templates were used to collect data from the Danube countries in a unique format to allow analysis of these data at the basin-wide level. Templates were prepared e.g. for the delineation of water bodies and the assessment of the risk of failure or for the identification and characterization of groundwater bodies. Also the inventory of protected areas for species and habitat protection was prepared in this way.
- **问卷调查与模板：**问卷调查的作用在于对涉及专门技术知识的特殊问题进行持续跟踪。例如，就多瑙河 GIS 的建立而言，需要搜集有关多瑙河沿岸国家现有 GI 体系以及数据有效性（即，数据中包括数据所有者等法律范畴的信息）的详细信息。模板主要用于撰写综合管理规划编制过程中需要用到的相关报告。在模板基础上，可采用特殊格式搜集多瑙河沿岸国家的相关信息，进而在整个流域范围内对这些数据进行分析。此外，模板也可用于其他一些方面，如，对水体进行描述，对失败风险进行评估，或对地下水体进行识别与描述。同样，物种保护区与栖息地保护区详细目录也可利用模板进行编制。
- **Significant Water Management Issues:** In order to focus efforts on the overall level four Significant Water Management Issues were identified: i) Pollution by organic substances, ii) Pollution by nutrients (modelled using the MONERIS model), iii) Pollution by hazardous substances, and iv) Hydromorphological alterations. These issues became the focus of measures in the overriding management plan.
- **重大水资源管理问题：**为集中精力确保整体发展，确定了四个重大水资源管理问题：1) 有机物质污染；2) 营养物污染（采用 MONERIS 模式进行模拟）；3) 危险物质污染；4) 水生改建。这些问题成为了最主要的管理规划中的重点措施。
- **The MONERIS (Modelling Nutrient Emission in River Systems) model:** The MONERIS model is a semi-static emission model for point and diffuse sources of nutrients, but it can also be adapted in order to deal with heavy metals and some priority substances. MONERIS has been applied to river basins in several European projects and for several river basins, including Danube. The model is based on: i) data of river flow (from gauging stations), ii) water quality (nutrient concentrations from monitoring stations), iii) statistical data about nutrient inputs into the catchment, and iv) geographical data (stored and analyzed in GIS). The model is composed of a series of equations that allow the estimation of point sources and

diffuse sources into the stream. For the catchment defined for a particular application of the model, MONERIS will estimate the loads emitted from each of the point sources (direct discharges, waste water treatment plant effluents), and through a series of diffuse pathways including atmospheric deposition, erosion, surface runoff, groundwater, tile drainage, and paved urban areas. MONERIS produces estimates of annual load through each of the defined point and diffuse pathways. It estimates nutrient retention and loss within the river system itself. The final output is an estimate of annual nutrient load in the river at the outlet of the study catchment, which is equal to the emissions into the river via point and diffuse sources *minus* the estimated nutrient retention and loss within the river system. MONERIS can help managers identify pathways that contribute significantly to nutrient loads and should be targeted for management practices aimed at nutrient emission reduction. Combined with geographic information in a GIS, it can help identify hot spots within the catchment, i.e. particular areas that, due to a combination of high potential emission and a susceptibility to efficient transport, contribute nutrients significantly more than other areas. Once MONERIS has been calibrated for a particular catchment, it can be used to develop management scenarios.

- **MONERIS (模拟河流系统营养物排放) 模式**：MONERIS 模式是一种针对营养物点源与面源的半静态排放模型，但是也可以对其进行调整，处理重金属及一些重点控制物质。MONERIS 已应用到了一些欧洲项目的相关流域以及其他一些流域，包括多瑙河。这一模式是基于以下方面建立的：1) 河流流量数据（水文测量站提供）；2) 水质（来自监测站的营养物浓度数据）；3) 集水区营养物统计数据；4) 地理数据（由 GIS 负责存储、分析）。该模式由一系列方程式组成，允许对进入水流的点源以及面源进行预估。就涉及该模式特殊应用的集水区而言，MONERIS 将对来自每一点源（直接排放、废水处理厂流出物），通过一系列扩散途径（包括：大气沉降、侵蚀、地表径流、地下水、瓦管排水以及已铺筑城区）排放出的负荷进行评估。MONERIS 可通过已确定的点途径、扩散途径计算出年度负荷估计值。可估算出河流系统自身的营养物保留与损失。最后可得出特定集水区出口河流年度营养负荷的估计值，这一数值等于通过点源、面源源进入河流的排放量减去河流系统内营养物保留与损失估计值。MONERIS 有助于管理者确定产生营养负荷的主要途径，应该用于旨在减少营养物排放的管理实践。通过与 GIS 所提供的地质信息相结合，有助于确定集水区内的热点区域，例如，由于潜在高排放量的集中以及快捷运输的敏感性，产生的营养物远多于其他区域的特定区域。一旦 MONERIS 专门应用于特定的集水区，则其可用于制定特定的管理方案。
- **Trans National Monitoring Network (TNMN)**: The TNMN network in the Danube contains 78 sampling points. Each monitoring location can have up to three sampling points, located on the left side, right side or in the middle of a river. The procedure of TNMN data collection is organized at a national level. The National Data Managers are responsible for data acquisition from TNMN laboratories as well as for data checking, conversion into an agreed data exchange file format (DEFF) and sending it to the TNMN data management centre, located in the Slovak Hydrometeorological Institute in Bratislava. This centre performs a secondary check of the data and



uploads them into the central TNMN database. In cooperation with the ICPDR Secretariat, the TNMN data are uploaded into the ICPDR website ([www.icpdr.org](http://www.icpdr.org)). A total of 52 determinants for water is being monitored, with a minimum sampling frequency of 12 times per year for water and twice a year for bio-monitoring. Types of determinants include data on flow (m<sup>3</sup>/s), temperature, pH, conductivity, alkalinity, heavy metals, toxic substances, BOD, COD and bacteria (for instance salmonella). The TNMN laboratories are free to choose any analytical method, provided they are able to demonstrate that the method in use meets the required performance criteria. Therefore, the minimum concentrations expected and the tolerance required of actual measurements, have been defined for each determinant, so that method compliance can be checked. In addition, a basin-wide analytical quality control programme (AQC) is organized regularly by the ICPDR.

- **跨国监测网络 (TNMN)**：多瑙河 TNMN 网络涉及 78 个采样点。每一监测点拥有三个采样点，分别位于河流左侧、河流右侧或河流中心。TNMN 数据采集程序是在国家层面上进行规划的。National Data Managers 负责从 TNMN 实验室采集数据，进行数据校验，将数据转换为规定的数据交换文件格式 (DEFF)，并将其发送至位于伯拉第斯拉瓦斯洛伐克水文气象局的 TNMN 数据管理中心。该中心负责对数据进行二次校验，并将其上传至 TNMN 中央数据库。通过与 ICPDR 秘书处进行合作，TNMN 数据随后又上传至 ICPDR 网站 ([www.icpdr.org](http://www.icpdr.org))。目前正在对 52 个水资源决定因素进行监测，其中水资源年最低采样频率达 12 次，生物监测最低采样频率为每年 2 次。上述决定因素的类型主要包括：流量数据（立方米/秒）、温度、pH 值、导电性、碱度、重金属、有毒物质、生化需氧量 (BOD)、化学需氧量 (COD) 以及细菌（如沙门氏菌）。TNMN 实验室可任意选用任何分析方法，前提是能够证明所用方法符合相关性能标准。因此，针对每种因素，对实际测量中的预期最低浓度以及规定公差进行了定义，以此确保可对方法合规性进行检验。此外，ICPDR 还定期组织面向整个流域的分析质量控制项目 (AQC)。

### 3.4 Decreased exposure to hazardous pollutants in the EU: how did it happen?

#### 欧盟减少危险污染物如何实现的？

#### 3.4.1 Introduction and principles 引言

The first early warnings of the environmental impacts of production and use of industrial and man-made chemicals, including persistent organic pollutants (POPs), came from observations from aquatic ecosystems in the 1950s and 1960s. The effects, for example, of methyl mercury, organochlorines and pesticides such as DDT on seabirds and marine mammals are well documented (Hario et al., 2004; Sørmo et al., 2005). The early studies identified chemical properties which were particularly important with respect to environmental effects and which later became important criteria for classification and labelling in chemical legislation. Examples of these are lipid solubility (lipophilicity, hydrophobicity), persistence, and bioaccumulation potential. The mechanism of biomagnification has been discovered, i.e. that chemicals are enriched higher up in the food chain, resulting in the highest levels in top predators like tuna or salmon, fish-eating birds, marine mammals (seals, dolphins) and eventually humans (EEA, 2011). Whereas food is a main source of exposure to many hazardous pollutants in humans, exposure through other media, as drinking water and inhaled air, may also be important (WHO, 2007).

有关由工业化学品与人造化学品的生产与使用而产生的环境影响的第一批预警中包括了持久性有机污染物（POP），POP 是在 20 世纪 50 年代与 60 年代对水生生态系统的观察中发现的。例如，甲基汞、有机氯杀虫剂及农药（如二氯二苯三氯乙烷，DDT）对海鸟以及海洋哺乳动物的影响均有据可查（(Hario et al., 2004 ; Sørmo et al., 2005)）。早期研究中确定了化学品中影响环境的关键特性，这些化学特性随后成为了化学品立法中用于分类、加标的重要标准。这些特性包括类脂溶解度（亲油性、疏水性）、持久性以及生物蓄积潜力。目前已发现了生物放大机制，即化学毒素转移并累积到高层食物链，由此使得顶端食肉动物包括金枪鱼或鲑鱼、食鱼鸟、海洋哺乳动物（海豹、海豚）以及人类（EEA, 2011）所吸收的化学物质达到最高水平。尽管食物是接触一些危险污染物的主要途径，但是也可能通过其他媒介，如饮用水、吸入的气体，接触到危险污染物。这一点也应引起重视（WHO, 2007）。

One of the first major responses to the concern about the impacts of chemicals in the environment was the development of the Helsinki Convention signed in 1974, which focused on the prevention and elimination of pollution by hazardous chemicals to the Baltic Sea Area. The 1970s was also the time when serious environmental problems,



including collapses of seal and sea eagle populations caused by PCBs and DDTs, became obvious to the larger public (HELCOM, 2010<sup>76</sup>). An early action was also the implementation (in 1976) of the EU Dangerous Substances Directive (now integrated into the EU Water Framework Directive) which aimed to eliminate pollution by a select list of substances and reduce the level of certain others. Since then, a range of legislation and policies have been put in place to address the **use** of hazardous substances, their **release** to Europe's environment, their **levels** within aquatic and terrestrial environments, and to **mitigate** the adverse impacts of these pollutants.

化学物质对环境影响的研究在 1974 年签订的《赫尔辛基公约》的编制中首次公开，该公约的主要目的在于预防并减少排入波罗的海区域的危险物质所造成的污染。20 世纪 70 年代公众越发认识到环境问题的严峻，如：PCB、DDT 导致了海豹、海鹰数量急剧下降（HELCOM, 2010）。早期所采取的一项措施同样是实施《欧盟危险物质指令》（1976 年，现已纳入《欧盟水框架指令》），早期的实施旨在利用选定物质减少污染并降低其他一些物质的污染等级。自此之后，系列相关的立法与政策解决了危险物质的**利用**问题及其在环境中的**排放**问题，确定其在水生和陆生环境中的**含量**，并**缓解**这些污染物所造成的负面影响。

The sources of hazardous pollutants to surface and underground water bodies in Europe are diverse, including household, municipal, and industrial wastewater, agricultural run-off, mining, landfills, exploitation of shale gas, shipping, harbour and port activities, offshore oil exploration and aquaculture. Long-range transboundary transport of contaminated air can result in wet and dry deposition of, e.g., mercury far away from the emission source itself. Moreover, deposited river bed sediments and their associated contaminants can be re-suspended into the water column during periods of higher river flow and transported downstream to new areas (EC, 2011).

在欧洲，地表和地下水体危险污染物的来源多种多样，包括生活、市政与工业废水，农田径流，采矿、填埋、页岩天然气的开采、海运、港口活动、近海石油开发以及水产养殖。污浊空气的远距离跨界运输可导致干湿沉降，如与排放源自身相距较远的汞。此外，堆积的河床沉积物及其相关的污染物在河流流量较大时可能会重新悬浮在水体中并迁移至下游其他区域（EC, 2011）。

EU legislation has led to documented reductions in the emissions of and exposure to many well-known hazardous substances to air and water in Europe. However, the

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<sup>76</sup> Already in 1962, however, the book *Silent Spring* by Rachel Carson was published. The book documented detrimental effects of pesticides on the environment, particularly on birds. The book facilitated the ban of the pesticide DDT for agricultural use in 1972 in the United States.早在1962年，雷切尔·卡森所著的书籍《寂静的春天》就已经出版了。书中就农药对环境，特别是鸟类的有害作用进行了介绍。该书促使美国在1972年迅速对农业用DDT农药予以禁用。

persistence and ubiquity, particularly in sediment and biota, of these substances mean that they continue to pose a risk to aquatic environments even when emissions are reduced and at sites far from human activity as in the Arctic. Moreover, a number of emerging pollutants, including chemicals with endocrine disrupting properties, for which the awareness of potential effects has developed only recently, are causing rising concern. These substances are, however, not yet included in routine monitoring programs. Lack of monitoring data implies that it is difficult to robustly assess their impacts on human health and environment. Furthermore, there is emerging evidence of so-called cocktail effects, implying that the current chemical-by-chemical approach to risk assessment may lead to underestimation of risks (EEA, 2011). Finally, there are a number of ways in which climate change may affect hazardous pollutants in water bodies. In this chapter we present **an overview of the developments with regards to reducing emissions and impacts of hazardous pollutants in Europe, challenges ahead, and legal and other instruments applied in the work.**

有资料证明，通过实施欧盟立法，一些众所周知的危险物质排入空气或水中的数量有所下降，与空气或水资源接触的频率也有所减少。然而，由于这些物质，尤其是在沉积物与生物群中具有持久性且无处不在，因此，即使其排放量下降或排放到像北极一样远离人类活动的地方，仍然会对水生环境构成一定威胁。同时，大量新兴污染物的出现也使得人类的担忧与日俱增。这些污染物包括具有内分泌干扰特性的化学药品，人类不久前才认识到这类化学药品的潜在影响。但是这些物质还尚未包括在常规监测项目中。此类监测数据的缺失表明，有效评价其对人类健康及环境的影响存在一定的困难。此外，所谓“鸡尾酒效应”的证据不断出现，意味着目前风险评价所采用的“逐个化学品检查法（chemical-by-chemical approach）”有可能导致对风险的低估（EEA, 2011）。另外，气候变化也可能会通过一系列途径对水体中的危险污染物施加影响。本章将对所取得的相关成就进行概括，内容涵盖欧洲危险物质排放量的减少及影响的降低情况，未来面临的挑战以及工作中所采用的其他措施。

### Box 3.3 What is a hazardous substance?

#### 框 3.2 何为危险物质？

A variety of chemicals are present in products and environments encountered in everyday life. In addition, nearly every industrial company uses chemicals in its production. Some of these chemicals can severely damage health and the environment if not handled properly. Emissions to air and water as well as disposal of hazardous substances may all be important sources of pollution. The definition of hazardous substances may, however, differ across various legislative frameworks. In principle, being “hazardous” is a consequence of one or more intrinsic properties of a substance. It may derive from physicochemical properties, toxicity to human health or toxicity to the environment (flora, fauna, microorganisms, deplete ozone layer, etc.). Some water pollutants which are actually needed in trace amounts may become extremely toxic when occurring in high concentrations. Copper, zinc, manganese, boron and phosphorus, for example, can be toxic or may otherwise adversely affect aquatic life when present

above certain concentrations, although their presence in low amounts is essential to support and maintain functions in aquatic ecosystems. The same is true for certain elements with respect to drinking water. Selenium, for example, is essential for humans but becomes harmful or even toxic when its concentration exceeds a certain level. The legal frameworks dealing with hazardous substances in Europe may have different understandings and use different criteria to select the substances they aim to regulate. While this may be unfortunate, the reason why the criteria differ is often related to the goals and priorities towards the environmental media to be protected from the hazardous substances (HS, 2009).

日常生活中所用的产品以及环境中存在着各种各样的化学物质。几乎每一家工业企业都会在其生产过程中使用化学物品。如果得不到妥善处理，则一些化学物质就会对健康与生态环境造成严重危害。空气中或水中的排放物以及危险物质的处理均有可能成为污染的重要来源。然而，有关危险物质的定义可能会因法律框架的不同而有所区别。原则上，“危险”这一特征是一种物质所具有的一种或多种内在特性共同作用的产物。可能来自于物化特性，对人类健康的毒性或者是对环境的毒性（植物群、动物群、微生物、臭氧层消耗等）。一些实际中使用极少的水污染物，如果以高浓度形式出现，则可能会变成剧毒物质。例如：铜、锌、锰、硼、磷在达到一定浓度以上时，会变成有毒物质或给水生生物带来不利影响——尽管少量的这些物质是支持、维持水生生态系统功能的必要条件，这同样也适用于有关饮用水的某些元素。例如，硒是人体所必需的一种物质，但是当其浓度超过一定水平时，则会变成有害物质，甚至是有毒物质。在欧洲，有关危险物质的法律框架可能会有不同的理解，可能会基于不同标准选择需要进行控制的相关物质。尽管这可能令人有些遗憾，但采用不同标准的原因通常与需要对其进行保护及使其免受危险物质影响的环境介质的目标、优先等级有关（HS，2009）。

Hazardous substances include a wide range of synthetic chemicals as well as naturally occurring chemicals (for instance metals such as Cd, Hg, Pb and As) and various by-products of natural and human-induced processes. Regarding impacts on humans, exposure to toxic chemicals can occur via inhalation, ingestion and direct contact with skin, and the variety of hazardous substances in use brings with them a range of well-documented health effects. Health effect may be categorized along two axes, acute versus chronic and local versus systemic. Acute effects refer to the case when hazardous substances produce toxic effects in humans or the environment after a single, episodic release. Acute effects include, for instance, skin or eye irritation, headache, nausea, difficulty in breathing, and burns. Other hazardous substances produce toxic effects in humans or the environment after prolonged exposure to the substance, which is called chronic toxicity. Chronic effects include liver and kidney disease, nerve and brain disorders, and reproductive damage. Local effects occur when the substance causes damage at the point of original contact, e.g. resulting from skin, eye, or respiratory tract exposure. System effect arise when the toxic substance affect the organs of the body, such as the liver, heart, nervous system, and muscles. Other important examples of systemic effects are carcinogen and reproductive effects and various endocrine

disrupting effects. Regarding reproductive effects, a so-called teratogen affects the developing fetus, implying that even though the mother may not suffer from exposure, the fetus may be damaged because it is more sensitive. Some chemicals cause more than one of these types of effect. Whereas acute effects are often reversible when the exposure stops, chronic effects can often not be reversed even if the exposure is stopped (USEPA 2013).

危险物质包括各种不同的合成化学品、天然化学物质（如镉、汞、铅、砷等金属）以及自然或人为活动所产生的各类副产品。就人体影响而言，人体可能会通过吸入药剂、摄食及直接接触皮肤等途径接触到有毒化学物质。有资料证明，除种类繁多之外，现有危险物质本身也带有一系列的健康影响。健康影响可以分为两类：突发性与慢性影响、局部与整体影响。突发性效应指的是危险物质在单独的、偶发性释放后对人类或环境产生毒性作用。突发性效应包括皮肤或眼部刺激、头痛、恶心、呼吸困难以及烧伤。就其他危险物质而言，会在长时间接触该物质之后，对人类或环境产生一定的毒性作用。这种现象称之为慢性中毒。慢性效应包括肝脏和肾脏疾病、神经和大脑疾病以及生殖健康危害。当危险物质对最初接触点造成损害时，就构成了局部效应，例如，皮肤、眼睛或呼吸道接触所造成的伤害。当有毒物质对身体器官，如肝脏、心脏、神经系统与肌肉产生影响时，就形成了系统效应。系统效应的重要例子还包括致癌物质和生殖影响以及各类内分泌干扰作用。就生殖影响而言，所谓的畸胎原会对发育中的胎儿产生影响，这意味着，尽管母亲可能在污染暴露中未受影响，但由于胎儿要更为敏感一些，因此可能会受到一定的影响。有些化学物质可能会产生一种以上的这类影响。然而，停止接触后，突发性效应通常是可以消除的，而慢性效应即使是停止接触后，通常来说也无法消除（USEPA 2013）。

Impacts on the environment are as diverse as the impact on human health. Hazardous substances can kill living organisms in a lake or river, destroy wildlife and vegetation in a contaminated area, cause major reproductive complications in wildlife, or otherwise limit the ability of an ecosystem to survive. Certain hazardous substances also have the potential to explode or cause a fire, threatening both wildlife and human populations. When talking about environmentally hazardous substances, the properties of most importance are those which impair the functioning of ecosystems. This means those adverse properties which threaten the stability of the entire population of micro-organisms, plants or animals, e.g., by weakening the immune system, disturbing reproduction, or inhibiting photosynthesis (Kislenko et al., 2009).

同人类健康一样，危险物质对环境所产生的影响也是多种多样的。危险物质可杀死湖泊或河流中的生物体，破坏污染区的野生动物和植被，对野生生物造成重大生殖并发症，或限制生态系统的生存能力。特定的危险物质可能会爆炸或引发火灾，对野生生物及人类构成一定的威胁。就危害环境物质而言，其最重要的特性在于能够影响生态系统的功能。这意味着这些不良特性将通过削弱免疫系统、干扰繁殖或抑制光合作用而对整个微生物群、植物群或动物群的稳定构成威胁（Kislenko et al., 2009）。

### 3.4.2 Tools

#### **Legal tools and frameworks applied in Europe** 欧洲所采用的法律手段和框架

As of today a range of policies and measures are working together to reduce the emission of hazardous substances to water bodies in the EU. These policies and measures encompass **product substitution, restrictions on marketing and use, the setting of emissions and environmental quality standards and monitoring according to these standards, requirements to demonstrate the implementation of clean production processes and best available techniques in applications for industrial permits, fiscal instruments, and actions to raise public awareness.** Part of the legislation targets the risk management of chemicals as such (production, handling, disposal etc.), whereas another legislation focus on the environmental quality in order to ensure that pollution does not lead to adverse effects on humans and environment – sometimes in specific geographic regions (see details below). Public consultation is an important element of communication and several directives specifically require Member States to make information available to the public and consult them on certain issues.

迄今为止，欧盟已制定了一系列政策并采取了一系列措施，力图降低水体中危险物质的排放量。这些政策与措施包括：产品替代，限制销售和使用，制定排放与环境质量标准并根据这些标准进行监测，有关清洁生产流程、正在申请工业许可证的最佳可行技术的相关实施要求，财政手段以及提高公众意识所采取的措施。部分立法的实施对象为此类化学物质的风险管理（生产、操作、处理），而另一些立法的重点在于环境质量，确保污染不对人体与环境（有时为特定地理区域，详细信息见下文）产生负面影响。公共协商是沟通的一个重要组成部分，一些指令中特别要求其成员国将相关信息公之于众，并就相关问题向公众咨询。

Whereas there were early efforts to target hazardous pollution in the 1970s and several regulations and directives were developed during the 1990s, **much of the legislation targeting hazardous pollutants has in fact been implemented relatively recently, including REACH and the Water Framework Directive.** In order to simplify Community legislation and remove obsolete provisions, earlier legislation is often integrated into newer legislation.

尽管早在 20 世纪 70 年代就采取了相关措施解决危险物质污染问题，20 世纪 90 年代又制订了一系列相关法规与指令，但是**多数有关危险物质污染的立法实际上在不久前才开始实施，这其中包括 REACH 与《水框架指令》。**为了简化共同体立法并删除一些过时规定，早期的立法通常会纳入新的立法中。

**Laws and regulations ('command-and-control' tools) have been the dominating instruments to abate hazardous pollutants in the EU over the last decades, although economic incentives and information-based instruments are also in use. Long-term monitoring programs on chemical status in water bodies, in vitro assays, in vivo markers and bioassays, and various population and community indices have**

**been instrumental to understanding the problem, enable prioritizing policies, and to evaluate their success.**

过去数十年中，尽管也采用了经济激励与信息化工具，但法律法规（“指挥控制”工具）一直是欧盟减少危险污染物的主要手段。有关水体、体外实验、体内标记与生物测定中化学状况以及各类种群与群落指数的长期监测项目对于理解这一问题很有帮助，能够确保优先政策的实施并对相关成就进行评估。

From the perspective of hazardous pollutants in the aquatic environment in Europe and their impacts on human health and environment a large number of frameworks and regulations are relevant, several of them containing their own definition of hazardous substances and criteria for prioritizing them. Some of the most important of these are (see Box below for a brief overview of the legislative system in EU):

就欧洲水生环境中危险污染物及其对人类健康、环境的影响而言，有一系列法律框架及法规可以参考，其中一些框架与法规中包含框架或法规自身对危险物质的定义以及确定其优先顺序的相关标准。其中一些最为重要的框架与法规包括（有关欧盟立法体系的概述，见下文框中所列内容）：

- Regulation No 1272/2008 on classification, labelling and packaging of chemical substances and mixtures (**CLP**) No 1272/2008 《化学物质及其混合物的分类、标记与包装法规》（**CLP**）
- Regulation No 1907/2006 on registration, evaluation, authorisation and restriction of chemicals (**REACH**) No 1907/2006 《化学品注册、评估、授权和限制法规》（**REACH**）
- Regulation (EC) No 850/2004 on persistent organic pollutants. No 850/2004 (EC) 《持久性有机污染物法规》
- Directive 2002/95/EC, **RoHS** on the Restriction of Hazardous Substances (short for Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment) 2002/95/EC 《有害物质限用指令》（**RoHS**）（全称是《关于限制在电子电器设备中使用某些有害成分的指令》）
- Directive 2008/1/EC on Integrated pollution prevention and control (**IPPC**) 2008/1/EC 《综合污染防治指令》（**IPPC**）
- Directive 2008/98/EC on waste (Waste Framework Directive). Integrates (i.e. repeals) previous legislation, e.g. the Hazardous Waste Directive and the Waste Oils Directive. 2008/98/EC 《废物指令》（《废弃物框架指令》），将以往立法，如《危险废物指令》与《废弃油脂指令》进行合并（即废除）
- The Waste Electrical and Electronic Equipment Directive (**WEEE**) 2002/96/EC which sets collection, recycling and recovery targets for electrical goods. 《报废电

子电气设备指令》（**WEEE**）2002/96/EC，设定了电子产品的收集、回收及废物利用目标

- Directive 96/59/EC on the disposal of polychlorinated biphenyls and polychlorinated terphenyls (**PCB/PCT**) 96/59/EC 《多氯联苯与多氯三联苯处理指令》（**PCB/PCT**）
- Directive 1999/31/EC on the landfill of waste ( Landfill Directive) 1999/31/EC 《垃圾填埋场指令》（垃圾掩埋法令）
- Water Framework Directive 2000/60/EC (**WFD**) and linked Directive 2008/105/EC on environmental quality standards (**EQS**) in the field of water policy (as of 2008 33 substances<sup>77</sup> or groups of substances are on the list of priority substances for which EQS are set) 《水框架指令》2000/60/EC (**WFD**) 以及与其关联的 2008/105/EC 《水资源政策领域环境质量标准指令》（**EQS**）（截止 2008 年，33 种物质或物质群列入了 EQS 所设定的重点控制物质）
- Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources, or Nitrate Directive. 91/676/EEC 《保护水资源免受来自农业源硝酸盐污染指令》，或《硝酸盐指令》
- Directive 2008/56/EC on community action in the field of marine environmental policy, or Marine Strategy Framework Directive (**MSFD**) 2008/56/EC 《海洋环境政策领域社区行动指令》，或《海洋战略框架指令》（**MSFD**）
- **Helsinki Convention** on the Protection of the Marine Environment of the Baltic Sea Area 《保护波罗的海区域海洋环境的赫尔辛基公约》
- **OSPAR Convention** for the Protection of the Marine Environment of the North-East Atlantic 《保护东北大西洋海洋环境公约》（**OSPAR**）
- The Protocol to the regional UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) on POPs (**POPs Protocol**, under the global Stockholm Convention on POPs (**POPs Convention**)关于 POPs（**POP** 议定书，《关于持久性有机污染物的斯德哥尔摩公约》）的区域 UNECE 《关于长距离越界空气污染物公约》（CLRTAP）的议定书（**POPs 公约**）
- **Basel Convention** on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 《关于控制危险物质越境转移及其处理的巴塞尔公约》

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<sup>77</sup>List: [http://ec.europa.eu/environment/water/water-](http://ec.europa.eu/environment/water/water-framework/priority_substances.htm)

[framework/priority\\_substances.htm](http://ec.europa.eu/environment/water/water-framework/priority_substances.htm) 清单内容网址 [http://ec.europa.eu/environment/water/water-](http://ec.europa.eu/environment/water/water-framework/priority_substances.htm)  
[framework/priority\\_substances.htm](http://ec.europa.eu/environment/water/water-framework/priority_substances.htm)

- The **Rotterdam Convention** on the Prior Informed Consent Procedure for certain hazardous Chemicals and Pesticides in international trade 《关于国际贸易中特定危险化学品与农药事先知情的同意程序的**鹿特丹公约**》
- International Code of Conduct on the Distribution and Use of Pesticides 《国际农药供销与使用行为守则》
- The **Minamata Convention** on Mercury 《关于汞的**水俣公约**》

### Box 3.4 Legal acts in the EU

#### 框 3.3 欧盟的相关立法

The aims set out in the EU treaties are achieved by several types of legal acts. Some are binding, others are not. Some apply to all EU countries, others to just a few.

欧盟条约中所设定的目标可通过不同类型的立法来实现。其中一些具有约束力，其他一些则不具有约束力。一些适用于所有欧盟国家，其他一些则只仅用于个别欧盟国家。

*Regulations:* a directly applicable and binding legislative act that does not require any national implementation measures. It must be applied in its entirety across the EU.

**法规：**一种直接适用且具有约束力的立法，不涉及任何国家履约措施。必须全部应用于欧洲地区。

*Directives:* a binding legislative act that sets out goals that all EU countries must achieve. Each country needs to specifically implement a directive and by that also incorporate it into national laws. However, directives normally leave some level of discretion in implementation to the member states.

**指令：**一种具有约束力的立法，可设定所有欧盟国家必须达到的相关目标。每个国家需要专门实施一种立法，并基于此将其纳入国家法律。但是，指令在成员国的实施通常具有一定的灵活性。

*Decisions:* a "decision" is binding on those to whom it is addressed (e.g. an EU country or an individual company) and is directly applicable.

**决定：**“决定”对相关对象具有约束力（如，一个欧盟国家或一家私营企业），可直接适用。

*Recommendations:* a "recommendation" is not binding and does not have any legal consequences. A recommendation allows the institutions to make their views known and to suggest a line of action without imposing any legal obligation on those to whom it is addressed.



建议：“建议”不具有约束力，不会产生任何法律后果。“建议”允许相关机构发表自身观点，提出一系列行动方案，而不会对相关对象施加任何具有法律约束力的义务。

*Opinions:* an instrument that allows the institutions to make a statement in a non-binding fashion, in other words without imposing any legal obligation on those to whom it is addressed. An opinion is not binding. It can be issued by the main EU institutions (Commission, Council, Parliament), the Committee of the Regions and the European Economic and Social Committee. While laws are being made, the committees give opinions from their specific regional or economic and social viewpoint.

意见：一种允许相关机构自由陈述观点的方式，换句话说，不对发布对象施加任何具有法律约束力的义务。一个观点是不具有约束力的。可以由欧盟主要机构（委员会、理事会、议会），地区委员会以及经济和社会委员会负责发表意见。制定法律的同时，各委员会可从自身区域观点或经济社会观点发表相关意见。

In addition to policies aimed at reducing risk of contamination of the environment from hazardous pollutants, there are a number of policies aimed at reducing the exposure, inter alia via food (food safety regulations). Examples are the Regulation (EC) 1831/2003 setting maximum levels of cadmium, mercury and lead in fish, molluscs and crustaceans to protect public health, and the Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture. Regarding drinking water, a key measure for reducing the need for and cost of purification required for Europe's drinking water is the establishment of safeguard or protection zones around the source. The creation of such zones, recognised in the Water Framework Directive legislation, must be associated with regulatory powers to control polluting activities (EEA, 2011). The drinking water quality as such is regulated by Council Directive 98/83/EC on the quality of water intended for human consumption (Drinking water Directive).

除降低危险污染物对环境的污染风险方面的政策之外，还有其他一些要求减少接触，尤其是通过食物摄入（食品安全法规）的政策。这类政策包括法规（EC）1831/2003——设定了鱼类、软体动物及甲壳纲动物中镉、汞、铅的最高含量以保护公众健康，以及针对环境保护，尤其是污水淤泥用于农业时的土壤保护的理事会指令 86/278/EEC。就饮用水而言，降低欧洲饮用水净化需求及成本的关键措施是在水源周围建立保护区。依据《水框架指令》，这类区域的建立必须配合一定的管理权限，以此对污染活动进行控制（EEA, 2011）。其饮用水质量由理事会指令 98/83/EC（针对人类饮用水水质）进行规范（《饮用水指令》）。

While EU Regulations are laying the basis for implementation of measures at the national level, they are also put in place to ensure that the provisions of international agreements are followed up by Member States (for instance emission inventories, national implementation plans, monitoring systems and information exchange mechanisms). The harmonizing of EU framework benefits consumers through safer

products while also ensuring equal level playing field for businesses. Moreover, a close cooperation between the different national authorities means double work can be avoided.

欧盟法规为相关措施在国家层面的实施奠定了基础，与此同时，这些法规的建立也有利于确保其成员国遵守国际条约的相关规定（如排放目录、国家实施计划、监测系统以及信息交换机制）。欧盟框架的协调发展使消费者通过安全的产品从中获益，与此同时也为相关企业创造了一个公平竞争的环境。此外，各国有关部门间的密切合作也避免了重复工作。

### **Different tools – different targets 不同工具——不同目标**

Hazardous substances may be released to the environment from every stage of the product chain: from the raw material (chemical products), from the production process, including the ones unintendedly built up during the process (e.g. dioxins), when transported, when used as an article or handled as a waste. Monitoring may target concentrations in water, air, food, and human tissue or in other organisms. Each of these issues may be regulated in order to minimize negative impact to humans and environment.

产品链的每一阶段均有可能将危险物质排放到环境中，这些危险物质可能来自原材料（化工产品）或生产流程，包括生产中无意识积聚起来的危险物质（如二氧芑），也可能来自于运输过程、使用过程或被当作废物处理的过程。相关监测可侧重于水、空气、食物以及人体组织中的浓度或其它生物体中的浓度。可对这些问题进行监管，尽量减少对人体以及环境的负面影响。

Evidently, several legal frameworks addressing one or more of the individual steps in the cause-effect chain have worked together to reduce the burden of hazardous pollutants in Europe. In the following, examples of some important legal frameworks are presented.

显然，欧洲是通过同时实施多个法律框架（解决因果链中的一个或多个独立步骤）而达到减轻危险污染物负荷的这一目的的。以下介绍了一些重要法律框架的实例。

#### **1. Classification 分类**

Classification of chemicals according to their potential risks to human health and environment is a fundamental part of efforts to reduce damage from hazardous pollutants. Regulation No 1272/2008 on ‘Classification, labelling and packaging of chemical substances and mixtures’ (CLP) is a **core regulation regarding classification of chemical substances**. It proposes and justifies a harmonised classification and

labelling of substances at EU level<sup>78</sup>. A detailed code system is developed to classify chemicals, spanning the many types of effects that may be caused by a substance (e.g., whether it is explosive or flammable, causes eye and skin irritation, is carcinogen or acute toxic, affects productivity, or causes acute or chronic effects in the aquatic environment).

依据化学品对人类健康及环境的潜在风险对其进行分类，是降低危险污染物危害相关措施的一个基本组成部分。No 1272/2008《化学物质及其混合物的分类、标记与包装法规》（CLP）是有关化学物质分类的一项核心法规。该法规提出了欧盟层面的物质统一分类与标记并对其进行说明。同时，建立了一个具体的化学品分类代码体系，对可能由物质造成的一些影响类型进行了分析（如，物质是否易爆炸或易燃，是否会对眼睛和皮肤造成刺激，是否含致癌物质或具有突发性毒性，是否会影响生产率，是否会对水生环境产生突发性或慢性影响）。

This classification may, however, not be sufficient for identifying priority substances within the various legal frameworks addressing specific impacts of hazardous pollutants. Examples of important criteria linked to the chemical properties of substances, in addition to risk codes as given in CLP above, are the persistence of the substance (i.e. whether it is readily degradable or not) and the likeliness of bioaccumulation (i.e. to what extent it is accumulating in organisms). These properties are important for identifying where in the impact pathway effects on human health and environment may occur. Various legal frameworks, presented below, may use a different wording for similar substances to characterize priority substances.

然而，这种分类方式可能还不足以确定各类法律框架（旨在解决危险污染物所造成的具体影响）下的重点控制物质。与物质化学特性相关的重要标准方面的范例以及前文 CLP 中涉及的相关危险性描述是确保物质持久性（即，是否容易降解）以及生物体内积累可能性（即，在生物体内的累积程度）的基础。这些特性是确定通过何种影响路径可能对人类健康及环境产生影响的重要条件。以下各类法律框架中针对相似物质采用了不同的措辞，以便对重点控制物质进行描述。

## 2. Production and use 生产与利用

Production of use and hazardous chemicals in the EU are addressed by the REACH Regulation. **Through the establishment of REACH, EU has modernised previous European chemicals legislation.** The objective of REACH is to improve the protection of human health and the environment whilst maintaining competitiveness and innovation in Europe's chemicals industry. All companies manufacturing or importing chemical substances into the EU in quantities of one tonne or more per year are

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<sup>78</sup> <http://echa.europa.eu/uk/addressing-chemicals-of-concern/harmonised-classification-and-labelling/annex-vi-to-clp>

required to register these substances with a new European Chemicals Agency (ECHA). Since REACH applies to some substances that are contained in objects (articles in REACH terminology), any company importing goods into EU could be affected. The basic idea is that having detailed information on the substances present in their products will allow retailers to work with the manufacturing base to substitute or remove potentially harmful substances from products, and if not removed ensure safe handling and disposal. To sell or use so-called Substances of Very High Concern in the REACH language (i.e. carcinogenic, mutagenic, toxic for reproduction, persistent and bioaccumulative chemicals), manufacturers, importers and retailers in the EU must apply for authorization from the ECHA. REACH covers most types of substances, whether manufactured, imported, placed on the market, or used on their own or in mixtures, but excludes some important issues which are regulated in other legislation, e.g., radioactive substances, the transport of dangerous substances, and waste. See chapter 2 for a more comprehensive overview of REACH.

REACH 法规对欧盟危险化学品的生产与利用做出了相关规定。通过颁布 REACH 法规，欧盟实现了以往欧洲化学品立法的现代化发展。REACH 法规旨在保持欧洲化学品行业的竞争力与创新性的同时，进一步保护人类健康以及环境。所有化学物质生产量达到一吨或以上的企业或每年向欧盟引进一吨或以上的化学物质的企业均需要向新成立的欧洲化学品管理署（ECHA）申请注册上述化学物质。由于 REACH 适用于物体中所含有的一些物质（参考 REACH 相关术语条款），因此任何进口货物到欧盟的企业均有可能受到影响。从根本上讲，要获得相关产品中所含物质的详细信息，零售商需要同生产基地一同协作，用其他物质代替产品中所含的存在潜在危害的物质或将其从产品中去除。如不去除，则应确保生产过程中的安全使用及处理。为销售或使用 REACH 中所谓的“高度关注物质”（即，致癌物、诱导有机体突变的物质、生殖毒性、持久性和生物累积性化学物质），欧盟生产商、进口商以及零售商必须向 ECHA 申请授权。REACH 涵盖了大多数类型的物质，包括已生产的、进口的及市场上出售的物质或是独立或混合使用的物质，但不包括其他立法中所规定的一些重要问题，如，放射性物质、危险物质的运输以及废弃物。有关 REACH 更全面的概述，请参阅第 2 章相关内容。

Hazardous pollutants may also simply be **banned**. For instance, **cadmium, mercury and lead are being banned from an increasing number of products in the EU**. Although listing exemption, the RoHS Directive (see above) states that “Member States shall ensure that, from 1 July 2006, new electrical and electronic equipment put on the market does not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).” RoHS is

closely linked to the WEEE Directive (see above) and is part of a legislative initiative to solve the problem of huge amounts of toxic e-waste<sup>79</sup>.

危险污染物可能会简单的被禁止。例如，欧盟正在努力禁止更多的产品中使用镉、汞以及铅。尽管，但是 RoHS Directive（见前文）中仍规定：“各成员国应确保，自 2006 年 7 月 1 日起，新上市的电子电器设备中不含有铅、汞、镉、六价铬、多溴化联苯（PBB）或多溴联苯醚（PBDE）。” RoHS 与 WEEE 指令（见前文）间有着密切的联系，这是解决有毒电子垃圾问题这一立法计划的一个规定。

There are no separate regulatory instruments in the WFD for the management of priority (hazardous) substances<sup>80</sup> but they are included and controlled under other (environmental) legislation, such as:

就重点控制（危险）物质的管理而言，WFD 未提供独立的监管工具，但是在其他（环境）立法中，涉及了这些工具并对其进行了规定。

1) Directive on Priority Substances: Sets environmental quality standards (EQS) for priority (hazardous) substances. EQS means “the concentration of a particular pollutant or group of pollutants in water, sediment or biota which should not be exceeded in order to protect human health and the environment”. EQS are defined as annual average concentrations and maximum allowable concentrations in inland and other surface waters. 《重点控制物质指令》：针对重点控制（危险）物质制订了环境质量标准（EQS）。EQS 指的是“水中、沉积物中或生物群中特殊污染物或污染物群的浓度，这一浓度应保持在一定水平，以此保护人类健康以及环境。” EQS 被定义为是内陆水及其他地表水的全年平均浓度与最大允许浓度。

2) Directive on Integrated Pollution Prevention and Control 2008/1/EC (IPPC), which requires to identify used and emitted priority and priority hazardous

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<sup>79</sup> The same six components are regulated in electronics in China by a similar regulation, see [http://en.wikipedia.org/wiki/China\\_RoHS](http://en.wikipedia.org/wiki/China_RoHS) 通过类似的法规，中国电子工业对相同的六种元素进行了规定，见地址 [http://en.wikipedia.org/wiki/China\\_RoHS](http://en.wikipedia.org/wiki/China_RoHS)

<sup>80</sup> This first list of priority substances in the WFD was replaced by Annex II of the Directive on Environmental Quality Standards, also known as the Priority Substances Directive, which set environmental quality standards (EQS) for the substances in surface waters (river, lake, transitional and coastal) and confirmed their designation as priority or priority hazardous substances, the latter being a subset of particular concern. WFD 重点控制物质的首个清单由《环境质量标准指令》附录二（也称重点控制物质指令）所替代，其中针对表层水（河流、湖泊及过渡水域和沿海水域）物质制订了环境质量标准（EQS），并对其重点控制物质或重点控制危险物质的身份进行了确认，后者是需要特别关注的一个子集。

substances when applying for environmental permit and to apply BAT to reduce or cease the emissions (BaltActHaz, 2009). 《综合污染防治与控制指令》2008/1/EC (IPPC)：要求申请环境许可，将 BAT 用于降低或停止排放时，确定使用过的或已排放出的重点控制物质与重点控制危险物质 (BaltActHaz, 2009)。

### 3. Emission and disposal 排放与处理

Information on industrial emissions to water must be reported under the European Pollutant Release and Transfer Register (E-PRTR), see chapter 1. Reporting under E-PRTR is, however, incomplete with regards to the spatial extent and temporal resolution of data, especially for some substances.

必须依据《欧洲污染物排放与转移登记制度》(E-PRTR) 报告水中的工业排放物的相关信息，见第 1 章。但是，依据 E-PRTR 进行报告，所得的数据空间幅度与时间分辨率不够完整，特别是对于某物质而言。

The Council Directive on Hazardous Waste requires that Member States **shall take the necessary measures to require that on every site where tipping (discharge) of hazardous waste takes place the waste is recorded and identified**. Member States shall take the necessary measures to require that **establishment and undertaking which dispose of, recover, collect or transport hazardous waste do not mix different categories of hazardous waste or mix hazardous waste with non-hazardous waste**. The mixing of hazardous waste with other hazardous waste or with other waste, substances or materials may be permitted under certain conditions. Where waste is already mixed with other waste, substances or materials, separation must be effected, where technically and economically feasible, and where necessary in order to comply with other EU legislation.

根据《危险废物理事会指令》，成员国应通过采取必要措施，要求对所有场所（涉及危险废物的倾倒/排放）的废物进行记录和标识。同时，成员国应通过采取必要措施，要求危险废物的确认与处理（处理、回收、收集或运输危险废物）过程中，不得将不同种类的危险废物进行混合或是将危险废物与无害废物相混合。在一定条件下，可允许将不同危险废物进行混合或是将危险废物与其他废弃物、物质或材料相混合。若危险废物已与其他废弃物、物质或材料相混合，则必须在技术、经济条件允许且能够确保符合其他欧盟立法的情况下，对其进行必要的分离。

### 4. Monitoring 监测

Several frameworks contribute to monitoring of hazardous pollutants in water bodies in the EU. Chemical status is reported, i.a. under the River Basin Monitoring Programs of

the Water Framework Directive; the EEA's Eionet<sup>81</sup> Water database, which holds freshwater and marine data reported by EEA member countries; monitoring programmes conducted by EUs Joint Research Centre (JRC); the regional sea conventions HELCOM and OSPAR and various European research studies.

欧盟水体危险污染物的监测涉及几个法律框架。水框架指令流域监测计划，欧洲环境署内陆水资源监测和信息网(Eionet-water)数据库（包括 EEA 成员国汇报的淡水、海洋数据），欧盟联合研究中心（JRC）所实施的监测计划，区域海洋公约 HELCOM 与 OSPAR，以及各类欧洲调查研究中均涵盖了所报告的相关化学状态数据。

Despite the improved knowledge base arising from this body of information, **very often uncertainty remains as to whether the observed concentrations of a particular substance pose a risk to aquatic environments and human health** (EEA, 2011). Still, a reasonable guidance to this question is given by comparing with Environmental Quality Standards. For instance, in the Environmental Quality Standards Directive under the WFD concentration limits are given for priority substances (PS) and priority hazardous substances (PHS).

尽管由上述大量信息所组成的知识数据库得到了进一步完善，但是对于已观测到的特定物质的浓度是否会对水生环境及人体健康构成风险这一问题，仍然存在不确定性（EEA，2011）。仍然需要通过与环境质量标准进行比较，从而为这一问题提供合理的指导。例如，WFD《环境质量标准指令》中，针对重点控制物质（PS）与重点控制危险物质（PHS）的浓度极限进行了规定。

The chemical quality of Europe's surface waters is primarily addressed by the recently amended Environmental Quality Standards Directive (EQSD). This WFD 'daughter' directive defines concentration limits for pollutants of EU-wide relevance known as priority substances (PSs). The limits are defined both in terms of annual average and maximum allowable concentrations, with the former protecting against long-term chronic pollution problems and the latter against short-term acute pollution (EEA, 2011).

最新修订的《环境质量标准指令》（EQSD）中对欧洲表层水的化学品质进行了规定。WFD 子指令对涉及整个欧盟的污染物，即重点控制物质（PS）的浓度极限进行

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<sup>81</sup> Data and map production services of emissions to water, hazardous substances in marine organisms and other end-points are open source, see eg <http://www.eionet.europa.eu/gis/> and <http://www.eea.europa.eu/data-and-maps> 有关水中排放量、海洋生物中危险物质以及其他终端危险的相关数据与地图制作服务均为开放资源，见网址 <http://www.eionet.europa.eu/gis/> 与 <http://www.eea.europa.eu/data-and-maps>



了定义。此外，还对全年平均浓度与最大允许浓度的极限进行了定义，前者主要针对长期慢性污染问题，后者则针对短期突发性污染（EEA，2011）。

### 5. *Comprehensive frameworks and international treaties* 综合框架与国际条约

To an increasing extent EU is developing Framework Directives into which previous legislation is often integrated and streamlined. While a Framework Directive sets the goals, provides the general framework for managing the issue in question, and sets the basic management principles, there are typically other legislation linked to the Directive that provides specific definitions, standards etc., or stipulates certain Regulations that must be followed by all Member States regardless of how they choose to implement the Directive. For instance, the Waste Framework Directive stipulates a 5 step approach to waste management, which are prevention, reuse and preparation for reuse, recycle, recovery, and disposal. The Water Framework Directive 2000 requires surface freshwater and ground water bodies - such as lakes, streams, rivers, estuaries, and coastal waters - to be ecologically sound by 2015 and that the first review of the River Basin Management Plans should take place in 2012 (EC, 2012). Regarding hazardous pollutants in marine waters, the Marine Strategy Directive complements the Water Framework Directive and ensures a coherent system of management across the hydrological cycle, while overlapping the OSPAR Convention (see chapter 2) and the North Sea Declaration<sup>82</sup>.

目前，欧盟正在不断制定各类框架指令，这些框架指令通常会以以往立法纳入其中或是对其进行改进。在框架指令设定目标，为管理歧义问题，提供总体框架并制定基本管理原则的同时，也指出存在其他一些与上述指令相联系且较为典型的立法，这类立法涵盖具体的定义、标准等，或制定所有成员国必须遵守的特定法规，而不考虑他们如何实施上述框架指令。例如，《废弃物框架指令》中针对水资源管理提出了一个“五步法”，内容包括：预防、再利用与再利用准备、再循环、回收及处理。

《水框架指令 2000》要求，到 2015 年，地表淡水与地下水体，如湖泊、溪流、河流、河口及沿海水域，应达到整体平衡，同时，应于 2012 年对“流域管理规划”进行初审（EC，2012）。就海水中的危险污染物而言，《海洋战略框架指令》除了涵盖 OSPAR 公约（见第 2 章）与《北海宣言》的内容外，还对《水框架指令》进行了补充，确保了水循环管理体系的持续运行。

EU is a signatory to several international treaties that target hazardous pollutants in water bodies, most prominent being the Convention for the Protection of the Marine Environment of the North-East Atlantic (the OSPAR Convention), the Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area

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<sup>82</sup> An overview of Ministerial Declarations from the North Sea Conferences can be found here:

[http://www.ospar.org/content/content.asp?menu=01310624810000\\_000000\\_000000](http://www.ospar.org/content/content.asp?menu=01310624810000_000000_000000) 有关北海会议上发表的《北海宣言》的概述 见网址 [http://www.ospar.org/content/content.asp?menu=01310624810000\\_000000\\_000000](http://www.ospar.org/content/content.asp?menu=01310624810000_000000_000000)



(HELCOM), and the POPs Protocol to the Convention on Long-Range Transboundary Air Pollution (LRTAP). The POPs Protocol specifies a scientific and procedural review process that could lead to the addition of other POPs chemicals others than those already covered by the protocol.

欧盟是若干国际条约的签约国，这些条约均以水体中的危险污染物作为限制对象，其中最为突出的条约包括《保护东北大西洋海洋环境公约》（OSPAR 公约）、《保护波罗的海区域海洋环境的赫尔辛基公约》（HELCOM）以及《关于长距离越界空气污染物公约》 POPs 议定书（LRTAP）。POPs 议定书中规定了一个科学的、程序性的审核流程，该流程可能会添加议定书中已规定的化学品以外的其他 POP 化学品。

The most recent treaty within the field of hazardous pollutants is the Minamata Convention on Mercury, agreed upon in 2013. As the largest emitter of mercury in the world, the treaty is of special relevance to China. Mercury from small-scale gold-mining and from coal-fired power stations represent the biggest source of mercury pollution worldwide. Miners inhale mercury during smelting, and mercury run-off into rivers and streams contaminates fish, the food chain and people downstream. Under the provisions of the Minamata Convention, Governments have agreed on a range of mercury-containing products whose production, import and export will be banned by 2020. These items have non-mercury alternatives that will be further phased in as these are phased out. They include batteries, except for 'button cell' batteries used in implantable medical devices, switches and relays, some compact fluorescent lamps, mercury in cold cathode fluorescent lamps and external electrode fluorescent lamps, soaps and cosmetics (mercury is used in skin-whitening products), some mercury-containing medical items such as thermometers and blood pressure devices.  
<http://www.unep.org/NewsCentre/default.aspx?DocumentID=2752&ArticleID=9647>

最新的有关危险污染物的条约是 2013 年签订的《关于汞的水俣公约》。作为世界上最大的汞排放国，该条约对中国有着特别重要的意义。小型黄金开采区与燃煤电站所排放的汞是世界上汞污染的最大来源。矿工在熔炼的过程中吸入汞，排入河流以及溪流的汞对鱼类、食物链以及下游人民造成污染，依据《水俣公约》的相关规定，各国政府就一系列含汞产品达成了一致，这类产品将于 2020 年禁止生产、进口或出口。在逐步淘汰这类产品的同时，将逐步引入其无汞替代品。其中包括电池（除植入式医学装置、开关与继电器中使用的“纽扣电池”之外），一些小型荧光灯，冷阴极荧光灯与外部电极荧光灯中所含的汞，香皂与化妆品（汞主要用于美白产品），以及一些含汞医疗用品（如温度计、血压测量装置）。  
<http://www.unep.org/NewsCentre/default.aspx?DocumentID=2752&ArticleID=9647>

Under the Minamata Convention, Governments have agreed that countries will draw up strategies to reduce the amount of mercury used by small-scale miners and that national plans will be drawn up within three years of the treaty entering into force to reduce - and if possible eliminate - mercury. The Convention will also control mercury emission and releases from large-scale industrial plants such as coal-fired power stations, industrial boilers, waste incinerators and cement clinker facilities.

根据《水俣公约》，各国政府同意由各国制定相关策略，降低小型矿山的汞使用量，同时，各国政府也一致认为，自本条约实施起三年内，应制定相关国家规划，以降低，或彻底淘汰（如可能）汞。该公约也将对大型工业工厂（如，燃煤电厂、工业锅炉、废物焚烧炉以及水泥熟料设施）的汞排放进行控制。

### 3.4.3 Results in Europe 欧洲成就

Creating consistency of laws, regulations, standards and practices across the internal EU market **harmonization is an overarching principle in EU's environmental legislation.** This ensures that the same rules apply to businesses across EU and means that a **business cannot obtain an economic advantage over those in another as a result of different rules. Harmonization also reduces compliance and regulatory burdens for businesses operating nationally or trans-nationally.** Ultimately the objective of harmonization is to facilitate free trade and protect citizens. While there are still severe remaining issues related to hazardous pollutants in Europe and the progress has been uneven across the EU, the broad picture is that the wide range of policies and measures within EU together with international efforts have contributed substantially to decreasing pressures from chemical pollution over the past 20 years. For instance, **a third of OSPAR's 26 priority (groups of) chemicals which pose a risk to the marine environment are expected to have been phased out by 2020** if current efforts continue. These include six pesticides, SCCPs, TBT, nonylphenol/ethoxylates and two brominated flame retardants (decaBDE, pentaBDE). For all other priority chemicals in OSPAR, additional action is needed to progress toward the OSPAR 2020 target of cessation of their releases to the environment (OSPAR, 2009).

协调性确保了欧盟整个内部市场相关法律、法规、标准及实践的一致性，是欧盟环境立法所遵循的一个首要原则。这确保了同样的规则适用于欧盟的所有企业，同时也意味着作为不同规则的结果，一个企业不能获得优于另一个规则下的企业的经济优势。此外，协调减少了法规遵从性以及国内企业或跨国企业的监管负担。协调的目的在于促进自由贸易并对居民进行保护。尽管欧洲仍然存在一些严重的涉及危险污染物的遗留问题，而且整个欧盟在此方面的发展也参差不齐，但是，总体而言，基于欧盟所采取的一系列政策与措施以及国际社会的不懈努力，过去 20 年中，化学污染所产生的压力出现了大幅减少。例如，如果这一趋势继续持续下去，则 **26 种 OSPAR 重点控制（成群的）化学品（对海洋环境构成威胁）中的三分之一有望到 2020 年被淘汰。**这些化学品中包括 6 种农药，SCCP，TBT，壬基苯酚/羟乙基物以及两种溴系阻燃剂（十溴二苯醚、五溴二苯醚）。就其他所有 OSPAR 重点控制化学品而言，需要通过采取其他措施，达到 OSPAR 2020 停止将这些化学品排放到环境中的这一目标（OSPAR, 2009）。

As evident from figure 3.10, 3.11 and 3.12 below, the broad range of policies and regulations targeting hazardous pollutants in European water bodies have resulted in the emissions to air and water as well as the input of pollutants to water being markedly decreased. In the case of PCBs, for instance, these are included in the OSPAR and the Helsinki Conventions as well as in the Stockholm Convention on Persistent Organic

Pollutants. Moreover, EU Directive 96/59/EC and the Regulation (EC) No. 850/2004 on persistent organic pollutants ban the production and use of PCBs and set requirements on the disposal of PCB waste. **However, due to the high historical use and/or the persistence and capacity to bioaccumulate of many of these substances, levels in sediments and biota are still high.** For instance, in spite of reductions the concentrations of heavy metals (cadmium, lead and mercury) and organic pollutants (PAHs and PCBs) in sediment, fish and shellfish remain unacceptably high in many, mostly coastal areas especially in OSPAR Region II (Greater North Sea), Region III (Celtic Seas) and Region IV (Bay of Biscay/Iberian Coast), with risk of pollution effects for marine organisms. The continuous phase-out of TBT in antifouling paints for ships has resulted in a clear decrease of pollution effects on marine snails, but problems persist over large parts of the OSPAR area, in particular in vicinity of harbours. Contamination with persistent organic pollutants such as PCBs, SCCPs, PFOS and brominated flame retardants is widespread and their long-range air transport to the OSPAR area, especially Region I (Arctic Waters), is of concern. There is no OSPAR monitoring in Region V (Wider Atlantic) and an assessment of this Region has not been made. There is however scientific evidence that contaminants such as TBT, PCBs and brominated flame retardants find their way into the deep-sea food web (OSPAR, 2009).

从图 3.10、3.11 以及 3.12（见下文）中可以明显地看出，针对欧洲境内水体中所含危险污染物而制定的一系列政策与法规，显著降低了此类污染物在空气中、水中的排放量以及排入水中的污染物数量。例如：就 PCB 而言，《OSPAR 公约》、《赫尔辛基公约》以及《关于持久性有机污染物的斯德哥尔摩公约》均对其做出了相关规定。此外，EU 指令 96/59/EC 以及 No. 850/2004《持久性有机污染物法规》（EC）中均禁止 PCB 的生产与利用，同时还对 PCB 废物的处理提出了相关要求。但是，由于一些此类物质在过去曾被频繁使用和/或其持久性与生物累积能力的限制，其沉积物数量及生物群数量仍然居高不下。例如，尽管污染物数量有所降低，但是在一些可能对海洋生物造成污染的区域，主要是沿海地区，尤其是 OSPAR 二区（大北海）、三区（凯尔特海）及四区（比斯开湾和伊比利亚海岸），泥沙、鱼类及甲壳类动物中重金属（镉、铅、汞）与有机污染物（PAH、PCB）的浓度仍然高到令人无法接受。从船用防污涂料中持续逐步淘汰 TBT，明显降低了对海蜗牛的影响，但是，在 OSPAR 的大部分区域，尤其是在港口附近，这类问题依然存在。由 PCB、SCCP、PFOS 以及溴系阻燃剂等持久性有机污染物所造成的污染覆盖了一片广泛的区域，而且，借助于空气扩散，它们经过长距离的“传输”进入 OSPAR 区域，尤其是一区（北极水域）——这一状况令人担忧。五区（广泛大西洋）未涉及 OSPAR 监测，也未对这一区域进行评估。但是，有科学证据表明，TBT、PCB 以及溴系阻燃剂等污染物通过一定的方式，进入了深海食物链（OSPAR, 2009）。

Banning of substances may have a relatively quick impact on river concentrations, while decontamination of groundwater may take a long time. For instance, atrazine pesticides were banned in EU in 2004 and recent surface water monitoring data show no exceedance of the environmental quality standard. Overall for Europe there is, however, a lack of reliable data on pesticides in groundwater.

严禁相关物质的使用可能会相对较快地对河流污染物浓度造成影响，而地下水的净化可能需要很长的时间。例如，2004 年，欧盟严禁使用阿特拉津农药，近期的地表水监测数据显示，该化学品并未超出环境质量标准。对欧洲而言，总体上缺少有关地下水中农药含量的可靠数据。

Instead of measuring concentrations in air, water and food and using them to assess exposures, potentially hazardous substances can be bio-monitored using human samples, thereby estimating the body burden of pollutants and synthetic chemicals. **Studies show a declining body burden of important toxics in some regions.** E.g. the levels of dioxin and PCBs were drastically reduced in mothers' milk in some EU countries during the last decades (**Feil! Fant ikke referansekilden.**3.14 demonstrates how banning of lead in petrol has affects the burden of lead in children's blood in Sweden.

不同于测量空气、水、食物中的危险物质浓度并利用这些数据对其接触情况进行评估，可利用人体样本对潜在危险物质进行生物监测，以此降低由污染物以及合成化学品所造成的人体负荷。**研究表明，在一些地区，由重要有毒物质所造成的体负荷有所下降。**例如，在一些欧盟国家，过去几十年中，母乳中二氧芑与 PCB 的含量均大幅降低（来源：OSPAR，见 EEA（2011）图）。图中显示了对汽油中铅含量进行限制举措是如何影响瑞典儿童血液中铅含量的。

In the Arctic, which acts as a sink for some hazardous pollutants due to their physicochemical properties, policies on reducing POPs, such as the Stockholm Convention on POPs and the Aarhus Protocol on POPs, have led to a decline in POPs in Arctic air and wildlife. Still, however, concentrations in marine food-webs and humans are high enough to affect the health of top predators in the marine food web (AMAP, 2009).

受到一些危险污染物理化性质的影响，北极成为了这些危险污染物的集合地。在北极，有关降低 POPs 的相关政策的实施，如《关于持久性有机污染物的斯德哥尔摩公约》与《奥尔胡斯持久性有机污染物议定书》，促使当地空气中以及野生生物中的 POPs 含量得以降低。但是，海洋食物链中以及人体内的 POPs 浓度仍然居高不下，足以对海洋食物链中的顶端食肉动物的健康造成一定的影响。

In spite of a relatively well-developed system for reporting emissions of hazardous pollutants to air and water, there are still remaining issues preventing a comprehensive account of such emissions. The spatial extent and temporal resolution of data describing emissions to water may be limited, and for some substances more than for others. Regarding emissions of mercury and cadmium, for instance, facilities smaller than the E-PRTR thresholds (and not, therefore, required to report under the regulation), may include many urban wastewater treatment plants and in sum may therefore contribute significant emissions of pollutants to water. Also, diffuse sources, which are also not reported under E-PRTR, may be of significance. Food is the main source of e.g. lead and cadmium exposure in the general population. Annual inputs from long-range transport

of air pollution and mineral and organic fertilizers to topsoil are roughly of the same magnitude. They all continue to contribute to the existing (relatively large) accumulation of cadmium in the topsoil. In spite of the decrease in cadmium emissions, ambient air concentrations and deposition, recently published data do not show a decrease in the cadmium body burdens in non-smokers in the last decade (WHO, 2007).

尽管已经制定了一个相对完善的体系来汇报空气、水中危险污染物的排放情况，但是仍然存在一些问题，使得无法对上述排放情况进行全面考虑。用于描述水中排放情况的数据空间幅度以及时间分辨率可能会受到限制，一些物质相较其他物质来说尤为明显。例如，就汞与镉的排放而言，规模小于 E-PRTR 标准（因此，不要求依据该法规进行汇报）的一些企业可能会包括一些城市污水处理厂，因此总体上可能会将大量的污染物排放到空气中。同样，E-PRTR 未涵盖的扩散源，可能也会产生重要意义。在一般人群中，食物是接触污染（如铅、镉）的主要途径。每年，空气污染、矿物质和有机肥料远距离运输对表层土的输入基本上相同。这些都使得表层土中的镉元素在现有基础（相对较多）上不断增加。尽管镉排放量、空气浓度及沉积物有所降低，但近期公布的数据并未标明，过去十年中不吸烟者由镉所造成的体内含量有所下降。

In the EQSD under the WFD concentration limits are given for priority substances (PS) and priority hazardous substances (PHS). However, **the focus upon a few pre-selected priority substances bears a strong risk of missing other problematic substances**<sup>83</sup>. In addition, **such an approach disregards the effects of chemical mixtures**. Research has therefore been initiated to develop tools that help linking chemical contamination with observed ecological effects.

WFD 指令下的 EQSD 对重点控制物质（PS）与重点控制危险物质（PHS）的浓度极限进行了规定。但是，**将重点放在少数预先选定的重点控制物质上，很有可能漏**

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<sup>83</sup> An example is various types of nanomaterials. as nanosizing can entail different chemical and physical properties. This challenges existing hazard identification approaches, which assume that the intrinsic property of a chemical can be discovered through studies of the bulk material. For example, from a chemical perspective carbon nanotubes are simply carbon, but in their nanotube form they present significant new hazards because of their shape and size. Studies have shown evident toxicity of some nanoparticles to living organisms and ecosystems. However, lack of available data and the inadequacy of current experimental protocols and risk assessment procedures make comprehensive risk assessments difficult to perform (UNEP 2014 and references therein).

例如各种纳米材料，因为纳米科学技术产生不同的化学和物理性质。这给现有危险识别方法提出了挑战，假定可以通过对大宗材料的研究发现化学的固有特性。例如，从化学的角度来看，碳纳米管又是碳，但是由于其形状与尺寸，因此可以以纳米管形式产生新的重大危害。研究表明，一些纳米颗粒对生物体及生态系统有着明显毒性。但是，由于缺乏可靠数据与现有实验以及风险评估程序不够充分，使得综合风险评估存在一定的困难（UNEP 2014 另见参考）。

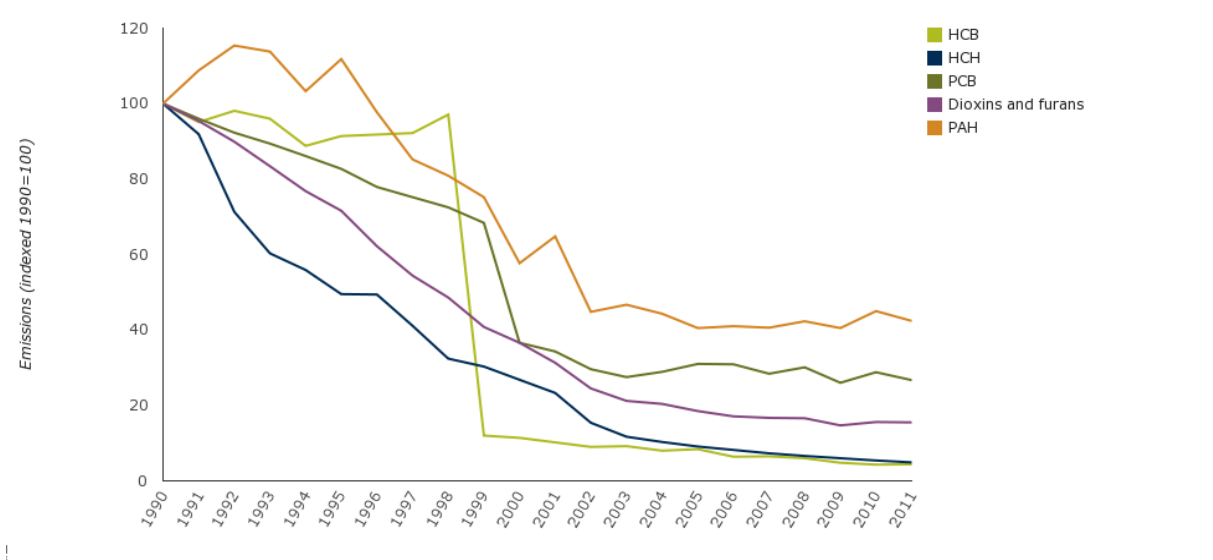
掉其他有问题的物质。同时，这一方法忽视了化学混合物的作用。因此，启动了相关研究研发新型工具，将化学污染与观察到的生态效应联系起来。

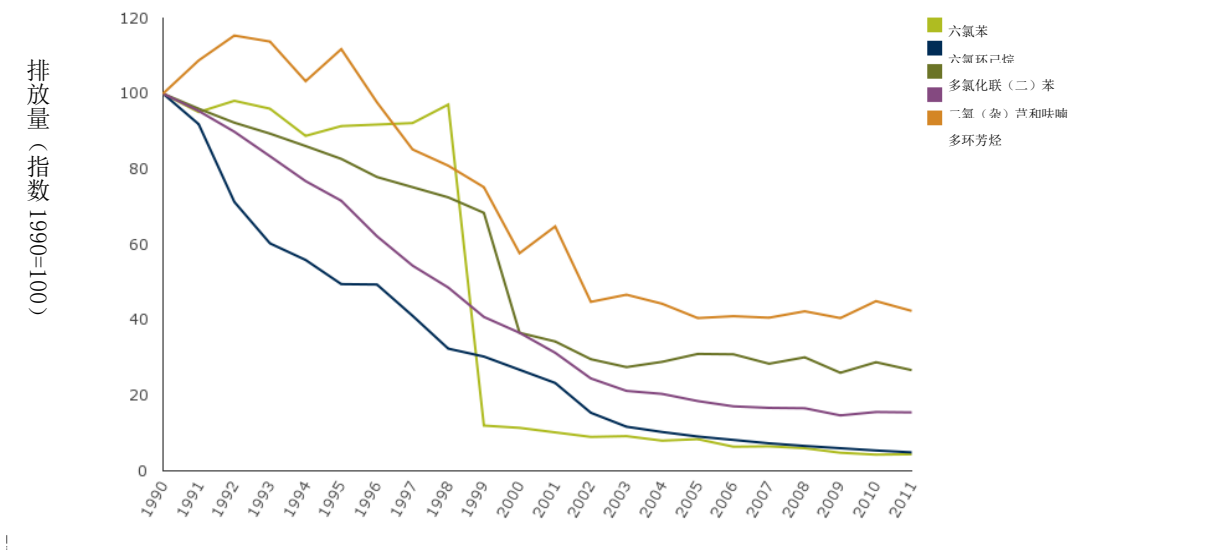
Finally, monitoring data may not always be comparable across EU member states as there may be inconsistencies in monitoring and reporting of hazardous pollutants. For instance, mercury may in some places be monitored in biota instead of in the water column, making detection more likely given the propensity of mercury to bioaccumulate.

最后，由于危险污染物的监测与报告可能存在不一致，因此监测数据在欧盟成员国内部可能并不总是具有可比性。例如，一些地方可能会对生物群内的汞而不是水柱中的汞进行监测，从而使得相关检测更倾向于汞的生物累积性。

**Figure 3.10 Emission trends of persistent organic pollutants (National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention))**

**图 3.10 持久性有机污染物的排放趋势（根据《关于长距离越界空气污染物公约》汇报的国家排放总量）（LRTAP 公约）**



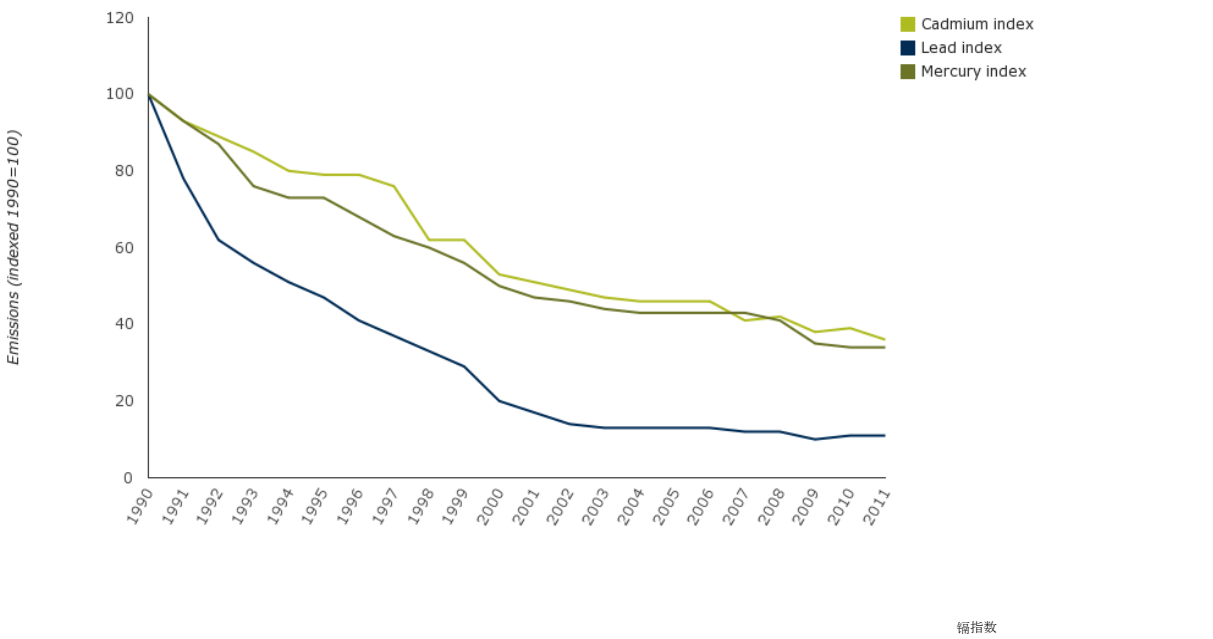


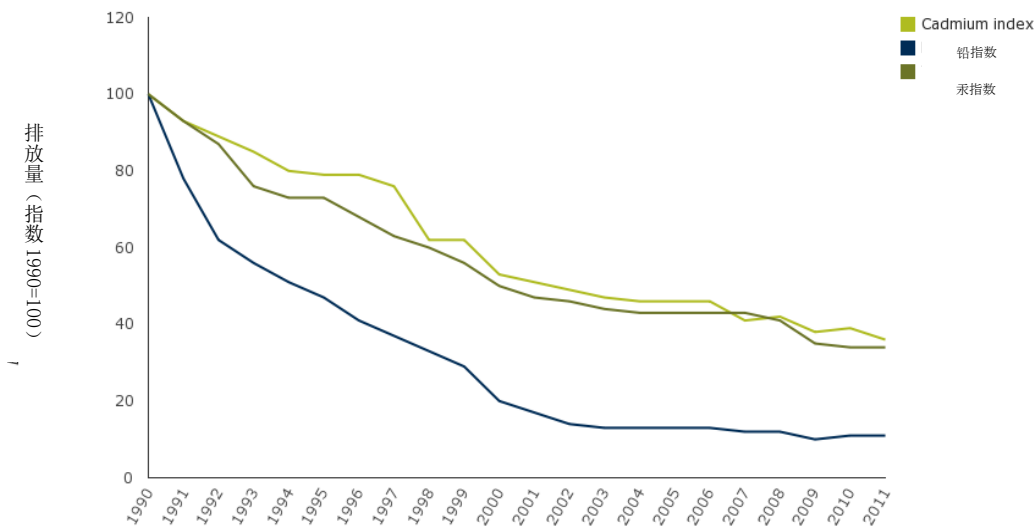
Source: European Environment Agency (EEA, 2014) <http://www.eea.europa.eu/data-and-maps/daviz/emission-trends-of-persistent-organic>

来源：欧洲环境署（EEA，2014）<http://www.eea.europa.eu/data-and-maps/daviz/emission-trends-of-persistent-organic>

**Figure 3.11 Emission trends of heavy metals (National emissions reported to the Convention on Long-range Transboundary Air Pollution (LRTAP Convention))**

**图 3.11：重金属排放趋势（根据《关于长距离越界空气污染物公约》汇报的国家排放总量）（LRTAP 公约）**



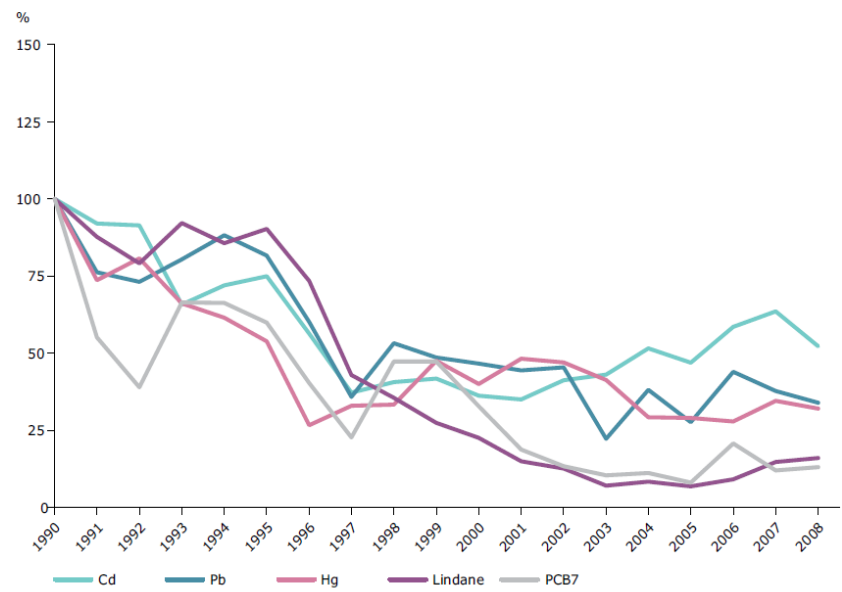


Source: European Environment Agency (EEA, 2014) [http://www.eea.europa.eu/data-and-maps/daviz/emission-trends-of-heavy-metals#tab-chart\\_1](http://www.eea.europa.eu/data-and-maps/daviz/emission-trends-of-heavy-metals#tab-chart_1)

来源：欧洲环境署（EEA，2014）[http://www.eea.europa.eu/data-and-maps/daviz/emission-trends-of-heavy-metals#tab-chart\\_1](http://www.eea.europa.eu/data-and-maps/daviz/emission-trends-of-heavy-metals#tab-chart_1)

**Figure 3.12 Input of hazardous substances (via riverine loads and direct discharges) into the North-East Atlantic during the period 1990 to 2008**

**图 3.12 1990 年-2008 年东北大西洋危险物质的输入（通过河流负载和直接排放）**





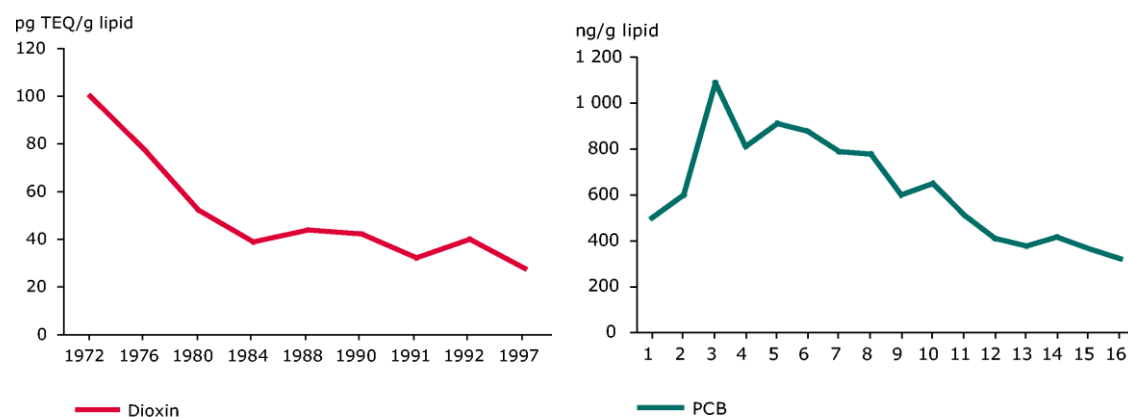


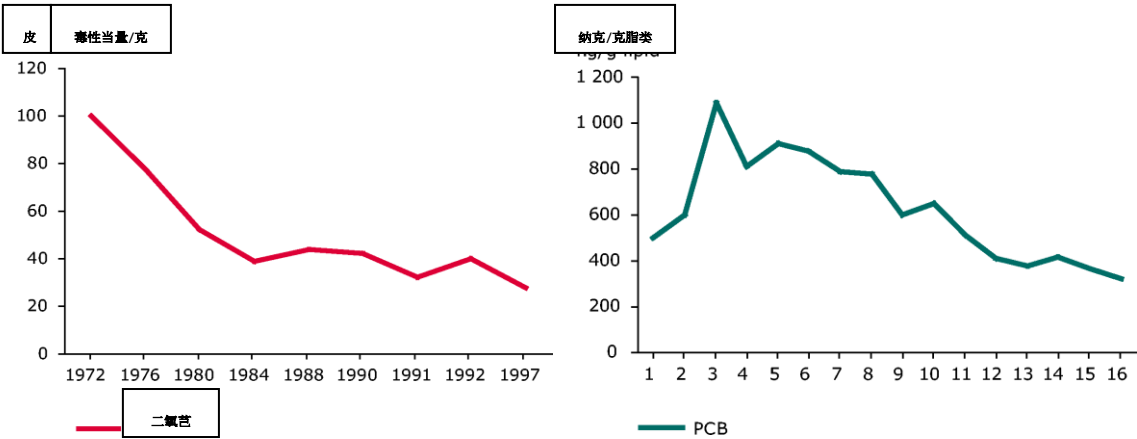
Source: OSPAR. see EEA (2011)

来源：OSPAR，见 EEA（2011）

**Figure 3.13 Dioxine and PCB in mothers' milk**

**图 3.13 母乳中二氧芑与 PCB 含量**



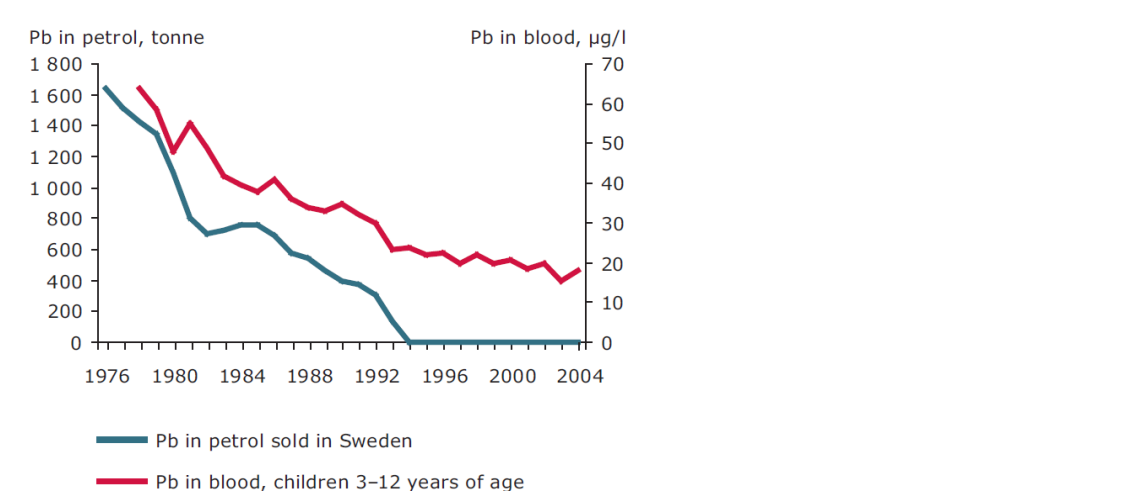


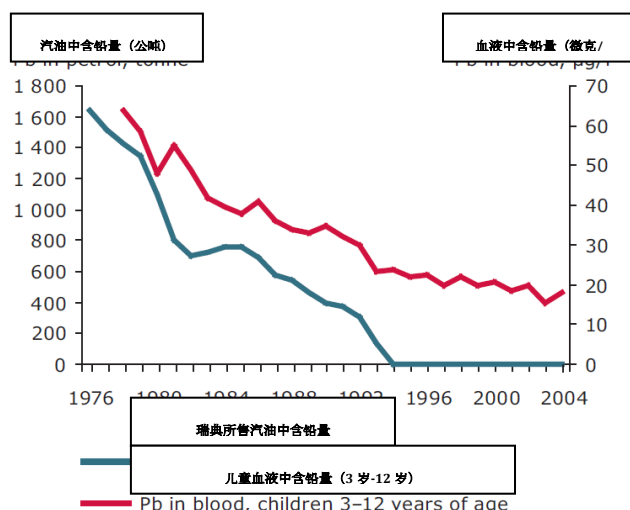
Source: EEA (2005) [http://www.eea.europa.eu/publications/eea\\_report\\_2005\\_10](http://www.eea.europa.eu/publications/eea_report_2005_10)

来源：EEA（2005）[http://www.eea.europa.eu/publications/eea\\_report\\_2005\\_10](http://www.eea.europa.eu/publications/eea_report_2005_10)

**Figure 3.14 Lead concentrations in children’s blood (southern Sweden), and lead in petrol (tonne) sold in Sweden 1976-2003**

**图 3.14 儿童血液中铅浓度（瑞典南部）以及（1976-2003）**





Source: EEA (2005)

来源：EEA（2005）

#### 3.4.4 Lessons and suggestions for China 对中国的启示和建议

**The volume of chemicals manufactured and used continues to grow, with a shift in production from highly industrialized countries towards developing countries and especially countries with economies in transition as China.** Between 2000 and 2009, annual sales of products of the chemical industry doubled, with the share manufactured in highly industrialized countries falling from 77 to 63% and the share manufactured in the BRIICS countries (Brazil, Russia, India, Indonesia, China and South Africa) increasing from 13 per cent to 28 per cent. Chemical production is expected to continue to grow in all parts of the world. As production of bulk chemicals shifts away from highly industrialized countries, there are concerns that the risks of chemicals for human health and the environment will be increased due to lack of regulatory experience in some countries, as well as insufficient infrastructure and resources to address these risks. Pre-market testing of new chemicals is far from satisfactory, and not enough is known about many chemicals already in commerce. A recent study showed that out of 95 000 industrial chemicals, adequate data on aquatic toxicity, bioconcentration and persistence were publicly available for less than 5 per cent (UNEP, 2014). In Europe, the current downward trend for many hazardous pollutants is a result of long-term efforts targeting every single aspect of the impact pathway for the chemicals. **A core lesson for China from the EU experiences is the usefulness of long-term programs to monitor the burden of hazardous pollutants in the various environmental compartments and in biota.** Combined with reliable data on emissions, such data enables design of science-based policies and realistic targets. **Command-and-control has dominated policies in the Member States (i.e. bans and licensing requirements towards industries), and there are only a few examples**

where fiscal policies have been effectively used (e.g. use of deposits-refund schemes and landfill taxes<sup>84</sup>).

化学品的生产和使用呈直线上升趋势，生产化学品的国家也从高度工业化国家转移至发展中国家，尤其是经济转型的国家，比如，中国。2008 年至 2009 年间，化工行业产品年销售额增加了一倍，高度工业化国家的产量从 77% 降至 63%，而“金砖五国” BRICS（巴西、俄罗斯、印度、印度尼西亚、中国以及南非）的产量则从 13% 上升至 28%。世界各地的化工生产预计将持续增长。由于高度工业化国家已不再是大宗化学品生产的中心，人们担忧一些国家可能会因为缺乏监管经验或是没有足够的基础设施与资源来应对这类风险，而使得化学品对人类健康及环境的风险增加。最新化学品的售前测试结果远非令人满意，与此同时，对已投入市场的一些化学品的了解也少之又少。最新一项研究表明，95000 种工业化学品中，有关水生动物毒性、生物富集以及持久性的完整公开数据不到 5%（UNEP, 2014）。对欧洲而言，目前一些危险污染物的下降趋势是长期对化学品影响途径的每一个方面进行研究的结果。对于中国而言，从欧盟经验中吸取的核心教训在于：制定长期计划将有利于对各类环境区划及生物群体内危险污染物的负荷进行监测，通过与可靠的排放数据相结合，为制定科学政策及现实目标提供了可能性。指挥控制法为各成员国所实施的主要政策（即，针对各行业的禁令及许可要求），仅有少数财政政策得到了有效实施（如，保证金退还计划与垃圾填埋税）。

Interplay with the public is crucial. In many cases, **EU citizens, e.g. through NGOs, have pushed governments to implement stricter rules.** In the case of waste management, for instance, a larger focus on preventing waste production (through the 5 steps listed above) was pushed by NGOs. **Media, often made aware of critical issues by NGOs, may also play an important role to alert the public and thereby push policy makers.** For instance, when the UK issued permits allowing 50 000 tonnes of hazardous pollutants to be dumped in the North Sea in 1989, one year before the deadline to end all dumping in the 1987 North Sea Declaration (an unbinding commitment as all of these Declarations), Greenpeace alerted the media. The attention led to an extraordinary meeting of the Oslo Commissions (one of the forerunners of OSPAR). This was embarrassing for the UK authorities as well as for the chemical companies involved, and in the end resulted in a UK resolution to stop its dumping of industrial waste (Skjærseth, 2012). In China, recent product safety scandals, e.g. regarding infant milk formula and vegetables grown in industrial wastewater<sup>85</sup>, are getting increasing public attention, which in turn likely is pushing regulators to implement stricter rules and sanctions.

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<sup>84</sup> Overview of the use of landfill taxes in Europe. ETC/SCP working paper 1/2012:

[http://scp.eionet.europa.eu/publications/WP2012\\_1/wp/WP2012\\_1](http://scp.eionet.europa.eu/publications/WP2012_1/wp/WP2012_1) 欧洲垃圾填埋税的使用概述 ETC/SCP 工作纸 1/2012  
:[http://scp.eionet.europa.eu/publications/WP2012\\_1/wp/WP2012\\_1](http://scp.eionet.europa.eu/publications/WP2012_1/wp/WP2012_1)

<sup>85</sup> <http://adage.com/article/global-news/chinese-consumers-trust-products-made-china/241165/>

与公众的互动至关重要。在多数情况下，欧盟居民，如通过非政府组织（NGO），促使政府实施更为严格的规定。例如，就废物管理而言，NGO 要求通过前述 5 个步骤，更多地关注废物生产的预防问题。媒体通常是通过 NGO 了解到一些重要问题，也可以通过向公众发出警告，进而促使决策者做出相关决定，从而在这方面发挥重要的作用。例如，当英国于 1989 年发放许可证，允许将 5 万公吨危险污染物倒入北海时，绿色和平组织便就此事通知了媒体——这离 1987 年《北海宣言》（所有宣言都不具有约束力）中规定的终止一切倾倒行为的截止期限（1990 年）仅差一年。随后，奥斯陆委员会（OSPAR 先驱之一）召开了一次特殊会议。这对于英国当局以及相关化工企业而言是颇为尴尬的，最后，英国决定停止倾倒工业废物（Skjærseth, 2012）。就中国来说，近期的产品安全丑闻（如，婴儿配方奶粉与种植在工业废水中的蔬菜）日益受到人们的广泛关注。反过来，这可能会促使监管部门实施更为严苛的规定以及制裁措施。

As evident from the description above, **EU legislation within the field of hazardous pollutants is in many ways a patchwork of legislative and other instruments, which over the years has been gradually integrated and streamlined.** As China is building up its own tools and mechanisms for abating hazardous and often trans-boundary long-range transported, pollution, **it should strive to avoid geographical overlap and duplication of responsibility, while allowing for input and suggestions from all relevant stakeholders.**

从上述内容中可以明显地看出，欧盟有关危险污染物的立法在很大程度上是立法工具与其他工具的“拼凑物”，近些年来，都已经被逐步合并或精简。鉴于中国目前正在建立自己的工具与机制来降低危险物污染以及长距离跨界运输污染，因此，在考虑所有利益相关方的投入与建议的同时，还应极力避免地理位置重叠与责任重叠。

While the primary focus in the near-term in China is likely to be the well-known environmental threats, emerging issues should be prevented from becoming future traditional environmental threats. **Endocrine disruption is a challenge that must be addressed in ways that take into account the rapid advances in knowledge about this type of environmental risk (UNEP/WHO, 2013).** Overuse and misuse of pesticides have become a major problem globally, especially in developing countries like China, which increase environmental and health risks. A 2002 study for the Global Greengrants Fund revealed that as much as 40% of pesticides on the market in China are sold under false brand names (Pesticide Action Network North America, 2003). The Ministry of Agriculture of China has announced a target of overall 20% reduction in pesticide use within the next five years (Ding and Bao, 2014). Obviously, when pesticides are sold under wrong names it becomes difficult to monitor the progress towards the target.

尽管中国近期的重点可能放在众所周知的环境威胁上，但是仍要防止新出现的问题在未来发展成为传统的环境威胁因素。内分泌干扰这一挑战必须通过一定的方法得到解决，这些方法应考虑有关这类环境风险的知识信息的飞速发展（UNEP/WHO, 2013）。农药的过度使用和滥用已经成为了一个全球性重大问题，特别是在中国这样

的发展中国家，环境风险与健康风险都会有所增加。2002 年全球绿色资助基金的一项研究表明，中国市场上多达 40%的农药在以虚假的品牌名称进行销售（北美农药行动网络，2003）。中国农业部已经宣布，未来五年农药使用量总体上将下降 20%（Ding and Bao, 2014）。很明显，如果农药以错误的名称进行销售，则很难针对这一目标对相关进展情况进行监测。







## References

- Amann M, Kejun J, Jiming H, Wang S, et al (2008): Scenarios for cost-effective control of air pollution and greenhouse gases in China. <http://gains.iiasa.ac.at/gains/download/GAINS-Asia-China.pdf>
- Amann M (ed.) (2012): Future emissions of air pollutants in Europe – Current legislation baseline and the scope for further reductions. TSAP Report #1 Version 1.0. IIASA, Austria. 62 pp.
- AMAP (2009): Arctic Pollution 2009, Arctic Monitoring and Assessment Programme, Oslo. <http://www.amap.no/documents/doc/arctic-pollution-2009/88>
- Atkins (2010): 'When the rivers run clear', in *Angles* issue 5: 2010. Published for ATKINS by Caspian Publishing Ltd.
- Aunan, K., Fang, J., Hu, T., Seip, H. M., & Vennemo, H. (2006): Climate change and air quality--measures with co-benefits in China. *Environ Sci Technol*, 40(16), 4822-4829.
- Aunan, K., Berntsen, T., O'Connor, D., Persson, T. H., Vennemo, H., & Zhai, F. (2007): Benefits and costs to China of a climate policy. *Environment and Development Economics*, 12(03), 471. doi: 10.1017/s1355770x07003610.
- BaltActHaz 2009. Baltic Actions for Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances. Project LIFE07 ENV/EE/000122 – BaltActHaz
- Beckerman, W. (1987): 'Limits to Growth, in *Palgrave*. in J. Eatwill, M. Milgate and P. Newman, ed., *A Dictionary of Economics*. The Macmillian Press Limited.
- Boekhorst, D.G.J. et al. (2010): 'Implementing Integrated River Basin Management in China', in Huitema, D & S. Meijerink (eds.) *Realizing Water Transitions: The Role of Policy Entrepreneurs in Water Policy Change*, *Ecology and Society* 15(2), 2010: 26.
- Bollen J et al. (2009): Local Air Pollution and Global Climate Change: A Combined Cost-Benefit Analysis, *Resource and Energy Economics*, 31,161-181.
- Boon, T.E. et al. (2009): *Implementation of the Habitats Directive in a Governance Perspective: The case of Denmark*. Institute of Forest, Environmental, and Natural Resource Policy, Universität für Bodenkultur Wien, Research Report 2-2009.
- Bruvoll, A. and Medin, H. (2003): 'Factors Behind the Environmental Kuznets Curve' in *Environmental and Resource Economics* 24: 27-48, 2003.
- Caixin (2013): Drawing a Red Line on Protecting the Environment. *CaixinOnline* 19. November 2013. <http://english.caixin.com/2013-11-19/100606848.html>

Caldwell and Wang (2011): A hidden problem: China's contaminated site soil pollution crisis. Inga Caldwell and Xinyu Wang, Vermont Law School, United States.

Cao, W., & Wong, M. H. (2007): Current status of coastal zone issues and management in China: a review. *Environ Int*, 33(7), 985-992.

CBD (2014): 'China – Country Profile'. *Convention on Biological Diversity*. Available at <http://www.cbd.int/countries/profile/default.shtml?country=cn#facts> Retrieved 20.1.2014.

Center for Crisis Management Research (CCMR)  
[http://www.tsinghua.edu.cn/publish/sppmen/4871/2010/20101217103410569321349/20101217103410569321349\\_.html](http://www.tsinghua.edu.cn/publish/sppmen/4871/2010/20101217103410569321349/20101217103410569321349_.html)

CEWP (2014): *China-Europe Water Platform*, see: [www.cewp.org](http://www.cewp.org).

Cheng S. (2003): Heavy metal pollution in China: origin, pattern and control, *Environmental Science and Pollution Research* 10: 192–198.

China Daily (2011): Soil pollution poisons more than farmland. *China Daily*, March 10, 2011.

China Dialogue (2014): 'China's ecological red lines unlikely to protect', *China Dialogue* 9 Jan. 2014. Available at: <https://www.chinadialogue.net/article/show/single/en/6641-China-s-ecological-red-lines-unlikely-to-protect>

CIRS (2013): Overview of Chemical Management Policies in China. Chemical Inspection & Regulation Service Ltd. [www.cirs-reach.com](http://www.cirs-reach.com).

Colette A et al (2012): Cobenefits of climate and air pollution regulations The context of the European Commission Roadmap for moving to a low carbon economy in 2050. ETC/ACM Technical Paper 2011/20. ETC/ACM, Bilthoven.

Christou & Porter (1999): GUIDANCE ON LAND USE PLANNING AS REQUIRED BY COUNCIL DIRECTIVE 96/82/EC (SEVESO II). INSTITUTE FOR SYSTEMS INFORMATICS AND SAFETY, EUR 18695 EN.

Desrochers, P. (2002): Cities and Industrial Symbiosis - Some Historical Perspectives and Policy Implications. *Journal of Industrial Ecology*, Volume 5, Number 4.

EAS (2010): Summary of progress and achievements in SDS-SEA implementation (2003-2010). 3rd EAS Partnership Council Meeting Agenda Item 8.0: Technical Session.  
[3http://www.pemsea.org/sites/default/files/pc-10-11-sdssea-progress.pdf](http://www.pemsea.org/sites/default/files/pc-10-11-sdssea-progress.pdf)

EC (2014a): "Drinking Water", web-portal, *European Commission*. Available at: [http://ec.europa.eu/environment/water/water-drink/index\\_en.html](http://ec.europa.eu/environment/water/water-drink/index_en.html)

EC (2014b): "A new EU Floods Directive", web-portal, *European Commission*. Available at: [http://ec.europa.eu/environment/water/flood\\_risk/index.htm](http://ec.europa.eu/environment/water/flood_risk/index.htm)

EC (2014c): EU's portal to the Habitats Directive and guidance documents and news. *European Commission*. Available at: <http://ec.europa.eu/environment/nature/legislation/habitatsdirective/>

EC (2014d): *Introduction to the new EU Water Framework Directive*, European Commission (updated 20/02/2014). Available at: [http://ec.europa.eu/environment/water/water-framework/info/intro\\_en.htm](http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm).

EC (2014e): *Environment. Facts, Figures and Maps*, European Commission (updated 20/02/2014). Available at: [http://ec.europa.eu/environment/water/water-framework/facts\\_figures/index\\_en.htm](http://ec.europa.eu/environment/water/water-framework/facts_figures/index_en.htm)

EC (2014f): *Management of Natura 2000 sites: Best Practice* (updated 27/03/2014). Available at: [http://ec.europa.eu/environment/nature/natura2000/management/best\\_practice\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/management/best_practice_en.htm).

EC (2013a): Green Infrastructure (GI) – Enhancing Europe's Natural Capital, European Commission COM(2013) 249.

EC (2013b): Environment: More citizens calling for greater nature protection. European Commission – IP/13/1018. Press Release. Brussels, 4 November 2013. Available at: [http://europa.eu/rapid/press-release\\_IP-13-1296\\_en.htm](http://europa.eu/rapid/press-release_IP-13-1296_en.htm)

EC (2013c): Commission Note on establishing conservation measures for Natura 2000 sites. European Commission.

EC (European Commission) (2012): A Marine Strategy Directive to save Europe's seas and oceans. [http://ec.europa.eu/environment/water/marine/directive\\_en.htm](http://ec.europa.eu/environment/water/marine/directive_en.htm)

EC (2012a): The economic benefits of the Natura 2000: Synthesis report 2012. European Commission.

EC (2012b): *EU-China River Basin Management Programme*, Fact Sheet, European Commission. Available at: [http://eeas.europa.eu/delegations/china/documents/eu\\_china/development\\_cooperation/rbmp\\_6083\\_20120627.pdf](http://eeas.europa.eu/delegations/china/documents/eu_china/development_cooperation/rbmp_6083_20120627.pdf)

EC (2011): Roadmap for moving to a competitive low carbon economy in 2050. , EC, Brussels.

EC (2010a): Europe 2020. A strategy for smart, sustainable and inclusive growth, European Commission COM(2010) 2020 final.

EC (2010b): *Water is for life: How the Water Framework Directive helps safeguard Europe's resources*. European Commission.

EC (2009): *Natura 2000: Health Check for Habitats and Species*, European Commission DG Env. Nature Newsletter, No 26, July 2009. Available at:  
[http://ec.europa.eu/environment/life/publications/lifepublications/natura2000/documents/n2000\\_26\\_en.pdf](http://ec.europa.eu/environment/life/publications/lifepublications/natura2000/documents/n2000_26_en.pdf)

EC (2008): *Handbook on the Implementation of EC Environmental legislation*  
<http://ec.europa.eu/environment/enlarg/handbook/handbook.htm>

EC (2007): *Guidance document on the strict protection of animal species of Community interest under the Habitats Directive 92/43/EEC*. European Commission.

EC (2003a): "REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning the Registration, Evaluation, Authorisation and Restrictions of Chemicals (REACH), establishing a European Chemicals Agency and amending Directive 1999/45/EC and Regulation (EC) {on Persistent Organic Pollutants} " Extended Impact Assessment. Commission Staff Working Paper COM(2003)644 final.

EC (2003b): *Guidance document No 8: Public Participation in relation to the Water Framework Directive*, European Commission. Available at:  
<http://www.waterframeworkdirective.wdd.moa.gov.cy/docs/GuidanceDocuments/Guidancedoc8Publicparticipation.pdf>

EC (2003c): *Guidance Document No 7, Monitoring under the Water Framework Directive*, European Commission.

EC (2003d): *Guidance document No 1: Economics and the Environment*, European Commission. Available at:  
[http://www.enorasis.eu/uploads/files/Water%20Governance/9.Guidancedoc01\\_Economics\\_WATECO\\_WG2-6.pdf](http://www.enorasis.eu/uploads/files/Water%20Governance/9.Guidancedoc01_Economics_WATECO_WG2-6.pdf)

EC (2000): Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. Official Journal L 327, 22/12/2000 P. 0001 – 0073. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000L0060:EN:HTML>

EC-JRC (2013): EC Joint Research Center. European Soil Portal – Soil Data and Information. [http://eussoils.jrc.ec.europa.eu/library/jrc\\_soil/policy/](http://eussoils.jrc.ec.europa.eu/library/jrc_soil/policy/)

ECON Poyry, Vista Analyse, CAEP and CICERO (2011): "Guidebook in using cost benefit analysis and strategic environmental assessment for environmental planning in China". Report 2011 – 023, Oslo, Norway.

Econ Poyry (2010): International Experience in Environmental Planning. Report R-2010-015, Oslo, Norway

Economist (2013): 'All dried up', *Economist* 12 October, 2013. Available at: <http://www.economist.com/news/china/21587813-northern-china-running-out-water-governments-remedies-are-potentially-disastrous-all>

ECOSTAT (2003): *Overall Approach to the Classification of Ecological Status and Ecological Potential*, Water Framework Directive Common Implementation Strategy Working Group 2 A Ecological Status (ECOSTAT), November 2003. Available at: The document is available here: <https://www.uni-due.de/kobio/docs/Ecological%20Classification%20Guidance.pdf>

EEA (2013a): NEC Directive status report 2012 Reporting by the Member States under Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants. Technical Report No 6/2013.

EEA (2013b): Biodiversity portal. *European Environment Agency*. Available at: <http://www.eea.europa.eu/themes/biodiversity>

EEA (2012): *European waters – assessment of status and pressures*, European Environment Agency, EEA Report No 8/2012, Copenhagen.

EEA (2010): *The European Environment. State and outlook 2010*. European Environment Agency, Copenhagen 2010.

EEA and JRC (2010): *The European environment. State and outlook 2010. Soil*. EEA Publication Office of the European Union, Luxembourg. 44 pp.

EEA (2005): *Environment and Health*. EEA Report No 10/2005. European Environment Agency, Copenhagen.

EEB (2011): *Where there is a will there is a way: Snapshot report of Natura 2000 management*, European Environmental Bureau, December 2011.

EEC (1992): *Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora*. European Economic Community. Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31992L0043:EN:HTML>

ESB International (2008): *Draft River Basin Management Plans. National Summary of National Summary of Programme of Measures*. December 2008. Available at: <http://www.wfdireland.ie/docs/National%20Summary%20Programme%20of%20Measures.pdf>

EU (2005): Thematic Strategy on Air Pollution.  
[http://europa.eu/legislation\\_summaries/environment/air\\_pollution/l28159\\_en.htm](http://europa.eu/legislation_summaries/environment/air_pollution/l28159_en.htm)

Ellen MacArthur Foundation. (2012): *Ellen MacArthur Foundation - Rethink the future*. Retrieved from [http://www.ellenmacarthurfoundation.org/case\\_studies/kalundborg-symbiosis](http://www.ellenmacarthurfoundation.org/case_studies/kalundborg-symbiosis)

Encyclopedia Britannica (2013): *Encyclopedia Britannica*. Retrieved from <http://global.britannica.com/EBchecked/topic/1378824/industrial-ecology>

EPSC (2004): Process Safety/Risk Management of Chemical Parks in Europe. Prepared for the European Process Safety Center by Christian Jochum, Report Number 29.

EU-Vri (2008): F-SEVESO. Study of the effectiveness of the Seveso II Directive. Final report.

Evans, D. (2012): 'Building the European union's Natura 2000 network'. *Nature Conservation* 1: 11-26, 2012.

Evans, D. (2006): 'The Habitats of the European Union Habitats Directive', *Biology and Environment*, vol. 106B, No. 3, pp. 167-173. Royal Irish Academy.

Frank (2007): The European Community and Marine Environmental Protection in the International Law of the Sea: Implementing Global Obligations at the Regional Level. Martinus Nijhoff Publishers, Leiden, The Netherlands.  
[http://books.google.no/books?id=CTRs35FxtXMC&printsec=frontcover&hl=no&source=gbg\\_summary\\_r&cad=0#v=onepage&q&f=false](http://books.google.no/books?id=CTRs35FxtXMC&printsec=frontcover&hl=no&source=gbg_summary_r&cad=0#v=onepage&q&f=false)

Geng, Y., & Hengxin, Z. (2009): Industrial park management in the Chinese environment. *Journal of Cleaner Production*, 17(14), 1289-1294. doi:  
<http://dx.doi.org/10.1016/j.jclepro.2009.03.009>

Gong, J. & Hongqiao Liu (2013): 'Half of China's urban drinking water fails to meet standards', *ChinaDialogue* 6 June 2013. Available at:  
<https://www.chinadialogue.net/article/show/single/en/6074-Half-of-China-s-urban-drinking-water-fails-to-meet-standards>

Grossman, G. M. and A. B. Krueger (1995): 'Economic Growth and the Environment', *Quarterly Journal of Economics* 110, 353-377.

Grossman, G. M. and A. B. Krueger (1993): 'Environmental Impacts of a North American Free Trade Agreement', in P. Garber, ed., *The U.S.-Mexico Free Trade Agreement*. Cambridge, MA: MIT Press.



Hario, M., Hirvi, J. P., Hollmen, T. and Rudback, E., (2004): 'Organochlorine concentrations in diseased vs. healthy gull chicks from the northern Baltic', *Environmental Pollution*, (127) 411–423.

Heise, S. & U. Förstner (2006): 'Risk from historical contaminated sediments in the Rhine basin', in *Water, Air, and Soil Pollution: Focus 6* (2006), pp. 261-271.

HELCOM (2010): Hazardous substances in the Baltic Sea - An integrated thematic assessment of hazardous substances in the Baltic Sea. Baltic Sea Environment Proceedings No. 120B Helsinki Commission.

Hering et al. (2010): The European water Framework Directive at the age of 10: A critical review of the achievements with recommendations for the future. *Science of the Total Environment*, doi:10/1016/j.scitotenv.2010.05.031.

Hey (2003): EU Environmental Policies: A short history of the policy strategies.

Huang H (2010): Chinese marine pollution laws. Legal briefing. UK P & I Club. Thomas Miller P&I Ltd – London. [http://www.ukpandi.com/fileadmin/uploads/uk-pi/Documents/Legal\\_Briefing\\_China\\_IOPA\\_low%20res.pdf](http://www.ukpandi.com/fileadmin/uploads/uk-pi/Documents/Legal_Briefing_China_IOPA_low%20res.pdf)

Huang, S. S., et al. (2007): Survey of heavy metal pollution and assessment of agricultural soil in Yangzhong district, Jiangsu Province, China. *Chemosphere* 67(11): 2148-2155.

Hunsaker, Carolyn T.; ROBIN L. GRAHAM; GLENN W. SUTER II; ROBERT V. O'NEILL; LAWRENCE W. BARNTHOUSE; ROBERT H. GARDNER (2008): Assessing Ecological Risk on a Regional Scale. *Environmental Management* Vol. 14 (2008), No. 3, pp. 325-332.

ICPR (2014): *International Warning- and Alarm Plan Rhine*, state: 01.01.14, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2013): Report on the identification of potential significant flood risk areas in the international river basin district Rhine, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2012): 'Action Plan on Floods in the Rhine catchment: 55 km<sup>2</sup> of floodplains along the Rhine regained', ICPR Press Release 10 July 2012, Strasbourg. International Commission for the Protection of the Rhine.

ICPR (2009a): Internationally Coordinated Management Plan for the international River Basin District of the Rhine, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2009b): Comprehensive fish-ecology analysis including an assessment of the effectiveness of ongoing and planned measures in the Rhine catchment area with respect

to the reintroduction of fish, Technical report No. 166, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2009c): Master Plan Migratory Fish Rhine, Technical Report No. 179, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2006): Habitat connectivity along the Rhine, Atlas of the Habitat Connectivity along the Rhine, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2005): Development of a typology (of sections) for the natural river Rhine. Technical Report No. 147. International Commission for the Protection of the Rhine, Koblenz 2005.

ICPR (2004): No frontiers for the Rhine. Inventory 2004 in the Rhine river basin, Co-ordinating Committee Rhine, International Commission for the Protection of the Rhine, Koblenz.

ICPR (2003): *Upstream. Outcome of the Rhine Action Programme*. International Commission for the Protection of the Rhine. Koblenz.

ICPR (2001): Rhine 2020. Program on the sustainable development of the Rhine, Conference of Rhine Ministers 2001, International Commission for the Protection of the Rhine, Koblenz.

IPCC (2007): [http://www.grida.no/publications/other/ipcc\\_tar/](http://www.grida.no/publications/other/ipcc_tar/)

IUCN (2013): *Anguilla Anguilla, the IUCN Red List of Threatened Species*, Version 2013.2. International Union for the Conservation of Nature. Available at: <http://www.iucnredlist.org/details/60344/0>. Accessed 1.2.2014.

James C, Schultz R. (2011): Climate-Friendly Air Quality Management - Strategies for Co-Control. RAP Energy Solutions for a changing world. Vermont. 72 pp.

McKinsey & Company (2009): Unlocking Energy Efficiency in the U.S. Economy. July 2009.

Kislenko K, Toropovs V, Dudutyté Z. (2009): Hazardous substances of environmental concern – what does that mean? Baltic Actions for Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances. Brochure prepared in the frame of the project “Baltic Actions for Reduction of Pollution of the Baltic Sea from Priority Hazardous Substances” supported by LIFE+ financial instrument of the European Community, Estonian Environmental Investment Centre, Environmental Ministry of Lithuania and Latvia.

Kuznets, S. (1955): ‘Economic Growth and Income Inequality’, American Economic Review 45(1), 1–28.



Li, Daiqing; Chen Zhang; Lisa Pizzol; Andrea Critto; Haibo Zhang; Shihai Lv; Antonio Marcomini (2014): Regional risk assessment approaches to land planning for industrialpolluted areasin China: The Hulunbeier region case study.Environment International 65 (2014) 16–32

Mateo-Sagasta, J. et al. (2013): *Guidelines to control water pollution from agriculture in China: Decoupling water pollution from agricultural production*. FAO Water Reports 40, Food and Agriculture Organization of the United Nations, Rome 2013.

MEP (2013): "MEP to Start Demarcate Ecological Red Line across the Country", Ministry of Environmental Protection P.R. China, 16 Sept. 2013.

MEP (2008): China's Fourth National Report on Implementation of the Convention on Biological Diversity. Ministry of Environmental Protection, 2008.

Ministry of Transport, Public Works and Water Management et al. (2009): *Internationaler Bewirtschaftungsplan. Bearbeitungsgebiet Deltarhein. 2009-2015*. Eine gemeinsame Ausgabe des niederländischen Ministerie van Verkeer en Waterstaat, Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer und des Ministerie van Landbouw, Natuur en Voedselkwaliteit sowie des Ministeriums für Umwelt und Naturschutz, Landwirtschaft und Verbraucherschutz des Landes Nordrhein-Westfalen und des Niedersächsischen Ministeriums für Umwelt und Klimaschutz.

Mishan, E. J. (1967): *The Costs of Economic Growth*. Staples Press, London.

Mostert, E. (2003): Conflict and co-operation in international freshwater management: A global review, *International Journal of River Basin Management*, 1:3, 267-278.

Mudavanhu, N., Dzomba, P., & Mudehwe, L. D. (2013): Potential Devastating Domino Effect: A Case Study of Msasa Industrial Area, Zimbabwe. *American Chemical Science Journal*, 3(1), 50-64.

Norway submission to the UN Economic and Social Council (2010): Executive Body for the Convention on Long-range Transboundary Air Pollution.

NRW (2013): *Chemical industry in North Rhine-Westphalia. Facts and Figures March 2013*, NRW.INVEST, Economic Development Agency of the German Stat of North Rhine-Westphalia (NRW). Available at: [http://www.invest-in-niederrhein.de/tl\\_files/standort\\_niederrhein/userupload/dokumente/Veranstaltungen/Lyon/Chemical%20industry%20in%20North%20Rhine-Westphalia\\_facts%20and%20figures.pdf](http://www.invest-in-niederrhein.de/tl_files/standort_niederrhein/userupload/dokumente/Veranstaltungen/Lyon/Chemical%20industry%20in%20North%20Rhine-Westphalia_facts%20and%20figures.pdf)

NYSEPB (New York State Energy Planning Board) (2009): State Energy Plan, Volume 1, December 2009. Available at [http://www.nysenergyplan.com/final/New\\_York\\_State\\_Energy\\_Plan\\_VolumeI.pdf](http://www.nysenergyplan.com/final/New_York_State_Energy_Plan_VolumeI.pdf)

NYT (2006): 'No Longer Europe's Sewer, but not the Rhine of Yore', *New York Times* 21.4.2006. Available at: [http://www.nytimes.com/2006/04/21/world/europe/21koblenz.html?\\_r=1&](http://www.nytimes.com/2006/04/21/world/europe/21koblenz.html?_r=1&)

OSPAR Commission (2009): Status and trend of marine chemical pollution. Hazardous Substances Series.

OSPAR Commission (2013a): "Distance to target" modelling assessment. Report by the Intersessional Correspondence Group on Eutrophication Modelling. OSPAR Commission. [http://www.ospar.org/documents/dbase/publications/p00599/p00599\\_distance%20to%20target%20modelling%20assessment.pdf](http://www.ospar.org/documents/dbase/publications/p00599/p00599_distance%20to%20target%20modelling%20assessment.pdf)

OSPAR Commission (2013b): Annual Report 2012/13. [http://www.ospar.org/v\\_publications/browse.asp?menu=00080800000000\\_000000\\_000000](http://www.ospar.org/v_publications/browse.asp?menu=00080800000000_000000_000000)

OSPAR Commission (2013c): 2012 Status Report on the OSPAR Network of Marine Protected Areas. Biodiversity Series. [http://www.ospar.org/documents/dbase/publications/p00618/p00618\\_2012\\_mpa\\_status%20report.pdf](http://www.ospar.org/documents/dbase/publications/p00618/p00618_2012_mpa_status%20report.pdf)

OSPAR Commission (2009a): Deposition of air pollutants around the North Sea and the North-East Atlantic in 2011. OSPAR Monitoring and Assessment Series. [http://www.ospar.org/v\\_publications/browse.asp?menu=00080800000000\\_000000\\_000000](http://www.ospar.org/v_publications/browse.asp?menu=00080800000000_000000_000000)

OSPAR Commission (2009b): Status and trend of marine chemical pollution. <http://www.ospar.org/>

OSPAR (2010): The quality status report 2010. [http://qsr2010.ospar.org/en/media/chapter\\_pdf/QSR\\_Ch01\\_EN.pdf](http://qsr2010.ospar.org/en/media/chapter_pdf/QSR_Ch01_EN.pdf)

OSPAR (2014) : Principles. [http://www.ospar.org/content/content.asp?menu=00320109000000\\_000000\\_000000](http://www.ospar.org/content/content.asp?menu=00320109000000_000000_000000)

Porter, S. and J. Wettig (1999): "Policy issues on the control of major accident hazards and the new Seveso II directive". *Journal of Hazardous Materials* 65: 1-14.

Prokop, Gundula; Martin Schaumann and Irene Edelgaard (2000): Management of contaminated sites in Western Europe. European Environment Agency, Topic report No 13/1999

Qiu J (2012): Chinese survey reveals widespread coastal pollution. *Nature* 877.  
<http://www.nature.com/news/chinese-survey-reveals-widespread-coastal-pollution-1.11743>

Rafaj, P., Cofala, J., Kuenen, J., Wyrwa, A., & Zyśk, J. (2014): Benefits of European Climate Policies for Mercury Air Pollution. *Atmosphere*, 5(1), 45-59. doi: 10.3390/atmos5010045.

RMBP (2011a): *Report on EU Mission to the Yangtze River Basin*, EU-China River Basin Management Programme, Ministry of Water Resources, Changjiang Water Resources Commission. Available at: [www.cewp.org](http://www.cewp.org)

RMBP (2011b): *EU Mission to the Yellow River – Final Report*, EU-China River Basin Management Programme, Ministry of Water Resources, Ministry of Environmental Protection. Available at: [www.cewp.org](http://www.cewp.org)

RMBP (2011c): *RiBaGo Exchange Report*, EU-China River Basin Management Programme, Ministry of Water Resources, Ministry of Environmental Protection. Available at: [www.cewp.org](http://www.cewp.org)

Shao, C., Yang, J., Tian, X., Ju, M., & Huang, L. (2013): Integrated environmental risk assessment and whole-process management system in chemical industry parks. *Int J Environ Res Public Health*, 10(4), 1609-1630. doi: 10.3390/ijerph10041609

Skjærseth, J.B. (2000): *North Sea Cooperation: Linking international and domestic pollution control*. Manchester: Manchester University Press.

Skjærseth, J.B. (2012): North Sea pollution control – One problem, different solutions. In: Andresen S, Boassen EL, Hønneland G (eds). *International Environmental Agreements*. Routledge Research in Environmental Politics. Routledge, London. 199 pp.

Sørmo, E. G., Jussi, I., Jussi, M., Braathen, M., Skaare, J. U. and Jenssen, B. M., (2005): Thyroid hormone status in gray seal (*Halichoerus grypus*) pups from the Baltic Sea and the Atlantic Ocean in relation to organochlorine pollutants, *Environmental Toxicology and Chemistry*, (24/3) 610–616.

UNDP (2010): *China Human Development Report 2009/2010. China and a Sustainable Future: Towards a Low Carbon Economy & Society*.  
[http://hdr.undp.org/en/reports/nationalreports/asiathepacific/china/nhdr\\_China\\_2010\\_en.pdf](http://hdr.undp.org/en/reports/nationalreports/asiathepacific/china/nhdr_China_2010_en.pdf).

UNDP/GEF (2009): *Reducing Environmental Stress in The Yellow Sea Large Marine Ecosystem*, UNDP/GEF Project.  
<http://www.boblme.org/eventDocs/Yellow%20Sea%20LME%20SAP.pdf>

UNEP (2014a): What is APELL?

<http://www.unep.org/resourceefficiency/Business/CleanerSaferProduction/SaferProduction/APELL/APELLProcess/WhatisAPELL/tabid/78884/Default.aspx>

UNEP (2014b): Annual Yearbook 2013.

UNEP (2010): APELL Multi-Hazard Training Kit For Local Authorities For Community Vulnerability Reduction, Prevention, and Preparedness. UNEP, Paris. 49 pp.

UNEP/INERIS (2008): Assessing the Vulnerability of Local Communities to Disasters: An Interactive Guide and Methodology. Community Risk Profile Tool (CRP)

<http://www.unep.fr/shared/publications/pdf/DTIx1054xPA-CommunityRiskProfile.pdf>

UNEP (2001): APELL for Mining. Guidance for the Mining Industry in Raising Awareness and Preparedness for Emergencies at Local Level . Technical Report No 41.

<http://www.unep.fr/shared/publications/pdf/WEBx0055xPA-APELLminingEN.pdf>

UNEP (1996): Management of Industrial Accident Prevention and Preparedness. A Training Resource Package.

<http://www.unep.fr/shared/publications/pdf/WEBx0110xPA-IndustrialAccidentsTraining.pdf>

UNEP/WHO (2013): State of the Science of Endocrine Disrupting Chemicals – 2012. An assessment of the state of the science of endocrine disruptors prepared by a group of experts for the United Nations Environment Programme and World Health Organization. Edited by Åke Bergman, Jerrold J. Heindel, Susan Jobling, Karen A. Kidd and R. Thomas Zoeller. UNEP/WHO.

UNEP (1988): APELL Awareness and Preparedness for Emergencies at Local Level. A process for responding to technological accidents. Industry and Environmental Office UNEP. Paris 1988. 64 pp.

<http://www.unep.fr/scp/publications/details.asp?id=WEB/0064/PA>

USEPA (2013): <http://www.epa.gov/oem/content/hazsubs/healthaz.htm>

US-EPA (2013): Solid waste and emergency response. Soils policy: Soil contamination in Europe.

[http://www.epa.gov/oswer/international/factsheets/200906\\_eu\\_soils\\_contamination.htm](http://www.epa.gov/oswer/international/factsheets/200906_eu_soils_contamination.htm)

US-EPA (2012a): Air Quality Management Plan.

<http://www.epa.gov/air/aqmp/index.html>

US-EPA (2012b): Air Quality Management Plan. Tools and Resources.  
<http://www.epa.gov/air/aqmp/tools.html>

van Keulen, Mw. M. (2007): *The Habitats Directive: A Case of Contested Europeanization*, WRR Scientific Council for Government Policy, Web publications 30, The Hague.

van Vuuren DP et al. (2004): Exploring the Ancillary Benefits of the Kyoto Protocol for Air Pollution in Europe. Technical Report 93, European Environment Agency, 2004.  
[www.eea.europa.eu/publications/technical\\_report\\_2004\\_93](http://www.eea.europa.eu/publications/technical_report_2004_93)

Vennemo, H. et al. (2012): *Application of SEA and CBA Methodologies in Environmental Planning* (in Chinese), China Environment Press.

Vennemo, H., Aunan, K., He, J., Hu, T., & Li, S. (2009): Benefits and costs to China of three different climate treaties. *Resource and Energy Economics*, 31(3), 139-160. doi: 10.1016/j.reseneeco.2009.03.003.

Versluis, E (2004): "Explaining variations in Implementation of EU Directives". European Integration online Papers (EIoP). Vol. 8.

von Stein J. (2010): International Law: Understanding Compliance and Enforcement. In: Denmark RA (ed.) *The International Studies Encyclopedia*. doi: 10.1111/b.9781444336597.2010.x <http://www-personal.umich.edu/~janavs/vonstein-compendium.pdf>

Wang et al 2013. Heavy metal pollution in coastal areas of South China: A review. Shuai-Long Wang a,b, Xiang-Rong Xu a,†, Yu-Xin Sun a,d, Jin-Ling Liu a, Hua-Bin Li Marine Pollution Bulletin 76 (2013) 7–15.

WD (2001): *Common Implementation Strategy for the Water Framework Directive (2000/60/EC)*, Strategic Document as agreed by the Water Directors under Swedish presidency, 2 May 2001. Available at: <http://ec.europa.eu/environment/water/water-framework/objectives/pdf/strategy.pdf>

Wei, B. and L. Yang (2010): A review of heavy metal contaminations in urban soils, urban road dusts and agricultural soils from China. *Microchemical Journal* 94(2): 99-107.

WHO (2007): Health risks of heavy metals from long-range transboundary air pollution. Joint WHO/Convention Task Force on the Health Aspects of Air Pollution.  
[http://www.euro.who.int/\\_\\_data/assets/pdf\\_file/0007/78649/E91044.pdf](http://www.euro.who.int/__data/assets/pdf_file/0007/78649/E91044.pdf)

WISER (2014): *Water Bodies in Europe: Integrative Methods to assess Ecological status and Recovery / Methods Database (work package 2.2)*. Available at: <http://www.wiser.eu/results/method-database/> Retrieved: 8 May 2014.

World Bank (2014): Marine protected areas (% of territorial waters).

<http://data.worldbank.org/indicator/ER.MRN.PTMR.ZS>

World Bank (2010): Overview of current situation on brownfield remediation and redevelopment in China.

Xie, Jian (2009): *Addressing China's Water Scarcity. Recommendations for Selected Water Resource Management Issues*, The International Bank for Reconstruction and Development, The World Bank.

Xinhua (2013b): 'Ecological "red line" great breakthrough in nature protection: expert', *Xinhua* 25 Nov. 2013. Available at: [http://news.xinhuanet.com/english/indepth/2013-11/25/c\\_132915115.htm](http://news.xinhuanet.com/english/indepth/2013-11/25/c_132915115.htm)

Xinhua (2012): 'Over half of China's urban underground water polluted', *Xinhua* 28 May 2012. Available at: [http://news.xinhuanet.com/english/china/2012-05/28/c\\_131615637.htm](http://news.xinhuanet.com/english/china/2012-05/28/c_131615637.htm)

Xu, I. & G. Liu (2009): The study of a method of regional environmental risk assessment, *Journal of Environmental Management* 90, pp. 3290-3296.

WB (1996): Regional Environmental Assessment. Environmental Assessment Sourcebook Update. Number 15, Environmental Department, World Bank.