EIPPCB documents

Environmental Requirements for Industrial Permitting

Vol. 1 – Approaches and Instruments

ENVIRONMENTAL REQUIREMENTS FOR INDUSTRIAL PERMITTING

Vol. 1

Approaches and Instruments

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

© OECD 1999
Permission to reproduce a portion of this work for non-commercial purposes or classroom use should be obtained through the Centre français d'exploitation du droit de copie (CFC), 20, rue des Grands-Augustins, 75006 Paris, France, Tel. (33-1) 44 07 47 70, Fax (33-1) 46 34 67 19, for every country except the United States. In the United States permission should be obtained through the Copyright Clearance Center, Customer Service, (508)750-8400, 222 Rosewood Drive, Danvers, MA 01923 USA, or CCC Online: http://www.copyright.com/. All other applications for permission to reproduce or translate all or part of this book should be made to OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France.

FOREWORD

Permitting systems for industry are an integral part of environmental regulations in OECD countries. By requiring facilities to operate in an environmentally-sound manner, permits help prevent environmental pollution and ensure that facility operators or enterprises adopt and pay for their own pollution control measures. However, there still remain many opportunities to improve permitting systems so that they can contribute more effectively to longer-term objectives such as sustainable development and resource conservation.

In late 1993, the OECD Environment Directorate launched a Project on Environmental Requirements for Industrial Permitting. The project involved three distinct phases: (i) a survey of permitting legislation, regulations and practices in OECD countries; (ii) the preparation of case studies of four industrial sectors (pulp and paper, metal finishing, oil refining, and iron and steel); and (iii) an international workshop on environmental permitting of industrial facilities which was held in May 1996. The main objectives of the project were:

-- to increase international understanding of how different countries' environmental requirements for industrial point sources were established and applied;

-- to examine the combined use of best available technology (BAT) requirements and environmental quality objectives (EQO) in setting permit conditions for industrial sources; and

-- to develop policy recommendations for integrated and preventive approaches in environmental permitting, including increased use of cleaner technologies.

The project publications come in three volumes covering each of these phases. Volume 1 contains the policy study of the entire project. It attempts to shed light on how current permitting strategies influence the choices of technology and processes by permittees. In addition, the report suggests how combinations of instruments may be applied to improve current approaches. The study reaffirmed the critical importance of environmental permitting for preventing and controlling pollution in the context of new strategies and tools for improving the environmental performance, such as integrated approaches, life cycle assessment, and the expanded use of economic instruments. Volume 2 contains the proceedings of the international workshop and the summaries of the sectoral case studies, while Volume 3 presents the results of the survey on regulatory approaches. Two of the sectoral case studies, i.e. those in the pulp and paper, iron and steel sectors include detailed country profiles, and therefore are published as separate OECD documents.

The report is published on the responsibility of the Secretary-General of the OECD.

ACKNOWLEDGEMENTS

The OECD would like to acknowledge the important assistance and support provided by government officials and experts from OECD Member countries during the preparation of this report. The project was also supervised by the "BAT-EQO" Advisory Panel, which included Delegates to the Pollution Prevention and Control Group from the following participating countries: Karel de Brabander and Bruno de Kerckhove (Belgium), James Riordan (Canada), Robert Droop and Jan Suurland (Netherlands), Antero Honkasalo (Finland), Horst Mierheim (Germany), David Mottershead (United Kingdom), Rick Picardi (United States), and Leopoldo Rubinacci (European Commission). Valuable input was also obtained from experts participating in the OECD Workshop on Environmental Requirements for Industrial Permitting held in Paris in May 1996. The amount of information gathering, fact checking and updating necessary to produce the survey and analysis of permitting approaches for these countries was substantial, and a great number of specialists in Member country administrations were instrumental in helping ensure that this was done in a thorough and accurate manner.

The project publications were compiled and written in the Pollution Prevention and Control Division of the Environment Directorate. The main responsibility for this work rested with Alain Rajotte and Laurent Renevier under the direction and editorial oversight of Rebecca Hanmer, former head of division, and Peter Wiederkehr. Environment Canada, the Ministry of the Environment of the Netherlands, and the Department of Environment of the United Kingdom, respectively, were responsible for carrying out the case studies on the pulp and paper, metal finishing, and oil refining sectors. Input, assistance and advice by past and present colleagues in the Environment Directorate are also acknowledged. Emily Neighbour, Freda O'Rourke and Lyndia Levasseur ably provided editing and logistical assistance. Layout and preparation of the final draft was provided by Blake Ferris, an independent consultant to the Environment Directorate.

The report was revised and approved by the OECD's Pollution Prevention and Control Group.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **11**

Chapter 1: **INTRODUCTION** **19**
1.1 Background 19
1.2 Objectives of the study 20
1.3 Scope of the study 22
1.4 Availability of information 23
1.5 Structure of the report 23

Chapter 2: **ROLE AND OBJECTIVES OF ENVIRONMENTAL PERMITTING** **25**
2.1 Development of policy principles and strategies 25
2.1.1 Basic policy principles and approaches 25
2.1.2 International environmental conventions 28
2.2 Regulatory framework for environmental permitting 33
2.2.1 The application procedure 37
2.2.2 Pollution limits and permit requirements 39

Chapter 3: **FACTORS AND TRENDS IN PERMITTING APPROACHES** **41**
3.1 The debate over the use of BAT and EQOs 41
3.2 The use of BAT criteria 43
3.3 The use of EQO criteria 48
3.4 The combined use of BAT and EQO 51
3.5 The incorporation of economic considerations 53
3.6 Integrated approaches to permitting: emerging trends 55

Chapter 4: **RESULTS OF THE BAT-EQO CASE STUDIES IN FOUR INDUSTRIAL SECTORS** **59**
4.1 Overview of the sectoral case studies 59
4.1.1 The pulp and paper sector 61
4.1.2 The metal finishing case study 64
4.1.3 The oil refining case study 66
4.1.4 The iron and steel sector 68
4.1.5 Findings from permit samples 71
4.2 Evolution of permitting strategies: some examples 74
4.2.1 Gradually tightening BAT-based ELVs 75
4.2.2 Local EQOs as an impetus for setting effluent limits 76
4.2.3 Handling non-compliance issues and reinforcing environmental improvements 77
4.2.4 Lessons learned 79
4.3 Strengths and limitations of permitting approaches 81

Chapter 5: **KEY ISSUES FOR IMPROVING ENVIRONMENTAL PERMITTING.....83**
5.1 Increasing the effectiveness of permitting systems 83
5.1.1 Improving permitting procedures.....83
5.1.2 Improving the effectiveness of BAT and EQOs approaches 85
5.1.3 Long-term goal setting 85
5.2 Improving environmental cost accounting for industrial facilities 85
5.3 Extending the scope of integrated permitting systems 87
5.4 Fostering technological innovation 87
5.5 The critical role of public involvement 88

Chapter 6: **CONCLUSIONS AND RECOMMENDATIONS.....91**
6.1 Objectives and achievements of the permitting process 91
6.2 Strengthening the links with other policy instruments 93
6.3 The components of effective permitting policies.....95

REFERENCES 97
Publications list of the OECD Project
on Environmental Requirements for Industrial Permitting 99

LIST OF FIGURES

Figure 1. Major issues, policy responses and environmental results in the Great Lakes region 29
Figure 2. Air pollution reductions achieved and forecast in OECD countries 30
Figure 3. Regulatory framework of environmental permitting in OECD countries 32
Figure 4. Single-media and integrated permitting 33
Figure 5. Interaction of technology, economics, environmental and social policy factors 42
Figure 6. Sequence of the combined use of EQS and BAT.....52
Figure 7. Environmental protection through internalisation of externalities 54
Figure 8. Extending integrated permitting approaches.....57
Figure 9. Savings from recycling materials (iron) 70
Figure 10. Decoupling of mill production and discharges after application of BAT-based limits.....76
Figure 11. Decoupling of mill production and discharges under tight EQOs 77
Figure 12. Achieving compliance through enforcement 78
Figure 13. The environmental permitting cycle for industrial facilities 82
Figure 14. Extending permitting.....92
Figure 15. Policy instruments for addressing material flows 94

LIST OF TABLES

Table 1. Regulatory approaches in the Baltic Sea and North Sea Conventions 27

Table 2. Relationship between policy principles, regulatory approaches and technological response in OECD countries 31

Table 3. Criteria for facilities subject to permitting 35

Table 4. Legal status and determinants of permit conditions 37

Table 5. BAT criteria and ELVs in OECD countries 45

Table 6: Environmental Quality Objectives (EQOs) and standards (EQSs) in OECD countries 49

Table 7. The industrial case studies: participating countries and permit samples 60

Table 8. Permitting approaches in participating countries 73

LIST OF BOXES

Box 1. Elements of the application document for environmental permitting 38

Box 2. The European Union's Integrated Pollution Prevention and Control (IPPC) Directive 56

Box 3. Relationships between regulation, science and technological innovation in the pulp and paper sector 62

Box 4. Small and medium-sized enterprises and the economic-ecological balance 66

Box 5. Searching for flexibility and cost-efficiency in the oil refinery sector: the air concentration "bubble concept" as an integrated permitting tool in Belgium 68

Box 6. Pollution prevention and resource productivity in the iron and steel industry: compatible objectives 70

Box 7. Impact of permitting strategies and requirements on pollution control and cleaner technologies 71

Box 8. Improving the performance of environmental permitting: the United States' experience 84

Box 9. Main advantages of environmentally-oriented cost accounting systems 86

ABBREVIATIONS USED IN THIS REPORT

AOX:	adsorbable organic halogens
BAT:	best available technology/techniques
BREF:	BAT reference document
BATNEEC:	best available techniques not entailing excessive costs
BDT:	best demonstrated technology
BOD:	biological oxygen demand
BOD_7:	biological oxygen demand over 7 days
BPEO:	best practical environmental option
BPO:	best practicable option
CAA:	Clean Air Act (USA)
CEPA:	Canadian Environmental Protection Agency
COD:	chemical oxygen demand
CWA:	Clean Water Act (USA)
EAF:	electric arc furnace
EIA:	environmental impact assessment
ELV:	emission limit value
EMAS:	ecomanagement and audit scheme adopted by EU Council; requires specific reporting
EMS:	environmental management systems
EPA:	U. S. Environmental Protection Agency
EPR:	extended producer/product responsibility
EQO:	environmental quality objective
EQS:	environmental quality standard
EU:	European Union
HAPs:	hazardous air pollutants
HELCOM:	Helsinki Commission on the Protection of the Baltic Sea
IJC:	International Joint Commission on the Great Lakes
ICPR:	International Commission for the Protection of the River Rhine
ISO 14000:	the International Organisation for Standardisation's (ISO) voluntary environmental management scheme for industry
IPC:	Integrated Pollution Control Act (the United Kingdom)
IPPC:	Integrated Pollution Prevention and Control (EU Directive)
LAAPC:	Local Authority Air Pollution Control (the United Kingdom)
LCA:	life cycle assessment
LRTAP:	Convention on the Long-Range Transboundary Air Pollution
NGO:	non-governmental organisation
OSPARCOM:	Oslo and Paris Commission for the Protection of the North Sea and the North East Atlantic
PAH:	polycyclic aromatic hydrocarbons
PM_{10}:	particulate matter of 10 micron size
PRTR:	pollutant release and transfer registers
RCRA:	U.S. Resource Conservation and Recovery Act
SMEs:	small and medium-sized enterprises
SS:	suspended solids
TA Luft:	Technical Instruction on Air Pollution Control in Germany
TSP:	total suspended particles/particulates
UNEP:	United Nations Environmental Programme
UNIDO:	United Nations Industrial Development Organisation
US EPA:	United States Environmental Protection Agency
VLAREM I & II:	Flemish Implementation Decree (I & II) on Environmental Protection
VA:	voluntary agreement

EXECUTIVE SUMMARY

Introduction

In OECD countries, industrial plants and other types of enterprise must apply for government permission to initiate and, periodically, to continue operation. This public permission takes the form of licenses or permits granted by government agencies on the basis of a variety of environmental, economic, and territorial criteria. The permitting process[1] seeks to ensure an environmentally-sound operation of the permitted facility. In addition to encouraging public involvement in decisions affecting plant construction and operation, permitting helps ensure fair competition under environmental and other regulations. Permits also address safety issues, notably in the event of a large accidental release of harmful substances or other accidents.

Over the last thirty years, permit systems have proven to be very effective in achieving large reductions in pollutant emissions from stationary sources. Where major industrial accidents have occurred (e.g. Seveso, Bhopal, Schweizerhalle), the environmental permitting systems were either inadequate, non-existent or poorly enforced. These incidents clearly demonstrate that strong, predictable and consistent enforcement of current regulations and permitting systems is a prerequisite to protect public health and the environment.

During the same period however, volumes of many traditional pollutants have increased as the economy has developed, and new environmental issues (e.g. persistent pollutants, climate change), have emerged. These changes, together with a heightened awareness of the scope and complexity of environmental problems, have increased concern over the long-term consequences of current patterns of economic activity. Although technology can make an important contribution to reducing pollution immediately and in the future, the opportunities offered by technical advances are often overlooked or unevenly implemented. Moreover, traditional "end-of-pipe" pollution control equipment is increasingly being displaced by cleaner production technologies and techniques which prevent pollution upstream of the discharge point. By adopting a precautionary approach during the determination of environmental requirements, permitting strategies have been a catalyst for the movement towards prevention. To keep pace with technical advances and address today's emerging and long-term environmental issues, permitting will not only have to continue developing in this direction, but should also multiply links with other policy instruments and move towards becoming a dynamic, continuous policy process.

This study examines environmental permitting for industrial facilities and its role in the implementation of pollution prevention measures in OECD Member countries. On the basis of an examination of permitting practices in various OECD Member and Observer countries, the study sought to verify the importance of three major conceptual instruments -- best available technology and techniques (BAT) requirements, and environmental quality standards (EQSs) or objectives (EQOs) -- for limiting pollutant emissions from industrial sources. More specifically, it sought to understand industry's technological response to permitting practices and uncover ways of improving the effectiveness of current programmes, particularly their contribution to pollution prevention.

---

[1] In this report, "environmental permitting" refers to the entire process by which governments grant permission to operate to industrial facilities.

The present study was carried out in the course of a larger OECD project on environmental requirements for industrial permitting. The project as a whole comprised three mutually-supporting efforts: a survey of permitting legislation, regulations and practices in various OECD countries; a set of case studies of permitting practices in four pollution-intensive industrial sectors (iron and steel, metal finishing, pulp and paper and oil refining); and an international workshop which took place in Paris in 1996[2]. The conclusions and recommendations presented in this study are based on the consensus of countries that participated in the Paris workshop, where preliminary results from the first two segments of the project were also discussed.

Factors and trends in permitting decisions

A central conclusion of the project was to reaffirm the critical importance of environmental permitting in preventing and controlling pollution, and in maintaining emissions at acceptable levels. The analysis of permitting trends in OECD countries further confirmed that a shift from pollution control approaches towards pollution prevention strategies is currently occurring. This shift is most likely a consequence of:

-- the role of international conventions such as OSPARCOM and HELCOM on marine environments or the IJC for freshwater systems and, as in the case of the UNECE Convention, on long-range transboundary air pollution.

-- the development of new policy instruments, such as LCA (Life Cycle Assessment), EIA (Environmental Impact Assessment) and EMS (Environmental Management Systems), which provide criteria to permitting authorities and enable them to assess the impact of permit requirements beyond the specific, local impacts of industrial facilities; and

-- an increasing convergence of regulatory approaches towards integrated, cross-media permitting, influenced primarily by scientific and technical progress and a more comprehensive understanding of the dynamics of natural ecosystems.

Many of the major opportunities for improving permitting systems lie in the context of the policy shift towards pollution prevention. However, simply ensuring that basic permitting procedures are carried out in a dynamic and thorough fashion is equally important. The review of permitting approaches also indicated that effective strategies are based on a pragmatic, case-by-case assessment of the issues relating to the environmental impacts of industrial activity. This means that permitting authorities must ensure that the documents submitted by permit applicants are sufficient to define permit conditions. Such judgements can be substantially reinforced through information exchange at the national and international levels, which aids in defining the best set of measures and methods. This is particularly important for assessing what emission levels can be achieved by optimal operation and maintenance. Once levels are fixed, monitoring procedures must be designed so that compliance can be verified and benchmarks for reviews of BAT and EQOs determined.

---

[2] OECD Workshop on Environmental Requirements for Industrial Permitting, 9-10 May, Paris, 1996.

The concepts of BAT and EQOs and their combined use

The quality of permitting decisions depends on a country's overall system of environmental standards and objectives as well as the quality of the related environmental assessment. BAT, EQOs and EQSs are conceptual instruments used by most permitting authorities to arrive at the Emission Limit Value (ELV) for pollutant emissions stipulated by the permit. The policy analysis showed that every country studied used environmental or technological criteria as a basis for the establishment of permit conditions for industrial facilities. BAT-based approaches appear to be a driving force for setting standards and permit requirements, but EQOs and EQSs ensure that environmentally safe emission levels are met and that long-term environmental protection objectives will be achieved. When used in isolation, both approaches have certain weaknesses. Therefore, BAT and EQOs are generally considered as complementary, mutually reinforcing approaches.

The *BAT concept* has evolved as one of the key elements for setting ELVs for industrial facilities. BAT is a legal or regulatory requirement in many OECD countries, but not in all of them. Although there is no commonly agreed definition of BAT (except for among EU countries) and existing definitions are quite broad, it is generally recognised that the BAT concept is critical for inducing change towards pollution prevention, and there are common points of understanding. BAT usually implies that environmental requirements for industrial point sources should be set at the level of environmental performance achieved by the world's cleanest plants, i.e. 10-15% of the best plants in a given sector. It is also generally understood that BAT implies cost-efficient options, in other words, that "best available" options are technically efficient and that inputs are efficiently allocated with regard to environmental impacts.

Technology-based requirements cannot be set in isolation. Insofar as the main function of such requirements is to protect human health and the environment, they should be derived from *environmental quality standards* (EQSs) and long-term environmental objectives. EQSs and *environmental quality objectives* (EQOs) are indispensable to identify environmental pressures and to assess the effectiveness of policies and measures. All countries surveyed have mechanisms for limiting emissions according to local quality standards and based on an understanding of the carrying capacity of the environment. EQOs focus on environmental impacts critical for specific areas, involve public participation and build political will into the process. They are crucial to direct actions towards the most important and urgent problems while avoiding costly surveillance programmes of releases to different environmental media. On an international level, they provide an important instrument for bilateral and multilateral conventions on transboundary pollution. When EQOs direct environmental policies, they can also serve as a driving force to guide research towards long-term protection goals, to improve environmental impact and risk assessments, and to ensure long-term protection of natural ecosystems through the application of the critical loads concept.

There is clear evidence that the *relationship between BAT and EQOs* has evolved significantly over the past few years. Recognising the complexity of defining the right balance between economic and ecological needs, a political consensus has emerged regarding the combined use of technology-based and ecology-based instruments in setting far-sighted environmental standards and permit requirements. It is increasingly recognised that an optimal definition of performance levels must be based on the combined assessment of local environmental goals and state-of-the-art technology for reducing harmful releases. Indeed, the examination of country practices leads to the conclusion that a permit cannot be optimally effective if it does not achieve a good balance between the precautionary approach (through technology-based requirements) and tailored, site-specific parameters based on environmental quality. If EQSs are exceeded, to attain acceptable environmental quality levels, requirements for control technologies and techniques must go beyond BAT, and should be set more stringently.

Integrated approaches to permitting

There is growing experience with different types of integrated approaches to pollution prevention and control such as cluster schemes for groups of substances, sectoral integration of different sources or ecosystem-based integration. The review of available information suggests that governments that have pursued integrated permitting programmes and cross-media approaches have found them to be efficient and cost-effective. Integrated permitting is also considered more effective than media-specific approaches in linking long-term environmental strategies for reducing pollution and making economic growth environmentally sustainable. Integrated pollution prevention and control can be further enhanced by the incorporation of environmental auditing requirements in permit application procedures. Sharing information on integrated approaches has become increasingly important in the context of co-ordinated actions under international, regional or global conventions. The incorporation of these experiences into the permitting of individual facilities is a major challenge and requires modification of existing rules and regulations as well as changes in the design and implementation of permitting systems.

Results of the BAT-EQOs case studies in four industrial sectors

The case studies on the pulp and paper, metal finishing, oil refining, and iron and steel sectors were based on permit samples and related information in which each participating country described the process for issuing permits and how BAT and EQOs were considered during the development of permits. The examination of permit samples for different industrial sectors has demonstrated that the influence of permitting programmes goes beyond the management of permit procedures. If properly administered and enforced, the permitting cycle can become a continuous policy process enabling all participants to contribute to the improvement of public understanding of the environmental issues addressed in the permit and of the solutions adopted. Plant-by-plant investigations initiated by the permitting system are essential for collecting data on technical possibilities. Indeed, the permit examples showed that monitoring frequent enough to identify fluctuations in discharges has several significant benefits: it 1) allows assessment of the environmental performance of plants; 2) reveals actual and potential environmental problems; and 3) allows any need for technical research and development to be identified.

The case studies indicate that there is a trend towards using permitting approaches to favour the use of environmentally-friendly materials and energy sources. This expansion of the conventional role of permits is occurring implicitly through the use of “best environmental options” to establish permit conditions. Tools such as environmental impact assessments and life cycle assessment, by providing an increasingly integrated picture of industrial activities prior to the permitting procedure, are also contributing to this trend.

Conclusions and recommendations

The examination of regulatory approaches in OECD countries revealed that pollution prevention and control is actively promoted through environmental permitting. However, three issues in particular need to be addressed to respond to current problems and to achieve long-term environmental objectives. These are: 1) improvement of permitting procedures by extending their scope; 2) developing indicators and instruments to foster technological innovation; and 3) encouraging closer public involvement.

Improving permitting procedures

Opportunities for improving permitting procedures include in particular:

-- The design and implementation of integrated cross-media permitting, which could stimulate pollution prevention initiatives over a longer time frame through a multi-layered set of gradually-implemented requirements.

-- The integration of permitting systems with other policy instruments. This could create a more conducive setting for long-term technological and managerial innovation and help foster spontaneous prevention strategies, both within and around a particular industrial process. Permit requirements should be set within the framework of a more comprehensive consideration of global concerns. Links with other pollution prevention instruments such as LCA, EIA, EMAS (Ecomanagement and Audit Scheme), voluntary environmental agreements and economic instruments such as eco-taxes need to be reinforced to take advantage of potential synergies and to avoid contradiction or interference from other measures. Such combined approaches would have the advantage of making environmental strategies more comprehensive and more coherent with economic objectives.

-- The development of environmentally-oriented cost indices for different production stages to identify the economic and technical opportunities for saving energy and materials as well as for reducing pollutant emissions. Environmentally-oriented cost accounting systems should become an important basis for effective environmental management systems (EMSs). Current cost accounting systems are often inadequate to fully identify what may be very substantial "win-win" opportunities at enterprise level.

-- The establishment of long-term goals and monitoring programmes linked to permitting schemes at plant level, and the development of harmonised international indicators for measuring the environmental performance of individual facilities and entire sectors. Domestically, harmonised measurement methods for comparing monitoring results from different industrial sectors need to be developed to ensure a fair implementation of the BAT principle.

-- The adaptation of permitting systems to small and medium sized enterprises (SMEs) and to diffuse sources. Permitting in SMEs, in particular, remains a mechanism for addressing site-specific issues. Traditionally, permitting has not dealt with issues upstream or downstream of the production process, for example, material and energy inputs and disposal of products and wastes. The scope of permits should be extended in order to influence resource productivity. Linking permitting mechanisms with policies addressing pollution from small or diffuse sources that are not covered by current permitting systems will require new provisions in terms of multi-source management.

Fostering technological innovation

Permitting systems can be improved to more effectively spur technology development and implementation. In particular, it is recognised that there is a need to better define the relationship between short-term requirements and the long-term goals that can ensure a sustainable future. The effectiveness of policy planning is largely dependent upon the ability of countries to produce and

apply technological solutions for environmental purposes. A major issue in that regard involves the incorporation of technological change into the permitting process. The use of performance-based standards is generally regarded as a fundamental principle for allowing the operator to choose the best methods of compliance while favouring technological innovation. In that respect, regulatory approaches must develop policy initiatives that can overcome obstacles to favouring and exploiting technological innovation.

The critical role of public involvement

Finally, an otherwise sound permitting programme will be inefficient if it has not been designed to encourage public participation and involvement. While the overall quality of the regulatory framework remains essential to a successful programme, experience has shown that permittee compliance and environmental performance is substantially improved when the public is sufficiently informed about and associated with the permitting process. Permitting systems should be made as transparent as possible, and should involve democratic processes where appropriate, incorporating the notion that present and future environmental quality is a public good. Many countries have been moving in this direction in recent years, but new initiatives are needed to ensure that the public is fully involved. In particular, efforts to better integrate local considerations into the permitting process are often dependent upon the full participation of the communities in question.

As both the impacts and complexity of environmental issues are increasing, much remains to be done towards achieving sustainable industrial development. Beyond the need to control and better manage the full material cycle of human activities, regulatory approaches and instruments must be designed so as to ensure that environmental needs and economic objectives are balanced. The results from this study on environmental requirements for industrial permitting have shown that this goal may be achieved by pursuing an optimal balance between environmental quality objectives and the development of environmentally sound technologies and techniques. In addition, there is a need to extend the scope of permitting to address both short-term environmental and economic needs and long-term goals for a sustainable future. Member countries must ensure that environmental standards and objectives are effectively implemented through permitting and must provide the incentive for the development of the innovative techniques and technologies that can make sustainable economic growth a reality. However, this task and the associated policy changes will not be possible in the absence of political will and a well-informed public. Accordingly, governments must work to involve stakeholders and build public awareness of the short and long term issues at stake.

ENVIRONMENTAL REQUIREMENTS FOR INDUSTRIAL PERMITTING

Chapter 1:

INTRODUCTION

1.1 Background

In recent years, most OECD countries have made considerable progress in improving the environmental impacts related to industrial activities and the production of the energy they require. Pollution intensities are on the decline, volumes of several types of conventional pollutants have been reduced, and national and international bans on a number of persistent, toxic or environmentally harmful substances have been agreed. Technical advances have made many of these improvements possible. Water pollution from industrial production, emissions of CFCs and other organic hydrocarbons from solvent use and acid deposition are all examples of industry-related environmental problems that have been substantially improved by policy-driven technological change.

Environmental permits, which for decades have been one of the pillars of the regulatory system to which industrial facilities in OECD countries are subject, have been a major factor in many of these improvements. They have also been an impetus for the technical advances which have often made improved environmental performance possible. Environmental permitting describes the process by which industrial facilities, by meeting various conditions stipulated in the permit, are granted permission to operate by government agencies. It is thus the major interface between the public interest as laid out in national environmental, health and safety regulations, and local stakeholders on the one hand, and the operators of facilities whose activities involve potential risks to human health or the environment on the other. In addition to preventing pollution and accidents through standard-setting and monitoring and enforcement procedures, the permitting process also fosters transparency and serves as a channel of information on industrial activities for the public.

For facility operators, permitting allows several different licensing, disclosure and legal issues to be integrated into a single procedure, thus simplifying the facility's relationship with government agencies, the public and local stakeholders. The permitting procedure also provides an opportunity for environment agencies and facility operators to exchange experience with regulations and discuss modifications of procedure, potential risks or new technical solutions. By identifying the state-of-the-art techniques with the best environmental performance, the permitting process serves as a clearing house for information about clean technology and pollution control equipment to plant operators, and provides benchmarks by which the environmental performance of a given facility can be measured. Finally, environmental permitting helps remove market distortions and fosters conditions of fair competition under environmental regulations; first, by ensuring that polluters pay for their own abatement and prevention measures, thus eliminating potentially uneven government subsidies to polluters, and second, by providing indicators for measuring and comparing the environmental performance of facilities within and across industrial sectors (and eventually, among

different countries), thus ensuring that permit requirements are coherent and set according to the same criteria.

Permits thus serve a wide range of indispensable functions and are valuable tools for the public interest and the private sector alike. As stated above, they have played a major role in improving industry's environmental performance over the last few decades. However, as the world economy develops, many of these achievements are likely to be outstripped by the rapid economic growth expected in the beginning of the next century. By 2010, the world's economic output is expected to nearly double, while output in non-OECD countries is expected to more than triple (OECD, 1997). Even at the pollution rates common in OECD countries today, this growth has the potential to create vast, unacceptable increases in environmental pollution. However, the fastest growth is expected to occur in areas where environmental performance is generally very poor and where regulations are often untested, fragmentary or non-existent. Irrespective of the challenges posed by the world's growing economy, advances in environmental science and in other fields have raised new concerns about the negative effects of human activity on the environment. For this reason, in the absence of new, dynamic efforts to control, and in particular, to prevent pollution, the outlook for maintaining environmental quality remains poor.

In spite of its past record, environmental permitting, like the rest of the regulatory framework, will have to adapt to meet this challenge. Earlier permitting strategies were characterised by pollution control through after treatment or "end-of-pipe" means, or through dilution and dispersion. Different environmental media (i.e. air, water, earth) were often addressed through separate permits. Subsequently, environmental policy in several OECD countries began to shift emphasis towards pollution *prevention* and *integration* of policy objectives, regulatory and economic instruments and monitoring or assessment practices. Recent trends in permitting programmes bear the mark of this gradual policy shift. Environmental permitting is focusing to a greater degree on preventing pollution at source through cleaner process technology and waste minimisation efforts. Links between permitting and other policy instruments in the framework of a more integrated approach are becoming more common. This trend should be encouraged. The nature of the permitting system seems at first to imply a set of static requirements. However, to adapt effectively to what are proving to be ever more dynamic and interrelated issues, permitting systems will have to become more flexible and interconnected with other policy instruments. In the next century, effective environmental permitting systems will retain the successful elements of past programmes while deepening the current shift towards a more prevention-oriented and integrated approach. On a more general level, permitting will increasingly need to be designed as a continuous, open-ended policy process which can adapt to new developments and ensure that environmental performance is constantly improving as economic growth progresses.

1.2 Objectives of the study

The purpose of the OECD project on Environmental Requirements for Industrial Permitting was to answer these needs by examining how technology-based requirements [e.g. Best Available Technology and Techniques (BAT)], and environmental quality objectives (EQOs) and standards (EQSs) are currently used in setting pollution limits for industrial sources. The policy study presented in this report attempts to detail experience in selected Member countries and identify opportunities for improvement in the use of these tools. Specifically, it attempted to assess the roles of BAT and EQOs and their combined use, and explore how permitting can contribute to increased pollution prevention and increasingly sustainable forms of industrial activity.

This report examines these issues in the context of environmental permitting procedures for industry. In OECD Member countries, emerging policy concepts, such as the precautionary principle, BAT and EQOs, the ecosystem approach, pollution prevention and integration, etc., have been identified as key elements of current environmental permitting approaches. Four issues of major strategic significance for the development and implementation of efficient environmental permitting requirements were examined during the course of the project, and are summarised in the following four questions:

- *What is the most effective use of technology-based requirements (BAT) and environmental quality objectives (EQOs) in permit conditions?*

  Permit requirements based solely on either BAT or EQOs criteria may lead to sub-optimal environmental performance of permitted facilities or may entail unnecessary costs to achieve compliance. Nevertheless, countries always use some environmental or technological criteria as a basis for the establishment of permit conditions. Depending upon the environmental priorities in a given area or for a given facility, permit criteria may be based on different combinations of principles. Clarifying when and how these principles should be applied is an important prerequisite for ensuring optimal permitting procedures and requirements.

- *How can pollution prevention be achieved more effectively through permitting mechanisms?*

  The effectiveness of environmental requirements depends to a large degree upon three procedural steps: (a) the identification of environmental issues to be dealt with through the application procedure; (b) the adoption and implementation of emission limits for preventing and controlling harmful releases and/or activities to avoid degradation of environmental quality, including the timetable to reach compliance with the requirements; and (c) the negotiation of procedures such as monitoring programmes and environmental assessments to ensure compliance with permit requirements. Each of these steps was analysed for the present report, with a view to providing new insights on the potential of permitting mechanisms to ensure environmental quality and contribute to continuous environmental improvements in industrial operations.

- *What is the most appropriate approach for taking economic considerations into account in permitting or standards-setting procedures?*

  Economic considerations affect permit requirements, both at the standards-setting and permitting stage. There are differences, however, in how and at what level of the process economic factors are taken into consideration. These discrepancies can have unintended effects on competitiveness both within and among countries. Moreover, economic considerations may lead to sub-optimum permit requirements due to conservative or otherwise inadequate cost accounting systems that neglect the influence of environmental factors on productivity and efficiency. More attention to this question is needed, especially regarding how better mutual understanding between permitting authorities and operators, increased transparency of decision-making processes, and clear guidelines from permitting authorities could substantially improve the effectiveness of environmental permitting.

- *What are the challenges of integrated permitting and how can these be met most effectively?*

  Growing evidence shows that the traditional division of environmental regulations into distinct groups addressing pollution of water, air and land separately limits the effectiveness of environmental policies and fails to take full advantage of technological innovations. Many countries recognise the current administrative limitations and are now moving towards integrated permitting systems or mechanisms to address cross-media transfer and globalisation of pollution, irreversibility of environmental effects and other emerging problems. Throughout the report, selected countries' practices are assessed with a view to identifying the most appropriate strategies for accelerating the move toward integrated pollution prevention and control approaches.

By examining these four topics in detail, this report hopes to identify the measures which may be applied under different situations to maximise the potential environmental benefits of permitting schemes, promote innovation in pollution control equipment and clean technologies and increase the cost-effectiveness of environmental policy instruments.

1.3 Scope of the study

The project summarised here was carried out in part by collecting and analysing information on permitting approaches in OECD Member and Observer countries. In the first phase of the project, the relevant laws, regulations, policies and practices were examined. The purpose was to understand the regulatory framework in which permitting decisions are taken so as to identify its main approaches and instruments. Results of this work have been summarised and published in a separate report: the Reference Guide on environmental requirements for industrial permitting[3].

The second phase comprised a series of case studies in four industrial sectors: iron and steel, metal finishing, oil refining and pulp and paper. The intent was to examine how permit limits and conditions are defined in practice for industrial facilities by reviewing and analysing permit samples provided by the participating countries and through contacts with the facilities involved. The industrial sectors were selected for the significance of their environmental impacts. One sector, metal finishing, was also chosen as a representative of small and medium enterprise (SMEs). The case studies on the iron and steel and pulp and paper sectors are also available as separate publications[4].

In the third phase, an international workshop on Environmental Requirements for Industrial Permitting was organised at the OECD headquarters in Paris. The workshop, which took place from 9-11 May, 1996, brought together nearly 100 experts and representatives from the public and private sector from more than 20 OECD Member and Observer countries. Several representatives from international organisations (i.e. UNEP, OSPARCOM, UNIDO, various NGOs) also participated. The purpose of the workshop was to provide a forum for the exchange of concrete information and experiences on the use of technological and ecological criteria for industrial permitting as well as on other major aspects of current regulatory approaches. Workshop discussions have shown that the concepts of BAT and EQOs are recognised and broadly used, if not always systematically, in all

---

[3] *Regulatory Approaches to Environmental Permitting in OECD Countries -- A Reference Guide*, OECD, Paris, 1996.

[4] "Environmental Requirements for Industrial Permitting: Case Study on Pulp and Paper Sector" and "Environmental Requirements for Industrial Permitting: Case study on Iron and Steel Sector", both published by OECD, Paris, 1998.

OECD Member and Observer countries. However, the economic, political and technical implications of the combined use of technology-based criteria, environmental quality objectives and regulatory standards in permitting decisions were not taken into account as frequently. The discussions focused on the four issues mentioned above and attempted to develop policy recommendations for efforts to improve current environmental permitting strategies and practices. The complete Workshop proceedings are also available as an OECD Document[5].

1.4 Availability of information

To understand the underlying policy principles behind current permitting decisions it is necessary to go beyond the facts or, more precisely, to grasp which facts may trigger a particular policy or technological response. Thus, the interpretation of current permitting decisions and strategies may be as productive as after-the-fact explanations based on a given set of historical data. The permit samples, although limited, have provided many examples of how permitting authorities strive to achieve the optimum level of environmental quality through different types of approaches and mechanisms. The expertise provided by participating countries throughout the project, in particular at the workshop, has also significantly contributed to a better understanding of these approaches.

However, the conclusions presented in this report should be interpreted with some caution. Even an in-depth investigation which limited itself to examining the influence of permit requirements on industry's technological response would be a daunting task. In preparing this report, it was clear that much more detailed and comparable data concerning specific permitted facilities and industrial sectors would be necessary to give more substance to some of the conclusions drawn. In particular, the relatively small number of permit samples, out of which only a few cover all environmental media, makes it difficult to identify any definite trend on how authorities deal with different issues through permit requirements. Nevertheless, the recommendations for improving environmental permitting approaches in this report reflect these emerging trends in OECD countries as well as the views of many experts in the field. Moreover, these recommendations reflect issues on which there is a high degree of consensus among the participating countries.

1.5 Structure of the report

During each of the three phases of the project, a considerable amount of information was accumulated on the approaches used by participating countries to achieve environmental objectives through permitting and other policy instruments. This report provides an overview and analysis of this information by examining the four key permitting issues introduced above.

In Chapter 2, the role and objectives of environmental permitting are discussed through an examination of regulatory approaches and related factors such as the main considerations influencing permit conditions, interaction with other policy instruments, and other issues. Chapter 3 takes a closer look at some of the main determinants of permitting decisions. In particular, the use of BAT and EQOs and their relationship to economic considerations is explored. The emergence of integrated BAT-EQO approaches and their importance as prerequisites to optimising permit conditions is also discussed, as are the particular benefits and shortcomings of both instruments used

---

[5] *Proceedings of the OECD Workshop on Environmental Requirements for Industrial Permitting*, OECD, Paris, 1998.

alone. In order to evaluate and compare current environmental permitting strategies and identify trends, Chapter 4 reviews the BAT-EQO case studies and permit samples provided by participating countries. Chapter 5 discusses issues important to furthering pollution prevention through permitting approaches, including the combined use of BAT and EQOs in setting permit requirements; the incorporation of economic considerations in the decision-making process; the trend toward integrated approaches; and, the interaction of permits with other policy instruments. The main conclusions and recommendations of the project are presented in Chapter 6.

Chapter 2:

ROLE AND OBJECTIVES OF ENVIRONMENTAL PERMITTING

2.1 Development of policy principles and strategies

In the absence of controls, it is generally agreed that economic activity tends towards unsustainable practices which create excessive amounts of pollution. Similarly, when society as a whole is called upon to repair or compensate the resulting damage to human health and the environment, these practices also give rise to underpriced products and create market distortions. For these reasons, government intervention is necessary to ensure that the environment is protected as a public good and that pollutant releases are controlled. The provision of environmental permits to industrial facilities is a fundamental element of the regulatory process addressing pollution. A coherent, harmonised system of permit requirements addressing different industrial sectors is also necessary to ensure that economic competition at both the domestic and the international levels remains fair under environmental regulations and that economic development proceeds in a sustainable way.

The type and degree of permit requirements in force in a given country are functions of a variety of aspects of environmental policymaking: national and local legislation, international treaties and conventions, technical regulations, norms and standards, licensing and supervision practices, compliance monitoring, and scientific R&D. In general, three basic objectives underlie the environmental permitting system for industrial facilities:

- avoiding and prohibiting pollution of the environment by requiring environmentally-sound operation and management;

- ensuring that control measures are paid for by the plant operator/enterprise, in accordance with the Polluter Pays Principle; and

- ensuring that the requirements set on polluters are based on impartial assessments of environmental impacts and available technical and economic means.

2.1.1 Basic policy principles and approaches

Permitting systems operate within the broader context of national and international strategies. While countries address environmental issues in different ways, experience and international co-operation has helped make the principles summarised below part of regulatory frameworks in most OECD countries.

The precautionary principle: Increasing awareness of the irreversible environmental effects which can result from human activities has provided new arguments for the implementation of the 'precautionary principle'. According to this principle, which has gained acceptance in several OECD countries, authorities should "take preventive measures when there is reason to assume that substances or energy introduced into the...environment may create hazards to human health, harm to living resources and...ecosystems, damage amenities or interfere with other legitimate uses (of the sea) even when there is no conclusive evidence of a causal relationship between inputs and their alleged effects" (Mierheim, 1994). Originally developed in Germany, it was introduced at the international level at the First International Conference on the Protection of the North Sea in 1984 (Jackson, 1991). Its implementation helped give the BAT concept its present importance in pollution prevention and control strategies.

The principle of pollution prevention: The principle of prevention at source is gaining increased acceptance as a basic orientation for environmental policy. In a similar fashion, the resource productivity concept (i.e. in the present context, eco-efficiency) is increasingly used by both environmental policy and industry, thus providing common ground for policymaking and demonstrating the importance of the economy-ecology relationship.

The ecosystem approach: Reliance on single-species tests and chemical-by-chemical methods of establishing effluent limits has failed to reveal the full range of impacts of hazardous compounds released in the environment (Tana and Lehtinen, 1996). Current trends in risk assessment and management include efforts to develop new models for integrating the structural and functional integrity of ecosystem communities into the regulatory process. More broadly, ecosystem approaches are increasingly translated into long-term perspectives, strategic goal-setting, and the development of integrated assessment methods in many countries (Harris *et al*., 1990).

The concept of ecologically-limited carrying capacity: Although early use of the concept of assimilative capacity has too often been translated into a "disperse and dilute" regulatory approach, several factors have led to the rehabilitation of the notion of environmental carrying capacity as a vital concept for environmental management. The scientific approach provides better tools for regional scale risk evaluation, and for solving cost effectiveness issues (e.g. the critical load concept for long-range transboundary pollution goals).

Full cost accounting and best practical environmental options: While technology-based requirements have been effective in substantially reducing pollutant emissions, concerns over the negative cost-benefit ratio of rigid applications of this approach and its impact on technological innovation continue to be put forward. This has prompted many countries to develop methodologies for environmentally-oriented cost accounting and evaluation approaches. Moreover, the need to reorient the current "one-way throughput" economy towards sustainable, closed-cycle forms of production is becoming widely recognised, and is contributing to the development of environmentally-oriented economic policy instruments and data resources.

Table 1. **Regulatory approaches in the Baltic Sea and North Sea Conventions***

	HELSINKI COMMISSION	OSLO and PARIS COMMISSIONS
1972		Establishment of the Oslo Commission by the Convention for the Prevention of Marine Pollution by Dumping from Ships and Aircraft.
1974	Establishment of the Helsinki Commission (HELCOM) by the Convention on the Protection of the Marine Environment of the Baltic Sea. The Contracting Parties agree to take all appropriate measures to control and minimise land-based pollution and to use the "best practical means" to reduce discharges of various substances.	Ratification of the Convention for the Prevention of Marine Pollution from Land-based Sources (Paris Commission).
1984	Best Available Technology (BAT) is first mentioned as "the best available and economically feasible technology".	The International Conference on the Protection of the North Sea (the Bremen Declaration) provides recommendations on three technology-based concepts for reducing/controlling pollution: **1)** "Best Technical Means Available" (for black list substances); **2)** BAT (for radioactive discharges, for petroleum and natural gas operations, and "the precautionary measures for air quality control by reduction of emissions at sources"; **3)** "Low-waste/non-waste technologies" as an area requiring additional information. Economic availability should be taken into account.
1987		The Second International Conference on the Protection of the North Sea (the London Declaration) includes some key considerations for technology-based concepts: **1)** "emission standards should take into account the 'best technical means available' and quality objectives should be fixed on the basis of the latest scientific data"; **2)** BAT should be used to reduce: "pollution at source from point sources; emissions of NO_X to the atmosphere from vehicles and combustion plants; polluting emissions of substances that are persistent, toxic and liable to bio-accumulate at source."; **3)** ELVs based on BAT should be set to reduce emissions from key industrial sources and other sectors within 4 years, if practicable; and **4)** A 50% reduction target for 1995 from 1985 level is adopted.
1988	The Ministerial Declaration on the Protection of the Marine Environment of the Baltic Sea Area includes: **1)** 50% reduction target (1987-1995); **2)** Recommendation for the use of BAT; **3)** Recommendation for low- and non-waste technologies.	
1990	The Baltic Sea Declaration stresses the need for: **1)** the use of BAT; **2)** the use of cleaner technologies; **3)** low- and non-waste processes.	The Third International Conference on the Protection of the North Sea (The Hague Declaration) recommends using BAT as a regulatory tool, and sets a 50% reduction target by 2000 for 16 substances and 70% reductions of Hg, Cd, Pb and dioxin.
1992	The Diplomatic Conference on the Protection of the Marine Environment of the Baltic Sea Area states that: the following points are fundamental means to control pollution: **1)** BAT (definition includes the precautionary principle) for point sources (especially land-based sources) (1991); **2)** BEP (best environment practice) for all sources.	Ratification of the Convention for the Protection of the Marine Environment of the North-East Atlantic which includes general obligations for the contracting parties to apply, among others: **1)** "the precautionary principle, by virtue of which preventive measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the marine environment 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 between the inputs and the effects"; **2)** "the polluter pays principle, by virtue of which the costs of pollution prevention, control and reduction measures are to be borne by the polluter"; **3)** taking into account best available techniques and best environmental practice including clean technology.

* Baltic Marine Environment Protection Commission (HELCOM): Denmark, Estonia, the EC, Finland, Germany, Latvia, Lithuania, Norway, Poland, Russia and Sweden. Oslo and Paris Commissions for the Protection of the Marine Environment in the North-East Atlantic (OSPARCOM): Belgium, Denmark, the EC, Finland, France, Germany, the UK, Ireland, the Netherlands, Norway, Portugal, Spain and Sweden.

Integrated multi-media permitting approaches: As knowledge of pollution patterns has increased, it has become clear that negative trade-offs (e.g. harmful cross-media effects) can occur as unintended consequences of media-specific requirements. The growing recognition of the highly interrelated, systemic character of the environment has recently become a driving force for institutional changeover to multi-media permitting approaches and practices.

Public participation and disclosure: An effective permitting system must be based on a comprehensive strategy for public participation and involvement. Because of the number of stakeholders involved in permitting, the granting of permits must involve democratic processes which ensure that decisions are based on transparent, predictable and justifiable reasoning. The involvement of the public in the decision-making process reflects the need to balance the right of free enterprise with social rights and aspirations, among which are the rights of the public to a clean environment and a fair, sustainable allocation of material resources, principles which are often incorporated in national constitutions.

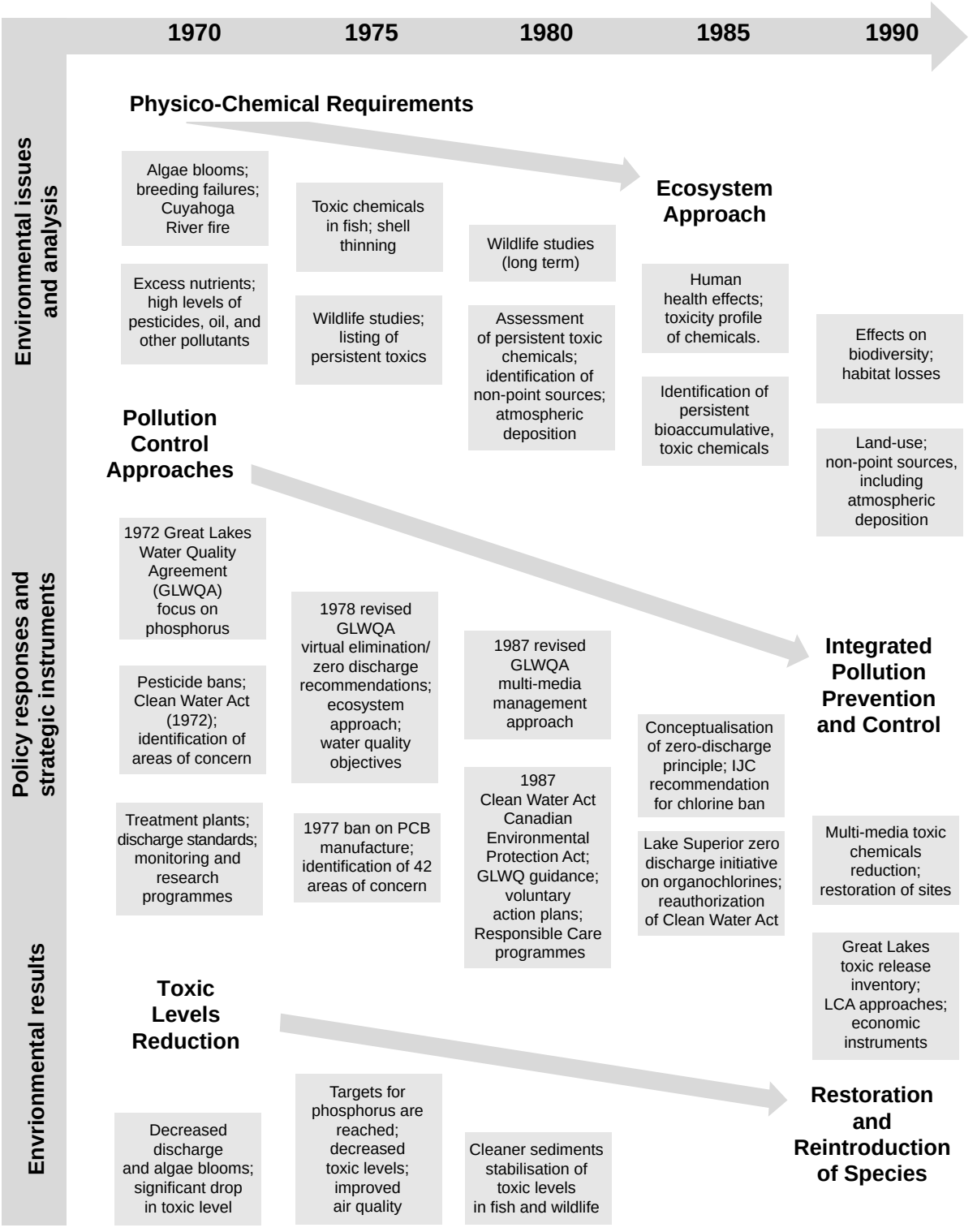
2.1.2 International environmental conventions

In recent years, OECD countries have gradually adopted policies and expanded their regulatory frameworks to address the consequences of polluting activities outside of their political borders as well as on their own territory. The growing realisation that neither environmental problems nor sustainable development can be tackled effectively on a solely national basis has been a prime factor behind the willingness of countries to work together towards concrete and pragmatic solutions.

In the early 1970s, international awareness of environmental issues was promoted through initiatives such as UNESCO's "Man and the Biosphere" Programme and the United Nations Conference on the Human Environment in Stockholm. Through these and similar efforts, it became increasingly recognised that a lack of co-ordination between different countries' environmental policies posed serious obstacles to the implementation of the integrated approach necessary for the protection of natural ecosystems. A growing number of co-operative efforts resulted from this awareness, and have been key factors in translating policy statements into action.

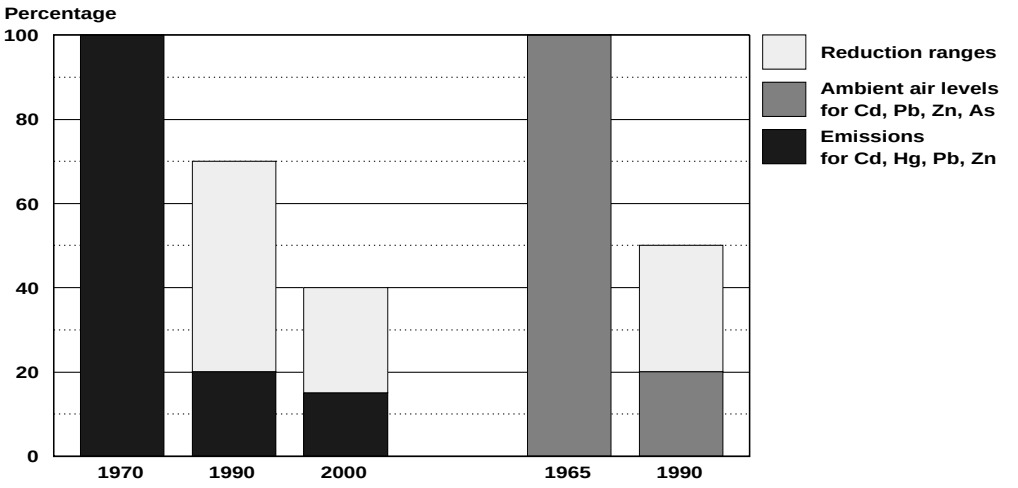
In particular, regional conventions on marine or lacustrine environments such as the North Sea, the Baltic Sea, the North Atlantic and the North American Great Lakes have contributed to harmonising different national permitting schemes. Table 1 summarises the regulatory approaches developed within the Baltic Sea (HELCOM) and the North Atlantic and North Sea (OSPARCOM) conventions. Figure 1 summarises the evolving relationship between environmental issues, policy principles and results in the case of the North American Great Lakes. The figure also illustrates the policy movement from a critical loads and pollution control outlook to the ecosystem/integrated pollution prevention and control approach typical for such sites in the early 1990s. Similar conventions were created to protect freshwater systems in Europe, such as the programmes of the International Commission for the Protection of the Rhine River, which led to a 60% to 80% improvement in concentrations of certain heavy metals over the last twenty years (Van Dunne, 1992).

Figure 1. **Major issues, policy responses and environmental results in the Great Lakes region**



One fundamental achievement of these conventions has been the recognition of the need to apply the precautionary principle to address the most harmful environmental impacts of human activities. The main feature of the precautionary principle is that it reverses the burden of proof which characterised the more traditional carrying capacity approach in environmental regulations. Confronted with the introduction of many new, untested and potentially hazardous compounds and the expansion of economic activities, many countries have adopted bans or minimisation policies based on that principle. This was the case with the multi-national phase-out of PCBs and ozone-depleting substances and recent efforts towards the virtual elimination of bio-accumulative and persistent toxic substances. Technology-based regulations and approaches are now seen as the most appropriate method of integrating the precautionary principle with standards-setting and permitting decisions.

Figure 2. **Air pollution reductions achieved and forecast in OECD countries**



Source: OECD, 1995.

These conventions have been paramount for addressing the failure of the “dilute and disperse” application of the carrying capacity approach. Discussions between contracting parties have led to concerted measures addressing the most serious problems and agreements on environmental monitoring and data handling, harmonised EQOs, technology-based guidelines and voluntary agreements. In turn, the implementation of ELVs and EQOs in national schemes have led to a substantial reduction of releases to the various environmental media over the last three decades. The achievements within the UN ECE Convention on Long-Range Transboundary Air Pollution (LRTAP) illustrate the effectiveness of BAT-based ELVs for substantially decreasing sulphur

dioxide and nitrogen oxide emissions from power plants in European countries. Under the Convention, these emissions were reduced by up to 60-80%. Further reduction requirements based on environmental quality, i.e. critical loads for sulphur and nitrogen deposition, are also proving the importance of EQOs for the implementation of more stringent reduction strategies in the long term.[6] Figure 2 illustrates the reduction of toxic trace or hazardous air pollutant levels achieved and expected as a result of BAT-based requirements, bans and process changes in OECD countries over the last 20 years.

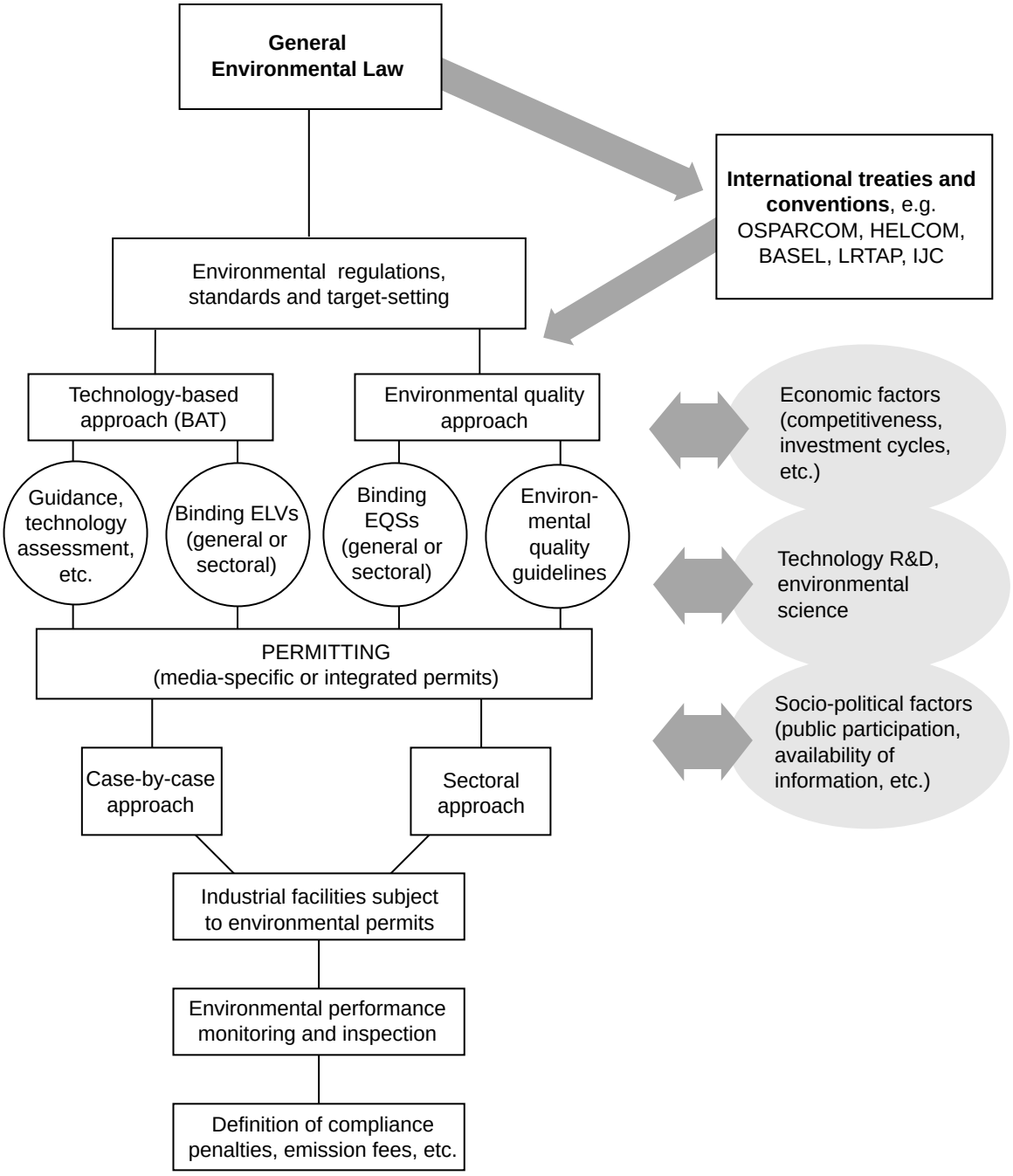
The adoption and implementation of new environmental policy principles and strategies are growing evidence of a definite trend towards more comprehensive and integrated policies in OECD countries. Table 2 provides an overview of the environmental principles and concepts as they have emerged: from pollution control in the 1970s to pollution prevention in the 1980s and eco-efficiency and sustainable development by the year 2000 and beyond.

Table 2. **Relationship between policy principles, regulatory approaches and technological response in OECD countries**

Environmental Policy Principles	Regulatory Approaches	Technological Responses
1970 - 1980s Pollution Control	• Environmental quality standards • End-of-pipe control requirements • Single media-specific approaches • Regulatory focus on releases and by-products	• Primary end-of-pipe treatment for emissions and effluents • Waste treatment and management • Improving process and product yield
1980 - 1990s Pollution Prevention	• Ecosystem approach: environmental quality standards and carrying capacity • Combinations of regulatory and economic instruments with focus on detoxification • Trends toward integrated approaches • Environmental impact assessment • Public information system	• Pollution prevention at source • Implementation of “3Rs” (reduce, reuse, recycle) • Secondary and tertiary end-of-pipe treatment and integrated technologies • Improving process and product yield while reducing impacts
Beyond 2000 Resource Productivity and Sustainable Development	• Life-cycle management • Full environmental cost accounting systems • Combining permitting with voluntary environmental agreements • Strategic long-term environmental goals • Regulatory approaches for products and services • Eco-efficiency and dematerialisation strategies	• Closed-loop technologies • Environmental management systems • Reduction of total material intensity • Eco-efficiency concepts for production • Benchmarking of activities • Provision of services rather than physical products

[6] Examples of long term emission abatement in OECD countries can be found in “Advanced Emission Controls for Power Plants”, OECD, Paris, 1993; and *Control of Hazardous Air Pollutants*, OECD, Paris, 1995.

Figure 3. **Regulatory framework of environmental permitting in OECD countries**



2.2 Regulatory framework for environmental permitting

The following sections provide a review of permitting procedures in OECD countries and illustrate how emerging policy principles are being implemented in permitting strategies. The analysis is based on the information contained in the various permit samples and related information on permitting strategies provided by participating countries. The environmental regulatory framework in OECD countries usually includes four main stages:

-- the establishment of a legal framework and standard-setting for emission sources and environmental quality;

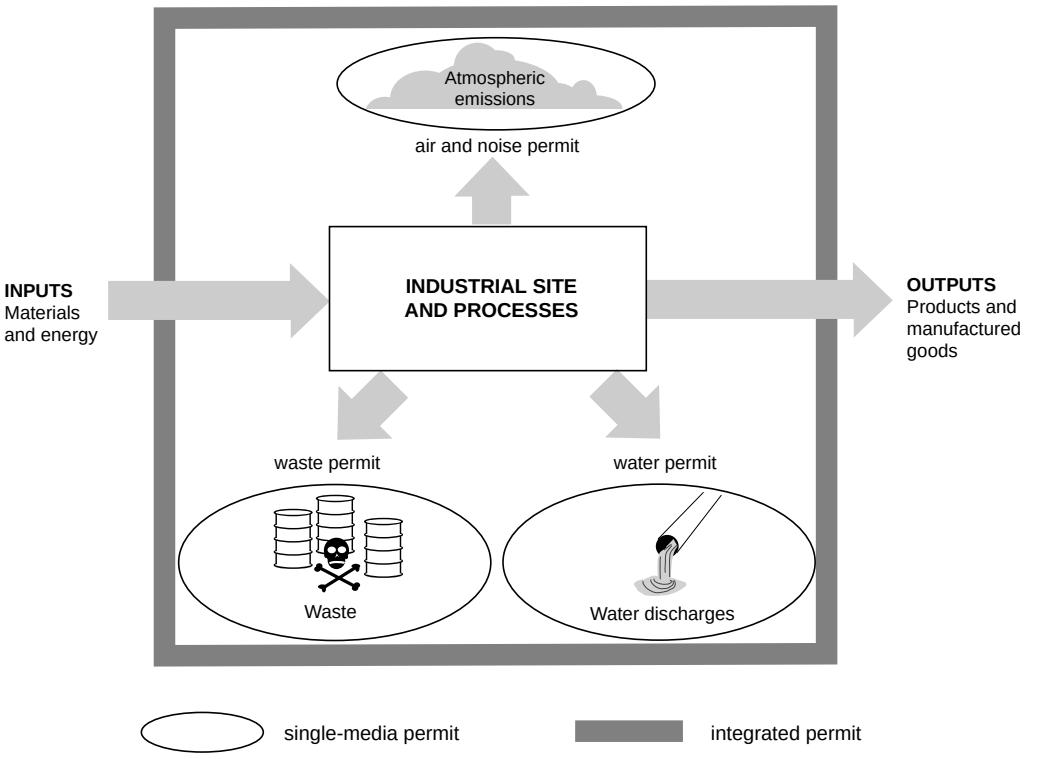
-- the issuing of permits for licensed industrial facilities;

-- the monitoring of compliance; and

-- the enforcement of permit conditions.

Figure 3 above provides a schematic overview of the role and status of environmental permitting within the overall environmental regulatory framework in OECD countries.

Figure 4. **Single-media and integrated permitting**



Typically, regulatory approaches for industrial permitting in OECD countries have been based on a sector or media-oriented approach where each component of the biosphere (i.e. air, water, and land, see Figure 4) is addressed by a separate law. Recently, many countries have been moving toward integrated permitting approaches in order to apply a more comprehensive and uniform approach to environmental releases.

Permitting schemes are established by general environmental protection laws. More detailed regulations specify the industries, processes, installations and chemical substances or types of nuisances to which permitting applies. Such regulations define the criteria for industrial facilities subject to permitting and further break down the target industries according to size, type of activities and toxicity of releases (see Table 3). Those installations falling below a certain threshold size (e.g. number of employees, size of production, amount and toxicity of discharges) are neither subject to permitting nor have to submit a declaration to some (government) local authority. Depending on the country's environmental framework, the type of facilities concerned and the environmental circumstances under consideration, permit programmes may be delegated to or jointly administered with regional and local authorities. In many, if not all countries, permit requirement conditions can be appealed.

Regulations usually include media-specific standards implemented through a permitting system that allows different timetables for compliance. The permitting system is therefore a legal, administrative procedure by which an authorisation is granted to a facility or individual to perform an activity under specific legal conditions deemed necessary to ensure the protection of environmental quality and public health (Table 4).

The permitting process analyses environmental and other risks, identifies key issues and, through the negotiation of permit conditions, allows plant operators and the permitting authority to settle on the best measures to address these issues. The permitting process is thus the primary interface between regulations and the actual environmental performance of industrial operations. Each step in the process -- i.e. application documents, consideration of ELVs and monitoring and reporting requirements, and government surveillance and enforcement programmes -- links different elements of facility operations to the policy objectives behind regulations. In this way, the permitting process brings together several different considerations into a single procedure. In contrast to a fragmentary system in which various requirements are developed in multiple, parallel, or sometimes overlapping programmes, this feature allows many issues to be addressed at a single stage of the regulatory process. The parameters of a given facility's permit requirements are generally of greater immediate interest to local stakeholders than are national or regional standards. Permitting is therefore also a direct link to the concerns of the public and an important means of getting local interests involved.

The application and requirement-setting stages are distinct parts of the permitting procedure. Each stage provides an opportunity for progress and presents potential obstacles to pollution prevention and control objectives. The next few sections outline the main aspects of these stages, each of which are key for encouraging the continuous improvement of pollution prevention and control at the plant level and improving environmental performance beyond the levels laid out in national regulations. This discussion is followed below by an assessment of the strengths and limitations of permitting programmes.

Table 3. **Criteria for facilities subject to permitting**

	Criteria for permitting[1] (plant size, type of activity, toxicity and amount of releases)	Number of facilities subject[2] to environmental permitting
Austria	• 60 industrial sectors for air emissions, and 14 sector categories for water releases.	National data not available [417 facilities under IPPC Directive]
Belgium	• type of activity related to potential risks • size of activity (classes III, II, I, where I is the highest class) • 52 source categories identified	National data not available
Canada	• quantities, concentrations, location of releases and their conditions. • environmental quality of local receiving media (air, water, land). • criteria established in permits issued by provinces.	Permits are applied to a large number of facilities throughout the country.
Denmark	• lists of polluting activities established. • 7 specific industry categories.	[270 facilities under IPPC Directive]
Finland	• type and size of activity (real estate/plants); • potential of environmental risks.	• 2 000 - 3 000 industrial facilities. [545 facilities under IPPC Directive]
France	• lists of 200 classified installations including most polluting activities. • thresholds established for size of facilities; impact statements.	• 68 000 Class I authorisations. [2608 facilities under IPPC Directive]
Germany	• plant size and type of activity; • amount of releases depending on potential risks; (> 200 air pollutants grouped into 5 toxicity classes); • 40 sector categories identified.	• 14 500 full BImSchG authorisations (air emissions, noise). [3881 facilities under IPPC Directive]
Italy	• large establishments (power plants, refineries) requiring a national authorisation. • production cycle, emissions quantities and quality.	[3068 facilities under IPPC Directive]
Japan	• type of activity, toxicity and amount of releases.	• 300 000 facilities (under water pollution control law) • 239 675 facilities (under air pollution control law)
Netherlands	• 28 categories of activities identified with negative environmental impacts.	• 3 000 facilities covered by the Environmental Management Act. [674 facilities under IPPC Directive]
New Zealand	• impact on the quality of the receiving environment, in particular, sensitive ecosystems.	No national data available
Norway	• potential for environmental impact of air, water and waste releases; • location, quality of receiving watercourses.	• 1 500 of which: 200 class 1 and 2 (with the highest potential environmental impacts).

Table 3., *continued*

Sweden	• type and size of activity (real estate/plants); • potential for environmental risks (impact statement); • list of hazardous activities requiring national or local permits.	• 7 700 of which 500 under national authority; 7 200 under regional authority. In addition, 17 000 facilities must declare their releases to municipal authorities. [211 facilities under IPPC Directive]
Switzerland	• potential of environmental impact (emission and environmental quality standards); • legally, all stationary sources of air and water pollutants subject to requirements under the Ordinance on Air and Water Pollution Control.	• 20 000 facilities (combustion installations not included)
United Kingdom	• environmental assessment of releases (air, water) • quality of receiving environment; ambient levels; sensitive receptors • integrated pollution control for most polluting industrial processes • local authorisations for air emissions	• 110 000 non-IPC wastewater permits. • 2 100 facilities covered by the Integrated Pollution Control (IPC) Act; [3023 facilities under IPPC Directive]
United States	• legally, all point sources discharging into water; • for air pollution sources, any major sources subject to: -- new source performance standards of Clean Air Act; -- standards for hazardous pollutants.	• 61 500 facilities and 11 600 pending authorisations (water); • 3 183 permits for hazardous waste facilities (of which 1 787 permits are for facilities still accepting waste); • 23 000 facilities requiring permits for air pollution.
European Union	• size and type of activity or installation; • nature and quality of releases and their environmental impacts; • 33 industrial sectors grouped into seven broad categories (energy production; metal, mineral and chemical industries, waste treatment facilities, and other activities such as pulp and paper, textile, food processing, etc.)	[about 15 000 facilities under IPPC Directive]

Notes: 1. Most countries reviewed use at least the following criteria: plant size, type of activity, amount and toxicity of releases. Additional country-specific criteria are shown here and include classified installations, environmental risks, and sensitive ecosystems. For more details on the regulatory approaches used, see the *Reference Guide* to *Regulatory Approaches to Environmental Permitting in OECD Countries (*1998).

2. In addition to national rules, member states of the European Union will be required to meet the obligations set out in the Integrated Pollution Prevention and Control (IPPC) Directive. The number of facilities subject to IPPC were estimated in a recent set of country studies (EC, 1997). The figures are shown here in brackets.

Table 4. **Legal status and determinants of permit conditions**

Legal status of permits	Considerations in setting permit conditions
• Describes the conditions under which industrial facilities are allowed to operate.	• Emission limit values and other conditions are based on technical and economic considerations;
• General considerations: -- environmental goals; -- rules of proper behaviour; -- explanations on state of the art.	• The choice of technology-based emission limits values is influenced by EQOs and pollution prevention objectives;
• Enforceable conditions: -- ELVs and timetable; -- safety measures; -- monitoring obligations; -- reporting.	• Choice of technology or technique is generally left to the operator to meet requirements;
• Requirements are described in unambiguous terms to ensure that they can be monitored and enforced.	• Decreases to one media may entail increases to others, requiring integrated media approaches.

2.2.1 The application procedure

The first determinant of the permitting process is the application procedure. The national framework of regulations, norms and licensing practices is the result of broad consultations and negotiations among the stakeholders and parties involved. Accordingly, the specific environmental issues that the licensing authority and the concerned operator will discuss derive from the basic regulatory framework. They may also relate to international agreements, legislation under development, regional plans, and other policy. Taking into account the prevailing laws and regulations, permitting authorities must define far-sighted environmental requirements that will lead to cleaner production and operations while at the same time ensuring that requirements are realistic and legally-enforceable conditions. Many of these steps interact and influence one another, but also place limitations on what each party may demand.

Once a plant has been identified as requiring an environmental permit, the application procedure is used to tailor environmental requirements to the specific circumstances of the installations. It is the duty of the operator to prepare the documents (i.e. gathering the data needed to assess the environmental impacts of projected operations). As shown in Box 1, to enable the permitting authority to identify the appropriate permit conditions, the application must provide a clear description of plant operations and materials used, as well as expected impacts on the environment and other information.

Box 1. **Elements of the application document for environmental permitting**

1. *Plant characteristics:*

   -- description of industrial processes used and recent modifications;
   -- listing of raw materials and chemicals, and their fate;
   -- nature and level of discharges per process unit;
   -- efficiency of emissions, effluents and waste treatment plants;
   -- results of risk analyses.

2. *Production capacity:*

   -- present situation and planned expansion of production;
   -- changes in type of production processes and products.

3. *Inquiries into measures to reduce and control environmental releases:*

   -- evaluation of BAT and measures needed;
   -- projected costs;
   -- provisions against failures and accidental releases;
   -- remaining environmental releases, wastes and by-products;
   -- potential impacts and cross-media effects.

Permitting authorities must then assess the results of the information provided by the operator to make sure that the application documents are sufficient for defining permit conditions. The preparation of these documents is the sole responsibility of the operator. No formal agreements on permit conditions can be made at this stage. The principal aim of the application procedure is therefore to exchange information to help both parties find the best mutually-acceptable means of improving environmental performance. This information exchange is particularly useful in assessing what emission levels can be achieved by optimal operations and maintenance. During this process, there ought to be a mutual respect for the different roles of permitter and permittee. This does not mean, however, that each party should remain ignorant of the concerns of the other. Permitting authorities, for instance, will be better able to set optimal timetables for complying with environmental requirements if they possess an understanding of the investment cycle of each industry. Similarly, the rules of secrecy and confidentiality are important to ensure a positive atmosphere for negotiations at the site. However, the application submitted to the permitting authority should be, and is in most cases, a public matter.

Moreover, the application procedure should aim at a negotiation process between permitting authorities and permittees that ensures compliance, but encourages operators to go beyond basic environmental requirements. In some cases, meetings between both parties after permit renewal can be an effective way to further discussion and identify potential difficulties or causes of non-compliance. There may be several reasons for an operator's difficulty in complying with permit conditions which, in turn, may call for a specific policy response. Although non-compliance is illegal and should be dealt with through fines, penalties, environmental charges or even imprisonment, non-compliance issues may be interpreted with more flexibility when the authority believes that the operator is showing good faith but fails to comply with permit conditions at the time. In many instances, plant-by-plant investigations (e.g. monitoring data and reviewing operations and management techniques in use) initiated by permitting authorities will help both parties to identify

the main reasons for non-compliance and the most appropriate means and requirements to solve the problems.

Although prescribing cleaner technologies is not a legal obligation under the permitting procedure, environmental objectives, such as cleaner technologies, reuse, recovery and recycling, eco-efficiency, etc., may nevertheless be indirectly pursued by processing comprehensive application documents. As such, tools like BAT, EMAS (Eco-Management and Audit Scheme), LCA, etc., help permitting authorities ensure that application documents provide the type of information needed to define stringent, far-sighted pollution limits and other permit requirements.

Therefore, the application procedure provides an opportunity for permitting authorities and industrial facilities to agree on the degree of environmental performance that should be reached by the operator. This interim period before the permit comes into force gives the enterprise additional time to adapt to upcoming requirements. The type of investigations required in the application document will make the operator aware of the environmental issues the permitting authority sees as most important. Discussions on new emission limit values and monitoring parameters will provide some indications on future permit requirements. In addition, these discussions enable agreement on the optimum timetable for complying with upcoming ELVs, thus providing additional flexibility for adjusting environmental investments within the financial cycle of the plants.

2.2.2 Pollution limits and permit requirements

The effectiveness of the licensing process is also highly dependent on the nature of the site and operating conditions (e.g. emission and effluent limits, wastewater treatment, solid waste disposal conditions, water intake) defined in the permit. Some permitting systems offer opportunities for site-specific tailoring of permit conditions, if national regulation of sector-specific emission limit values does not exist. Countries with decentralised permitting systems and numerous competing sources in the same industry often apply uniform emission and effluent standards contained in national legislation. Such standards typically impose binding requirements that may be made more stringent by permitting authorities as the case warrants. In countries with highly legalistic and adversarial systems where the permitting authorities have relatively little initiative, permit conditions (including those designed to promote pollution prevention) may be achieved at greater cost through the upstream standards-setting procedure. On the other hand, the absence of uniform requirements in other countries may raise the concern of uneven treatment and thus of unfair competition.

In addition to ELVs, a set of conditions to schedule and check the environmental performance of the site are included in the permit. Such conditions include compliance with deadlines, duration of the permit, the renewal procedure, monitoring and informational requirements. The conditions attached to a permit can be as important as performance requirements (emission limits) in influencing the technological response of the regulatees towards pollution prevention or pollution control. It is relatively common that the core requirements of the permit (based on national emission standards, for example) leave little discretion to permitting authorities while secondary matters like deadline conditions can sometimes be adjusted and can thus provide some room to manoeuvre. Very tight compliance deadlines may prevent some enterprises or facilities from identifying more innovative processes -- especially smaller enterprises with no in-house research capabilities and a more restricted access to technology -- and force them to opt for readily available end-of-pipe solutions. Conversely, excessively long compliance deadlines may waste some of the enterprise’s potential for technological change by giving it a right to pollute beyond what it can actually accomplish.

Ideally, permit conditions should create a momentum, encouraging the regulated entities to seek to reduce their emissions beyond the established limits, preferably through pollution prevention (e.g. via process redesign). The “right” permit limits, that is to say those which would stimulate optimal and environmentally-sound solutions are difficult to establish. An understanding of the local conditions and what industry is likely to withstand both technologically and financially, are crucial for reaching the optimum permit limits. Uncertainties about potential benefits will always pose a hazard to the cost-efficiency of selected measures. Finding the best ways to balance the relative certainty of existing technologies with technological dynamism and continuous environmental improvements is a major challenge.

Chapter 3:

FACTORS AND TRENDS IN PERMITTING APPROACHES

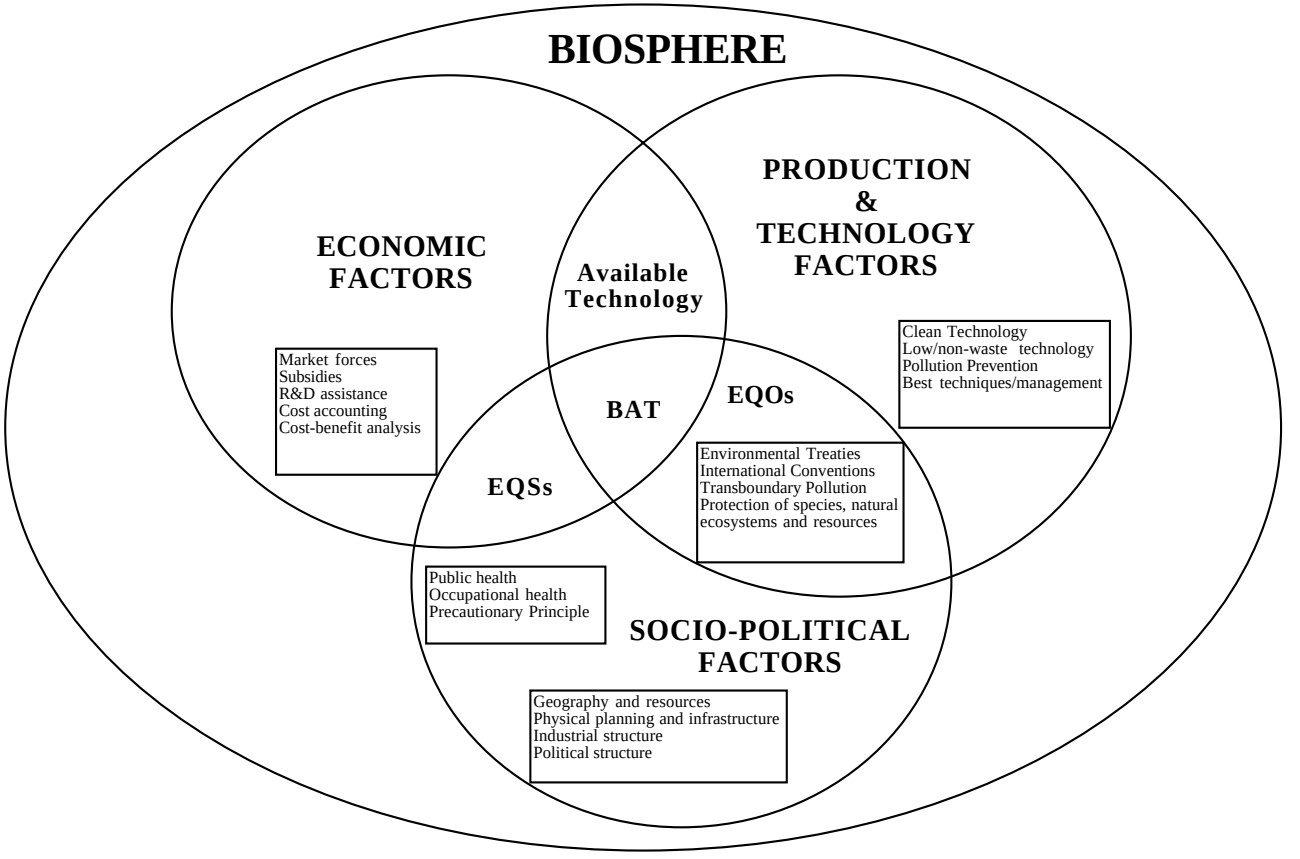
3.1 The debate over the use of BAT and EQOs

In the early 1970s, a regulatory shift occurred in many countries which substituted technology-based strategies and standards for the predominant use of the carrying capacity approach for regulating pollutant releases. This policy shift resulted partly from the disappointing results of the permissive application of the "dilute and disperse" principle and partly from the perceived absence of reliable and indisputable models for tracing the effects of pollutants in the different media.

The debate on the use of BAT and EQOs has often been thought of as a confrontation. Thus considered, these policy instruments seem to be mutually exclusive. An all-EQO approach was thought to be the ideal system for linking the actual quality of an environment (whether local, regional or global) with the sources emitting polluting substances, thus avoiding "unnecessary" costs. An all-BAT approach was viewed as being the most appropriate system, however, for controlling pollutant releases with obvious impacts and for implementing the precautionary principle. In fact, the issues are not as clear-cut. Many studies have shown "that technological dominance of regulatory programmes is achieved at a high social cost and with sometimes poorer environmental results than anticipated" (Luken, 1990). On the other hand, the acknowledgement of the assimilative capacity of the environment may provide dischargers with a "free ride" for using that margin and benefiting from lack of evidence at the expense of better practices and future ecological balance. When considered separately, each of these two approaches entail benefits and shortcomings, therefore providing additional incentives for their combined use.

Although the legislation may not make any explicit reference to BAT or EQOs, the review of regulatory frameworks in Member countries shows that these two approaches are complementary and not mutually exclusive. (see Tables 5 and 6). Indeed, permit requirements are most often the consequences of technological, economic and environmental considerations. In some countries, broader "best practicable option" principles are also laid out which encompass technological, receiving media, and economic considerations. In addition, other policy instruments, such as environmental impact assessments (EIAs) and life-cycle assessment (LCA), are increasingly used to assess the overall environmental impacts of the facilities and the effectiveness of requirements set in the permits. The complex relationships between these factors are illustrated by Figure 5.

Figure 5. **Interaction of technology, economics, environmental and social policy factors**



Examination of the issues and country practices leads to the conclusion that a permit cannot be optimally effective if it does not incorporate a good balance between the precautionary approach, through technology-based requirements, and tailored, site-specific parameters based on environmental quality. The combined use of BAT and EQO requires, therefore, the identification of the most appropriate circumstances for using each tool, considering their strengths and weaknesses for addressing different issues, and the clarification of when and how both concepts should be applied.

3.2 The use of BAT criteria

The BAT concept has evolved as one of the key elements for setting ELVs for industrial facilities. Table 5 provides an overview of BAT criteria and ELVs used in OECD countries. Generally, BAT requirements for a specific industrial facility derive from reviews of the techniques economically available world-wide with the best overall environmental performance (e.g. the best performing 10-15% of plants in a given sector). While there are some literal differences in the definitions of BAT, generally speaking, it is used according to similar principles. The definition developed in the European Council Directive concerning Integrated Pollution Prevention and Control (96/61/EC) provides a good example of how BAT is understood in OECD Member countries.

> *"The term 'best available techniques' shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emission and the impact on the environment as a whole:*
>
> -- *'techniques' shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned;*
>
> -- *'available' techniques shall mean 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 reasonable to the operator;*
>
> -- *'best' shall mean most effective in achieving a high general level of protection of the environment as a whole."*

Thus, the definition goes beyond the assessment of the technology to encompass:

- the analysis of the relationship between input materials and energy used and pollutant outputs (substituting more benign materials for toxic compounds);
- plant management and design;
- operating practices;
- preventive maintenance; and

-- monitoring requirements.

End-of-pipe measures are also integrated to ensure that environmental residues are controlled. In specific circumstances (e.g. hazardous waste), binding BAT rules may lead to the use of specific techniques, although countries tend to favour ELVs which leave the choice of specific technical options to facility operators.

Industry's views regarding BAT-based emission standards or other control requirements vary widely among sectors and depend on their specific conditions. Some sectors may completely reject it as a concept for establishing binding rules, but may well accept its utility in defining guidelines; others fully endorse the concept and its use for setting uniform and legally binding emission standards for the entire sector. In other words, the technical substance of BAT is considered helpful, while the formal legal obligations related to it are often less desired. Therefore, industry's eagerness to participate in the drafting of BAT-related information, and its concomitant reluctance to accept legally binding emission standards may be an indication that the problem with technology-based standards is not with the substance or stringency of the requirements themselves, but the way in which these requirements are applied to each specific situation (e.g. deadlines for compliance, constraints for specific processes/operations, etc.). Technological innovation and, in the long run, environmental performance may be either encouraged or retarded by flexibility on these points.

However, the conditions of an up-to-date permit should reflect an optimum solution based on given BAT-type levels, taking into account global as well as local impacts. This implies the setting of targeted environmental objectives. Since technology and environmental knowledge develop relatively fast, BAT changes with time and thus will never refer to a single technology and/or set of standards. There will always be plants in each sector or branch with better environmental performance than others, thus providing new BAT-based emission levels. By the same token, differences in facilities' environmental performance in the same industrial sector require that environmental authorities design permit conditions to encourage the continuous improvement of industrial operations.

Emerging trends in the use of BAT seek to ensure that it keeps pace with new developments in technology and environmental science. These include the integration of global environmental impacts for determining requirements at plant level; the increasing use of life-cycle assessment (LCA) to integrate all environmental aspects of the industry's life-cycle; and the development of "integrated" BAT notes (e.g. the "BREFs" produced as part of the EU IPPC Directive).

In addition, although a growing number of policy experts and officials support the implementation of technology-based approaches for the regulation of industrial pollution, more information on the environmental results achieved through such measures is needed to provide additional and more effective guidance. In this regard, the assurance that local considerations are well integrated into permit requirements remains an issue. For example, an excessive reliance upon release monitoring for compliance purposes may be insufficient to guarantee that local considerations are fully assessed and is sometimes seen as a short-term remedy for gaps in knowledge about the state of the environment.

Likewise, the development of harmonised international indicators for measuring and comparing the environmental performance of facilities within and across industrial sectors is a key issue which has been raised in workshop discussions. This is also necessary to ensure that environmental regulations do not result in conditions of unfair competition between enterprises domestically and internationally.

Table 5. BAT Criteria and ELVs in OECD Countries

COUNTRY	BAT Criteria	Type of Sources/Sectors and sectoral ELVs	General ELVs
AUSTRIA	– BAT = "state-of-the-art technology" – BAT requirements in several laws (Trade and Industry Act; Water Act; Steam Boiler Emission Act; Waste Management Act)	– 60 industrial branches planned in accordance with the Water Act – 14 industrial branches covered by ordinances to Water Act – Air emissions regulated, e.g. boilers, dry cleaning plants, plants handling chlorinated hydrocarbons, cement industry, glassworks, gypsum industry, foundries, others	
BELGIUM A) FLANDERS B) WALLONIA	– Required by law (VLAREM II) – BAT = "the most advanced state of development of processes" – Taken from EC Directive 84/360 (Air) and 76/464 (Water)	– Classification list in VLAREM I – General requirements apply to all classified industrial processes – Sectoral requirements based on BAT – Site-specific requirements where needed – General and sectoral requirements	 – ELVs were finally taken from EC legislation
CANADA	– No uniform definition of BAT at federal or provincial level – "Environmental codes of practice specifying procedures/practices or release limits" (CEPA)	– Standards set for, e.g.: • thermal power generation • pulp and paper • chlor-alkali mercury releases • secondary lead smelters	– Mostly in licences
DENMARK	– BAT = the least polluting technology – State-of-the art activities, processes and operational methods	– Industrial substances (e.g. motor vehicle repair shops, anti-fuelling treatment vessels) – Guidelines issued for: • shipyards • plants for foodstuff production • electroplating and hot galvanising	
FINLAND	– State-of-the art activities, processes and operational methods – Similar to HELCOM and EU IPPC criteria	– SO_2 emissions from coal-fired power and boiler plants – Case-by-case at the permitting stage	– National standard for SO_2 – Some guidelines on air emission limit values and targets
FRANCE	– Rules and prescriptions for prevention of accidents, pollution, conditions for establishing an installation	– 68 000 Class I installations subject to an authorisation	– Case-by-case assessment

continued on next page

Table 5. *Continued*

COUNTRY	BAT Criteria	Types of sources/sectors and sectoral ELVs	General ELVs
GERMANY	– State-of-the-art "Stand der Technik" = state of development of advanced processes, facilities, modes of operation for restricting emission levels	– Sector specific emission limits	– 200 air pollutants listed in TA Luft limit values
ITALY	– Technological system for controlling and reducing emissions	– Large companies, power plants, refineries	– Limit values on 289 pollutants such as SO_x, NO_x, suspended particulates, CO, carcinogenic substances, inorganic and organic substances
JAPAN	– No definition – Technological assessment	– Case-by-case evaluation	– Case-by-case evaluation
KOREA	– No explicit definition – Technological assessment: "pollution preventive facilities"		
NETHER-LANDS	– Based on the ALARA principle (As Low As Reasonably Achieved) – "State-of-the-art" = measures to limit emissions, process-integrated or as add-on-technology – Dutch Emission Guidelines – Best Practicable Means (BPM) for non-blacklisted substances – Best Technical Means (BTM) for black-listed substances	– 28 sector categories identified – National emission guidelines applied case-by-case – Minimum releases for black-listed substances	– Binding emission limit values
NEW ZEALAND	– Best Practicable Option to prevent or minimise any actual or likely adverse effect on the environment of the discharge – BPO as a synthesis of environmental, economic and technical constraints		– Decisions taken on a case-by-case basis
NORWAY	– Latest stage of development of process, facilities or of methods of operation	– Some minimum discharge standards in some industrial branches	– Case-by-case evaluations
SWEDEN	– What is technically feasible to prevent disturbances to the environment	– Case-by-case assessment	– Case-by-case assessment
SWITZERLAND	– State-of-the-art, i.e. the state of development of advanced processes, facilities and operating modes	– 50 sector categories addressed in the ordinance on Air Pollution Control	– 180 air pollutants addressed – 52 water quality standards for effluent parameters agreed within IPCR and OSPARCOM

continued on next page

Table 5. *Continued*

COUNTRY	BAT Criteria	Types of sources/sectors and sectoral ELVs	General ELVs
UNITED KINGDOM	– Under Integrated Pollution Control (IPC) regime = use of BATNEEC to prevent release of substances or render harmless released substances – Local Authority Air Pollution Control (LAAPC) regime = BATNEEC		– Set in IPC Process Guidance Notes, no statutory force – Set in LAAPC Process Guidance Notes, statutory force
UNITED STATES	– Different BAT requirements according to CAA, CWA and RCRA and criteria: the type of application (new or existing sources), the industrial category, the area in which the operation takes place (attainment area [AA] or non-attainment area [NAA]) or the pollutant under review – In cases where a BAT standard is not developed, the permit writers must use their best professional judgement (BPJ) in setting requirements; this applied in particular to "non-conventional" pollutants – For water, new facilities must meet BDT on effluent limitations (New Source Performance Standards - NSPS) or pre-treatment (Pre-treatment Standards for New Sources - PSNS) in all areas	– Technology-based standards are administered by pollutant types and by industrial category for existing sources (including Pre-treatment Standards for Existing Sources - PSES)	– For criteria pollutants, "Best Demonstrated Technology" (BDT) is required for a major new source regardless of attainment status – For existing facilities, "Best Available Control Technology" (BACT) is required in attainment areas, but more stringent limits or "Lowest Achievable Emission Rate" (LAER) in non-attainment areas are applied – For the control of hazardous air pollutants (HAPs), "Maximum Achievable Control Technology (MACT) is required in all cases – For water, discharges must meet applicable State ambient water quality criteria to protect human health and aquatic life as required – For the environmental control of waste, BAT is required in all areas
EUROPEAN UNION	– IPPC Directive – Integrated BAT notes cover total environmental disturbances (i.e. air, water, land, noise)	– The Directive covers 33 industrial sectors in seven categories, including energy production, metal production, minerals, chemical waste management, and other activities such as pulp and paper	– National emission limits to be established on the basis of BAT and taking existing EU Directives into account – ELVs to be considered for polluting substances including: • 13 air pollutants and their compounds (SOx, NOx, CO, VOC, metals, dust, asbestos, chlorine fluorine, arsenic, cyanides, carcinogens, PCDD/PCDF) • 12 water pollutants and their compounds (organohalogens, organophosphates, organotin compounds, persistent HC compounds, cyanides, metals, arsenic, suspended materials, nitrates, phosphates, BOD/COD related substances)

There is a common understanding that BAT represents a cost efficient choice. This means that it is technically efficient and that inputs are efficiently allocated with regard to environmental impacts.

3.3 The use of EQO criteria

Defining environmental quality objectives (EQOs) or the limits of the carrying capacity of the environment as the starting point for developing policies and measures is a sound approach to protect ecosystems and human health. However, setting EQOs and EQSs is extremely science-intensive, since they require knowledge about the paths of pollutants across media and ecosystems and about their ecological impacts as well as their behaviour in the food chain. This information is often not available, except for some critical levels and loads of a few pollutants, and are often limited due to the complexity of the ecosystem concerned. In addition, dealing with a variety of pollutants which might produce different effects at several scales (local, regional, global) implies that the relationship between local environmental conditions and release requirements may not be straightforward. Therefore, the precautionary principle has been introduced to implement BAT and to ensure that the polluters assume their responsibility to adequately protect the environment.

The traditional interpretation of the carrying capacity concept has many shortcomings that must be overcome in order to ensure environmental quality and protection. Environmental issues such as food chain contamination, cross-media transfer of pollutants, or reproduction failures in species are just a few illustrations of the complexity and interrelation of different ecosystems, a condition which makes it difficult to identify clear cause and effect relationships between pollutant concentrations, impacts and specific activities. In an effort to circumvent some of these difficulties, countries are increasingly moving toward the use of ecosystem-based objectives in order to fully assess the impact of human activities on the living environments. EQSs and targets have also been strengthened through internationally agreed reduction targets (e.g. the critical levels/loads concept), or even bans on the use of persistent or bioaccumulative toxic substances. An overview of the use of EQOs and EQSs in OECD countries is provided in Table 6.

The inherent limitations of science to determine limits for the assimilative capacity of the environment mean that socio-political and economic considerations inevitably influence environmental strategies. However, scientific uncertainty associated with environmental issues does not mean that science has to be subordinated to political and/or economic considerations. Usually, each situation calls for a specific set of investigations, approaches and requirements. The challenge is to implement a policy process that will not compromise the complexity and difficulty of a decision-making process, which includes different fields of force (e.g. environmental science, economics, socio-political factors, etc.) for the sake of simplicity. Indeed, EQOs as a driving force depend on many assumptions, e.g. the range, the degree of pollution, and the status of a given area. The precautionary principle may or may not be taken into account. Criteria like human health, carrying capacity (critical levels and load concepts), preservation of fish stock, biodiversity or landscape may vary from case to case. The basis for defining objectives may be more or less scientifically-based, and the time range may vary.

Table 6: **Environmental quality objectives (EQOs) and standards (EQSs) in OECD countries**

COUNTRY	EQO Criteria	EQS Level
AUSTRIA	– Threshold values for pollutants	– Mostly target values – Standards defined for air pollutants SO_2, CO, NO_x, and particles – Legally binding EQOs for woodland areas (SO_2, NO_2, HCl, HF, NH_3 and particles)
BELGIUM A) Flanders B) Wallonia	 – Maximum allowed quantities of pollution factors in air, water and soil – Natural or other substances that must be present in environment to protect ecosystems and promote biological diversity – EC Directives	 – EU Directives and German "TA-Luft" regulations – Limit values, guide values, target values – EC Directives
CANADA	– Quantitative and qualitative terms to support and maintain particular uses of the environment (CEPA)	– EQS for, e.g. water, sediment, soil, biota tissue, drinking water – EQS according to media, resource use and ecosystem
DENMARK	– Pollutants present in the environment outside a plant	– Guidelines – EQOs set for individual plants
FINLAND	– EQOs – Health criteria – Water classification scheme	– Decided at licensing stage – EQSs for air quality
FRANCE	– EQOs dependent on actual quality of the media	– Broad objective of bringing all national water systems up to 1-A level – Binding air EQOs – Regions can adopt more stringent levels
GERMANY	– Effects on the environment which affect humans, animals, plants, soil, water, atmosphere, cultural assets and other material goods	– Immission values
ITALY		– Defined at national level but may be rendered more stringently locally
JAPAN	– Protection of human health – Conservation of the living environment	*Water* – Uniform national standards for 23 toxic substances applicable to all public waters and groundwater – Rivers, lakes reservoirs and coastal waters are classified on the basis of water usage and EQSs values for prevention of eutrophication are established for each category of water usage *Air* – Uniform national standards for SO_2, NO_2, CO, O_x, SPM, benzene, trichlorethylene and tetrachlorethylene *Soil* – For prevention of groundwater pollution, there are standards for 24 toxic substances applicable to all soil. For agricultural land soil there are 3 additional standards for toxic substances.

continued on next page

Table 6: ***continued***

COUNTRY	EQO Criteria	EQS Level
KOREA	– Protection of health of citizens and creation of comfortable environment	– Uniform in Korea – More stringent in some areas
NETHERLANDS	– Available scientific/technical data – Available information on state of environment – Expected developments – Options for restricting risk	– EQOs set below Maximum Permissible Concentration (PC) but no lower than Negligible Concentration (NC) – Air Quality Standards for SO_2, black smoke, NO_2, CO, lead, benzene – Guide values for 24 substances (e.g. VOCs, PM_{10}, ozone, asbestos) – Air quality objectives for NO_2, SO_2, benzene
NEW ZEALAND	– Use, development and protection of natural and physical resources	– Water quality guidelines for water colour, clarity, undesirable biological growth – Air quality guidelines – Soil quality guidelines
NORWAY	– Improving the quality of receiving environment in accordance with national policy Scientifically-based EQOs versus politically-based EQOs	– Air quality guideline values based on effects on health and the environment (dose-response relationship) – Classification system for water quality (degree of pollution versus suitability for various uses)
SWEDEN	– Ensure the survival of healthy, balanced populations of naturally occurring species	– National air quality standards for SO_2, NO_2, CO, TSP, PM_{10}& black smoke. – Local limits on noise, vibration, light
SWITZERLAND	– Immission limit values applicable to the evaluation of noxious or inconvenient releases	– Ambient air, soil and water quality standards Levels that do not threaten human, animal and plant life, impede the well-being of the population, damage buildings or affect soil fertility or water quality
UNITED KINGDOM	Maintaining and improving the quality of receiving environment	– Classification of controlled waters, statutory quality objectives replacing administrative strategies National air quality standards developed = air quality standards which represent no or minimal risk of health effects to the public = benzene, 1,3 butadiene, CO, Pb, NO_2, O_3, PM, SO_2
UNITED STATES	*Air* – Protecting public health and the environment from pollutants *Water* – protecting the designated use of water bodies *Waste* – protect public health and environment from release of hazardous constituents in waste	*Air* – National Ambient Air Quality Standards (NAAQS) for CO, Pb, NO_2, O_3, PM_{10}, SO_x – National Emission Standards for HAPs (NESHAP = 189 different compounds) *Water* – Water quality standards + development of specific national recommended criteria for protection of aquatic life and human health from toxics.
EUROPEAN UNION	– Integrated approach to achieve a high general level of protetion of the environment as a whole. – Indicative list of environmental impacts to be considered.	– EU Directives, in particular air and water quality standards

Above all, EQOs focus on those environmental impacts critical for a given area and encourage public participation in the process. They provide a tool of special importance for bilateral and multilateral conventions of transboundary water bodies and international lakes and sea areas. They also serve as a driving force to make monitoring and research more effective, to improve environmental impacts and risk assessments, and to target knowledge of critical loads. For all of these reasons, the concerted adoption of environmental targets through international conventions such as, for example, the UNECE Convention on Long-Range Transboundary Air Pollution (LRTAP) or the Helsinki Commission for the Protection of the Baltic Sea (HELCOM) has a major influence on the design of technology-based approaches to environmental management.

3.4 The combined use of BAT and EQOs

There is clear evidence that the relationship between BAT and EQOs has evolved significantly over the past years. Recognising the complexity of defining the optimal balance between economic and ecological needs, a political consensus has emerged regarding the combined use of technology-based and ecology-based instruments in setting far-sighted environmental standards and permit requirements. In this perspective, it is increasingly recognised that an optimal definition of performance levels must be based on the combined assessment of ambient environmental goals and the current state of technology for reducing harmful releases. Concerning the interaction between technology-based and environmentally-based considerations for setting efficient permitting requirements, the examination of issues and the sharing of different countries' approaches and experiences have led to the following conclusions:

- BAT should always be used, regardless of the actual environmental situation, either as a general principle, a requirement or an approach to ensure equal treatment of cases;

- Requirements based on environmental quality must be used as references for the application of release targets, so as to allocate efforts and resources most effectively;

- Requirements should be made more stringent according to the harmfulness of the controlled substances;

- Guidelines for setting BAT-based ELVs and general EQOs and a general framework should be available at the national level, including the methodologies used for defining the requirements (e.g. determination of risk, risk limits, stack height, diffusion models, mixing zones);

- Where EQSs are exceeded in spite of BAT requirements, further reduction of polluting releases must be achieved over and beyond BAT so that a particular source or a group of sources operating in that particular area will not contribute to a breach of the environmental quality. If necessary, these requirements may lead to forced closure for some existing sources or denied authorisation for new sources, process expansion or modification;

- Plans for future (economic) expansion of facilities should be ecologically-sound. The question of whether or not to grant an EQS which leaves room for expected growth should be addressed in advance. While setting total emission levels within a bubble concept approach, a margin of safety can be included and standards can be reviewed regularly;

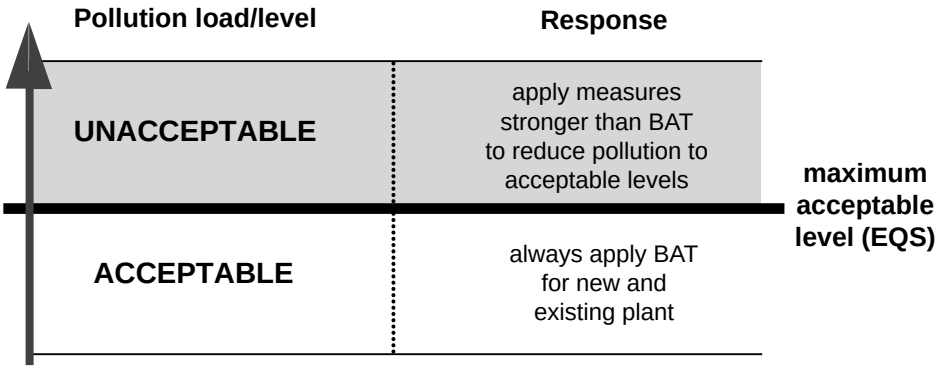
-- BAT is increasingly understood as a dynamic concept encompassing a wider range of considerations, from cross-media environmental impacts to technological innovation and diffusion;

-- Both technology-based and environmentally-based instruments should be used within the framework of a comprehensive plan set at the national level. They should clearly articulate policy objectives and translate them into sectoral targets that provide a predictable framework for industry and information for permit writers and the public;

-- The public needs to be closely involved in the decision-making process at the earliest stage and fully informed of the negotiated requirements.

Some of these conclusions are illustrated in Figure 6, which provides a simplified look at the principles used in the combined use of EQS and BAT and the sequence in which they are generally applied. Finally, economic considerations need to be carefully and gradually incorporated in the setting of environmental and technology-based standards. If the notion of economic feasibility is incorporated into the setting of both EQSs and BAT-based ELVs, obviously the level of control required will be according to BAT, and will sooner or later meet EQOs. A potential alternative for permitted facilities could be to combine long-term targets, conditions of permit duration and renewal into a constant review process where environmental performance required at plant levels would be in accordance with long-term perspectives. Voluntary agreements (VAs) with industry may offer such a combined approach.

Figure 6. **Sequence of the combined use of EQS and BAT**



3.5 The incorporation of economic considerations

Economic considerations are a determinant of permitting decisions. There are differences, however, in the way in which economic considerations are factored into the decision-making process, the level at which they are taken into account and how these costs -- which vary considerably between countries -- are calculated. As a general principle, economic considerations should not lead to the relaxation of environmental requirements, but they are often used to weigh several factors against each other, for example, technical feasibility or social and political acceptability. Practice shows that in some countries, permitting authorities do relax requirements from the norm, when specific environmental conditions do not seem to require it (e.g. high dispersion factors for polluting releases). The risk of such an approach, however, is that the environment is not being protected effectively and that its quality will deteriorate as a result.

BAT-based standards and permit ELVs often become obsolete within three to five years due to technological developments. Today's permitting system may also act as a barrier to integrated life-cycle approaches. On the other hand, the process of updating sectoral standards and introducing new ones normally involves stakeholders and decision-makers at a high political level and experience shows that this has resulted in generating momentum for innovation. Mere discussions on environmental taxes seem to have the same effect.

Usually, economic factors will be incorporated according to the type and severity of environmental problems being addressed. A grading system which takes into account attributes of pollution such as persistence and balances them with other attributes such as quantities released, toxicity, etc. is being established. In addition, when negotiating timetables for compliance with EQSs or permit conditions, permitting authorities will take into account differences between new and existing installations, and the environmental significance of pollutant releases of different installations or sectors. Furthermore, in accordance with the Polluter-Pays-Principle, efforts are being made in a number of countries to strive for better internalisation of environmental costs, and to achieve a balance between enterprise costs and social costs (see Figure 7).

However, decisions on how to integrate economic considerations into individual permits are often based on short-term cost-benefit analyses of permit requirements and associated measures. Some studies have revealed that there may be a very large, unexploited potential for realising cost savings through environmental protection measures at enterprise level (German Federal Environmental Agency, 1996). Indeed, it appears that environmental protection measures are often not carried out by enterprises because of the inadequacy of current cost accounting systems and methods to identify and directly relate costs of the various environmental protection measures to the production costs of the products. In addition, two principal barriers were identified that inhibit the introduction of cost-saving environmental measures: 1) current enterprise practices with cost-benefit analysis of measures, and 2) the lack of appropriate "know-how" to identify a number of promising measures at various stages of the production process. Another example is provided by the US EPA in its Pollution Prevention Programme (EP3). It concluded that providing plant managers with pollution prevention recommendations was not sufficient, despite the potential for reducing costs to produce their products (Yakowitz, 1995). Among the factors that were identified for explaining this behaviour was the fear that cleaner technologies:

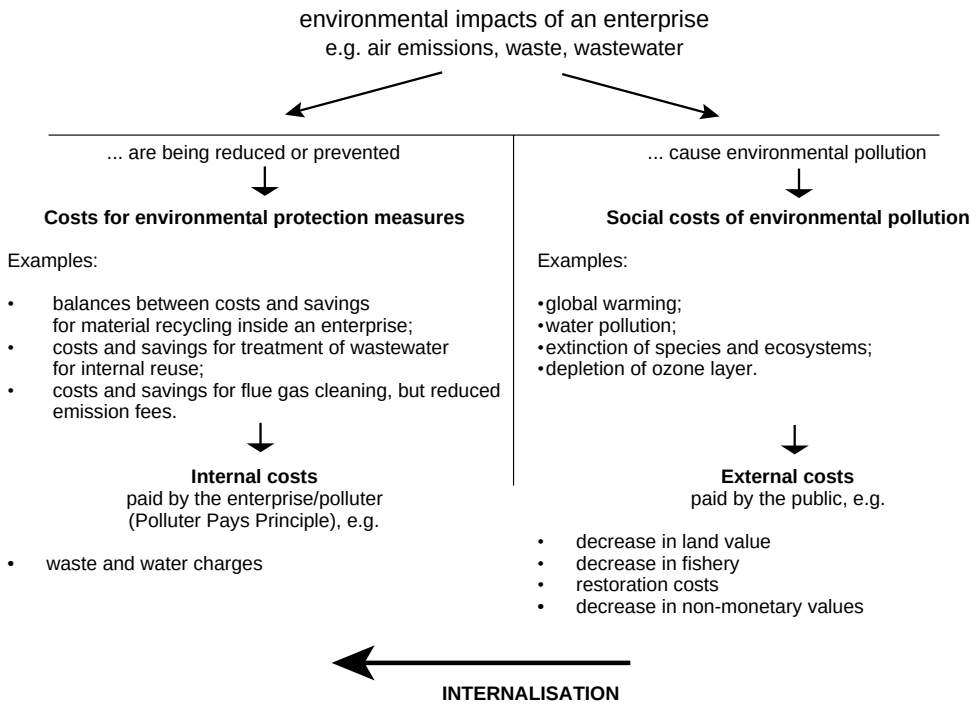
-- may impair product quality;

-- take too much time to implement; and

-- are thought to be more costly than end-of-pipe devices.

Thus, environmentally-oriented cost accounting systems are of strategic importance to dispel those beliefs and to overcome the economic and expertise-related barriers to their introduction. A major conclusion of the German study is the need to modify current cost accounting systems in order to provide public authorities and industry with reliable economic indicators on environmental costs related to the different stages of the production process. The development of these environmentally-oriented cost indices will increase awareness and attention to efficient use of materials and energy. Environmentally-oriented cost accounting systems can be an important pillar of an effective environmental management system as defined by EMAS or ISO 14000, and they are an important step towards sustainable development.

Figure 7. **Environmental protection through internalisation of externalities**



Source: H. Mierheim, 1998.

3.6 Integrated approaches to permitting: emerging trends

In 1991, the OECD Council adopted a Recommendation (C(90)164) encouraging OECD governments to implement *"integrated pollution prevention and control"* (IPPC) approaches, taking into account "the effects of activities and substances on the environment as a whole." A priority area of concern was to promote "multi-media" regulation of polluting sources so that all environmental pollution and waste requirements for a particular source are assessed at the same time and the best overall environmental option is selected. In the wake of this recommendation, the Council of the European Union adopted the 1996 Integrated Pollution Prevention and Control Directive, which made IPPC a general policy objective for EU Member states (see Box 2).

Available information suggests that integrated permitting programmes are effective and cost-efficient means to reduce pollution. Such programmes can reduce administrative costs by replacing specialised single-media inspection personnel with smaller groups of personnel trained in several different media. Involving the same personnel in different media issues has also helped to identify opportunities for efficiency. IPPC can also be promoted through the incorporation of environmental auditing requirements in permit application procedures. In many OECD countries, environmental audits have gained acceptance as tools for assessing the ensemble of environmental protection issues related to a given activity. Such audits are also well-suited for determining the environmental impacts of each technical option under consideration and for ranking them according to attractiveness from an environmental standpoint. Where it has been implemented, integrated permitting is generally considered more effective than media-specific approaches in linking long-term environmental strategies and promoting sustainable development.

However, analysis of current integrated permitting systems appears to show that few systems are truly integrated. Most countries are still in transition towards integrated multi-media permitting. While the philosophy of IPPC is more or less generally accepted, establishing efficient transitional administrative mechanisms to bring legislative, regulatory and permitting processes closer together may pose difficulties. Shifting from a segregated (i.e. environmental media-specific) system to a fully integrated system may be overambitious in the short term. To begin the transition, environmental decision-making may initially strive for integration along certain lines: sectoral integration of sources (e.g. grouping entire industry sectors) or cluster approaches for groups of pollutants, substances or geographic areas. Ecosystem-based standards may become increasingly relevant as instruments for integrating pollution prevention and control measures.

Another difficulty involves the development of substantial criteria for integrated environmental protection at the site-specific level. The weight of different factors is perhaps more explicit in integrated permitting systems, where there are clear trade-offs in emissions to different media (e.g. air pollution abatement by scrubbers versus disposal of the scrubber residue). There are also trade-offs between input and output (e.g. between energy efficiency and emissions reduction or recycling).

In Sweden, where integrated pollution prevention and control has been practised through multi-media permitting for almost thirty years, the limitations of conventional permitting have made themselves felt. Although Swedish regulations mandate that environmental impact assessments must be conducted by enterprises as part of their application for authorisations from the National Licensing Board for the Protection of the Environment, planning remains limited as permitting authorities do not have jurisdiction over all the components of environmental policy. For instance, automobile traffic, a very significant source of air emissions, can offset the effects of individual improvements in the permitted sectors.

Box 2. **The European Union's Integrated Pollution Prevention & Control (IPPC) Directive**

On 24 September 1996, the Council of the European Union adopted the Directive 96/61/EC concerning integrated pollution prevention and control (IPPC). The Directive entered into force on 30 October 1996 and requires Member states to adopt the laws, regulations and administrative provisions necessary for compliance by 30 October 1999, with a transition period for some of the provisions of the Directive until 30 October 2007 for existing installations. With this Directive, a new centrepiece of EC pollution control legislation is finally in place. The Directive covers pollution to air, water and land emanating from large installations (defined by thresholds) of 33 industrial sectors. Article 3 lists the general principles governing the basic obligations of operators. Competent authorities must ensure that installations are operated so that

- all preventive measures are taken against pollution, in particular through application of BAT;
- no significant pollution is caused;
- waste production is avoided or, when produced, recovered or eventually disposed of;
- energy is used efficiently;
- measures are taken to prevent accidents and to limit their consequences; and
- measures are taken upon cessation of activities to ensure the return of the site of operation to a satisfactory state.

To illustrate further the scope of the Directive, pollution is defined as "the direct or indirect introduction as a result of human activity, of substances, vibrations, heat or noise into the air, water or land which may be harmful to human health or the quality of the environment, result in damage to material property, or impair or interfere with amenities and other legitimate uses of the environment". "Best available techniques" (BAT) play a key role under this Directive. BAT forms the basis for the operating conditions included in permits. A body for the exchange of information and the development of BAT between Member states and industries concerned, the "Information Exchange Forum (IEF)", is to be established by the Commission. Expert groups will develop BAT reference documents (BREFs) for the industrial activities covered by the Directive. If a need for further action is identified on the basis of this information, the Council can set Community-wide binding ELVs.

Under the IPPC Directive, the operator must give comprehensive information on all aspects of the installation and its environmental effects when applying for a permit. Where more than one competent authority is involved in the permitting procedure, they must co-ordinate to guarantee an effective integrated approach. The permit application as well as a copy of the permit and the results of monitoring must be made available to the public. Furthermore, an inventory of the principal emissions and their sources shall be published every three years by the Commission, on the basis of information supplied by the Member states. Permits will be subject to periodic reconsideration and updating. This introduces a dynamic element and ensures that, e.g. the need for more stringent emission limit values or substantial changes in the best available techniques can be taken into account. All in all, the IPPC Directive is designed to ensure:

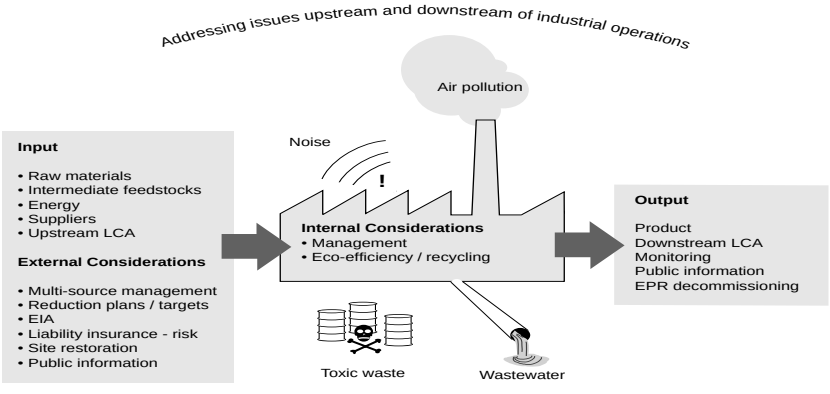
- a high level of protection of the environment as a whole, including aspects of efficient energy use, waste minimisation or recovery and accident prevention;
- transparency through public access to information;
- an integrated approach throughout the permitting procedure; and
- the obligation to adapt to changes in technology and to new findings.

Indeed, a main problem of conventional permitting approaches arises from the fact that permitting authorities have to work on the basis of applications or renewals of licenses that are about to lapse. The underlying issue is the nature of the mechanisms that trigger permitting in the first place. At the moment, permitting schemes are reactive. They need to be more pre-emptive and forward-looking. A more comprehensive permitting scheme would undoubtedly require policy inputs within the purview of planning authorities so as to extend the scope of permitting strategies beyond their immediate, legal concerns (see Figure 8).

Extending integrated permitting means including considerations of the input side (energy, material, resource use) as well as striving for consistency with other, broader considerations (e.g. multi-source management, global reduction targets, EIA, international requirements). Also, the output side (e.g. fate of products, extended producer/product responsibility, decommissioning) needs to be more consistently included in permitting conditions.

It is increasingly recognised that the promotion of sustainable development patterns requires a more integrated approach to industrial production. Effective environmental strategies must ensure that all environmental impacts, from raw material demands to waste discharges (including those from post-consumption of products), are included in regulatory and permitting requirements. In such an integrated system, energy and material input is optimised and waste generation is minimised. Ideally, waste or by-products from one producer will be used as material inputs for other processes.

Figure 8. **Extending integrated permitting approaches**



Indeed, as environmental regulations are increasingly addressing the problems of waste, examples of industries implementing integrated approaches to environmental management are more prevalent. For example, in the United States:

-- Meridian National, a steel processing company, is now pre-processing its spent sulphuric acid both for re-use and as resealable material, selling ferrous sulphate compounds to magnetic tape manufacturers;

-- Atlantic Richfield Company, an oil refinery complex in Los Angeles, has reduced its waste generation from about 12 000 tons per year in the early 1980s to about 3400 tons by the end of the 1990s. Savings in disposal costs were estimated at $2 million a year. In addition, the company sells some of its by-products, such as spent alumina catalysts to Allied Chemical, and its spent silica catalysts to cement makers, making additional savings on its environmental costs (Tietenberg, 1996).

These examples suggest that effective integrated approaches to preventing industrial pollution lead to optimised production and technology innovation with both environmental and economic benefits. This also implies a need for better integration of environmental and economic instruments, in order to further environmentally sound conditions of fair economic competition, e.g. by implementing stringent environmental requirements and through appropriate pricing of environmental impacts from production and consumption patterns.

Chapter 4:

RESULTS OF THE BAT-EQO CASE STUDIES IN FOUR INDUSTRIAL SECTORS

In this section, practical examples from the BAT-EQO case studies and additional permit samples provided by countries are used to illustrate specific permitting strategies.

The BAT-EQO case studies were launched to examine how environmental requirements contained in industrial permits were established in specific sectors as well as their influence on the environmental response and performance of plants under review. The sectoral case studies, i.e. in the pulp and paper, metal finishing, oil refining and iron and steel sectors, were based on permit samples and related information in which each participating country described its permit process and how BAT and EQOs were considered. The participating countries and permit samples provided in the four case studies are listed in Table 7. The detailed review of the case studies is included in the proceedings of the OECD Workshop on Environmental Requirements for Industrial Permitting[7].

4.1 Overview of the sectoral case studies

The pulp and paper, iron and steel, oil refining and metal finishing sectors were selected on the basis of their environmental significance in OECD countries. The metal finishing sector was also chosen as representative of a sector composed of small and medium enterprises. The case studies consist of the review and examination of permit samples provided by participating countries and information derived from questionnaires addressed to the regulatory authorities and permittees.

Different numbers of permits were provided for each industrial case study, with some countries providing media-specific permits for single facilities and others countries providing several examples. Facilities under review vary in size, age, technological processes used and physical factors of location (e.g. located in sensitive ecosystems, in an industrial zone, in transboundary areas, etc.). However, in most cases, participating countries supplemented their permit samples with the rationale underlying ELVs and other permit conditions. This comprehensive information has been compiled in a recent OECD report[8].

The following subsections provide a summary of the technical and environmental characteristics of each sector as well as a listing of the technological response of facilities to permit conditions. Section 4.1.5 further discusses the case studies' findings with regard to the objectives of the policy study, i.e. the use of BAT and EQO for setting permitting requirements and the role of environmental permitting in promoting pollution prevention.

---

[7] See the project publications list at the end of this report.

[8] *Regulatory Approaches to Environmental Permitting in OECD countries: A Reference Guide*, OECD, 1998.

Table 7. **The industrial case studies: participating countries and permit samples**

COUNTRIES		Pulp and Paper *Sulphite and Kraft processes*	Metal Finishing *Electrolytic metal finishing process*	Oil Refining *Oil refineries*	Iron and Steel *Integrated and non-integrated mills*
Austria		1 water permit 1 air permit	1 water permit 2 air permits		
Belgium	*Flanders*		2 integrated permits	4 integrated permits	
	Wallonia	1 water permit			
Canada		7 water permits 7 air permits			
Finland		3 water permits 3 air permits 2 waste permits			1 integrated permit (air, waste, noise) 1 water permit 1 notification*
Germany		2 water permits 1 air permit 1 waste permit	1 water permit		1 provisional decision**
Italy				3 air permits	
Japan* **		1 water permit 1 air permit	1 water permit 1 air permit	1 water permit 1 air permit	1 water permit 1 air permit
Korea					1 water permit 1 air permit
Netherlands			1 water permit 1 air permit 1 waste permit		
New Zealand		2 water permits 1 air permit 1 waste permit		1 water permit 1 air permit	
Norway		1 integrated permit			
Sweden		1 integrated permit			1 integrated permit
Switzerland		1 water permit 1 air permit 1 waste permit	1 water permit 1 air permit		
United Kingdom			2 integrated permits	2 integrated permits	1 integrated permit 1 air permit
United States		3 water permits 2 air permits		2 water permits 2 air permits 2 waste permits	1 air permit

Note: With the exception of the survey on metal finishing, the case study reports have been supplemented with country profiles outlining national approaches of the participating countries for the industrial sector under review.

* In Finland, the notification procedure is used for facilities judged not to have a polluting impact on water.

** The provisional decision in Germany covers only part of the prerequisites for the granting of a license.

*** An additional permit is required when wastewater is discharged underground.

4.1.1 The pulp and paper sector

A number of mechanical and chemical processes are used to extract fibres from raw materials to manufacture paper products. In chemical pulping, non-fibrous materials -- lignin, gums, etc. -- are dissolved from wood and then flushed out using water. As a result, pulping generates large quantities of contaminated effluent, which may or may not be fully recovered. Mills usually convert some quantities of these by-products into energy. With state-of-the-art technology, a kraft pulp mill produces more energy and heat than is needed for the process. In contrast, mechanical pulping requires huge amounts of electricity.

If released into the environment, the effluent has high COD (and consequently has a high toxicity) and BOD, which causes oxygen depletion and nutrient production and may lead to eutrophication of receiving water bodies. In addition, the effluents contain chemical contaminants resulting from pulping and bleaching processes. Among others, these include chlorine compounds. Although uncertainties remain as to the environmental significance of organochlorines, national regulations have been established to control these compounds, mostly using the adsorbable organic halogens (AOX) control parameter to set ELVs and, in some cases, by targeting dioxin and furan discharges. In both cases, stricter standards have led to a strong trend towards substituting chlorine dioxide (ClO_2) as a preferred bleaching agent for elemental chlorine (Cl_2). Nevertheless, because of other ecological issues linked to pulp and paper effluents, research and development activities have been focusing on developing closed-cycle bleach kraft mills (see Box 3, below).

The kraft pulp industry has faced serious environmental pressure from regulatory authorities, local stakeholders and the market during the past decade. Indeed, its environmental impacts have been significant due to effluent discharges of organic substances and nutrients causing both oxygen depletion, toxic effects and eutrophication in the receiving water bodies. In addition, the industry's impacts on forestry, flora and fauna have drawn much negative attention to the sector. Among the environmental impacts of this industry, much concern has been raised in relation to the presence and effects of chlorinated compounds in receiving environments. Although the first alarming reports about chlorinated compounds did not concern the pulp and paper industry, the markets paid attention and played a significant role in the uncommonly rapid implementation of more environmentally-benign bleaching technologies. However, regulatory issues have also been regarded as an important driving force behind recent developments in kraft pulping technologies.

In the pulp and paper case study, participating countries selected facilities using chemical processes (sulphite and kraft processes) in order to allow the comparison of approaches for the same types of mills. The chemical pulp mills impose the greatest environmental load and therefore represent a prime choice to study how environmental requirements are addressed. In addition, the case study focused on the examination of water permits. The case study covered environmental permitting in 10 countries which include most of the major pulp and paper producing countries (see Table 7 above).

Box 3. **Relationships between regulation, science and technological innovation in the pulp and paper sector**

Identical facilities may place different strains on the environment according to where they are located geographically. The pulp and paper case study has shown that the emissions of the different pollutants may be reduced depending on the characteristics of the receiving environment and the objectives pursued by permitting authorities. In turn, different permit requirements translate into the need for several types of technologies. If one examines techniques and technologies installed by mills to control harmful effluents, it is obvious that most facilities on small freshwater streams are usually required to install secondary treatment works in order to control and degrade organic compounds. Many pulp mills in Canada, Finland and the USA which are located near small, inland water bodies have adopted secondary treatment in order to meet BOD and toxicity requirements. In Finland, a special emphasis has additionally and with success been put on the reduction of nutrients. Conversely, some Swedish mills located by the sea were not required to install such control technologies because of the high dilution capacity of the marine environment, i.e. its capacity to absorb organic compounds. In the view of some commentators, this margin has allowed the Swedish authorities to "trade" BOD and nutrient requirements for internal measures to phase out the use of chlorine in the bleaching process.

Interventions by regulatory bodies have forced mills world-wide to install technologies which prevent or reduce the formation of toxic organochlorines by substituting alternative bleaching agents. The identification of chlorine as a precursor of highly toxic substances has also brought the industry to revise bleaching technologies, enabling the development of more environmentally-benign techniques and operations, leading to reductions in material intensity as well as to energy savings. Even the science policy issue of whether AOX reduction is or is not the right control strategy has pushed the industry and public authorities to seek ways to ensure that the environment and public health would be fully protected. While this issue remains controversial, the industry continues to work on the implementation of technological innovations that are environmentally-compatible. As closed-loop pulp mills come closer to the commercial stage, pollutant releases in this sector could dwindle to almost zero.

While it may appear that Swedish mills have had the opportunity to develop new technologies through in-plant measures because of the "financial break" offered by permitting authorities on BOD requirements, substantial investments have nevertheless been necessary to achieve current environmental performance, including low releases of not only AOX but also COD. A more accurate assumption would link short-term requirements and long-term objectives to the assessment of the industry life-cycle to further pollution prevention strategies. Although environment quality may be dependent upon control technology in the short-term, a careful crafting of environmental requirements needs to take into account the possibility of finding long-term solutions to current problems. Advances in bleaching technologies have shown that much progress could be made in a relatively short timeframe when certain problems and well-targeted working plans are addressed. For example, in Finland, the authorities' targets to reduce the nutrient discharges led to intensified research in that field, resulting in turn in successful development of in-plant measures as well as of the activated sludge treatment process.

(continued on next page)

(continued)

Life cycle assessments and integrated multi-media approaches promise new options for the development of processes and products. The identification of real and potential environmental problems like transport and energy consumption is an issue of growing importance. Selective identification of regional environmental issues on one hand and global issues on the other will affect long term strategies and hopefully will continue to bring up a variety of new solutions. Obviously a better international information database on research programmes and new techniques would provide a basis for more developed BAT, and would help ensure optimal overall solutions. A careful examination of the environmental features of industrial activities, including the relative efficiency of current industrial practices and the necessity of introducing an eco-efficiency concept can also yield win-win solutions. An interdisciplinary conceptualisation of scientific, technological and environmental issues is still in its infancy. There may be many small but as yet unexploited opportunities for cost savings and environmental improvements. To realise them will depend on the stringency and design of environmental regulations (Porter and Van der Linde, 1995).[9]

In establishing permit conditions, it appears that authorities have used both BAT and EQO concepts and achieved a good balance. Technology-based requirements have been set on the basis of "state-of-the-art" technologies, with a view to establishing an optimal balance of pollution prevention and end-of-pipe measures. Clearly, local considerations have directly or indirectly influenced the stringency of requirements as well as the types of control imposed on mills. The review of permits and information provided by permittees further indicates that, to some extent, similar technological measures have been introduced in response to permit limits. In certain aspects, for example, regarding AOX levels, some mills have even gone beyond permit requirements. With respect to the environmental impacts of pulp bleaching, pollution prevention measures were implemented through a mix of technological innovation, improved techniques and better operating practices. These included:

-- complete cooking liquor recovery;

-- extended cooking and oxygen pre-bleaching used to reduce bleach plant effluent;

-- alternate bleaching agents: chlorine dioxide (ClO_2), peroxide (H_2O_2), ozone (O_3), etc.

-- widespread application of biological treatment of varying efficiency;

-- good spill control;

-- reduced water use;

-- better process control; and

---

[9] For a different opinion, see Palmer et al., 1995.

-- development of closed-loop technologies.

As a result of the above technological improvements, the kraft pulp mills have significantly reduced both the toxicity and quantity of their discharges, specifically:

-- BOD has been reduced to less than 15 kg/tonne with secondary treatment and to less than 1 kg/tonne in some mills;

-- COD_{CR} has been reduced to less than 40 kg/tonne before treatment and 15 kg/tonne after treatment;

-- AOX has been reduced to less than 0.2 kg/tonne at mills that still use ClO_2 in the bleaching process; and

-- Phosphorus and nitrogen have been reduced, after biological treatment, to levels below 15 g/tonne and 150 g/tonne respectively.

4.1.2 The metal finishing case study

The metal finishing sector is primarily made up of small and medium-sized enterprises (SMEs). In the electrolytic metal finishing industry, different processes (metalworking, welding, painting, assembling, etc.) produce several kinds of products (metal products, machines, means of transport, electronics, etc.). Before electrolytic metal finishing, products are degreased in organic solvents, by aqueous cleaning, or pickled. The most important metal coatings are zinc, nickel, copper, chromium and cadmium. The process usually takes place in a reservoir with a bath fluid through which an electrical current is passed. The product is often rinsed with water after a galvanising step, between galvanising steps or after degreasing or pickling. The storage of chemicals and wastes, treatment of emissions (aqueous and gaseous) and water discharges represent the main environmental problems related to electrolytic metal finishing.

Austria, Belgium (Flanders), Germany, the Netherlands, Switzerland and the United Kingdom were the participating countries in this case study. With the exception of Belgium and the United Kingdom, who provided integrated permits, the remaining samples were media-specific permits covering mostly water and air releases. The Netherlands also provided a waste permit. An interesting characteristic of this case study is that all participating countries are neighbours to each other and except for Switzerland, they are Member states within the European Union. Thus, in the wake of the EU IPPC Directive, the policy and environmental Acts of these countries are in the midst of major changes. It is therefore revealing to examine the similarities and differences between the countries' approaches in setting permit conditions for similar facilities in the context of harmonisation under EU Directives.

Differences in ELVs primarily concern water discharges, since water protection policies often address more local concerns, i.e. most surface water and communal wastewater treatment programmes need to fulfil specific local environmental quality needs. Therefore, there is actually a balance between EQOs and BAT considerations when effluent and discharge limits are set. As such, the implementation of IPPC is likely to level out ELVs for this sector. In response to ELVs and other conditions that were set in the permit samples, the plants have used a combination of pollution prevention techniques through in-process measures, together with end-of-pipe treatment techniques controlling remaining emissions. The following measures have been reported by the facilities:

-- transport of nickel carbonate in closed containers, emptied under low-pressure;

-- purchasing of nickel carbonate with a moisture degree of 33%;

-- dividing of exhaust air streams for better treatment;

-- installation of RedOx and pH control of the oxidising washing media;

-- use of scrubber and internal re-use of scrubber water;

-- circulation and re-use of water streams;

-- dividing of wastewater streams for better treatment;

-- installation of treatment stages for sulphate, nitrite and sulphite;

-- detoxification of rinsing water containing cyanide;

-- transition from sodium hypochloride to peroxide for cyanide detoxification;

-- precipitation of rinsing water containing nickel;

-- re-use of treated effluent as rinsing water;

-- combination of ion exchange and electro-deposition;

-- ultrafiltration of degreasing baths to lengthen the immersion time;

-- transition to water-based degreasing; and

-- optimal use of pickling regulators.

The policies and environmental regulations of participating countries are continuously evolving. This is particularly true for the metal finishing sector: unprofitable plants have been forced to shut down and special operations are increasingly contracted out to more environmentally-efficient plants. More efficient techniques and technologies have been developed to reduce the environmental burden and therefore improve BAT. In the wake of the EU's IPPC Directive, the harmonisation of requirements is likely to contribute to improved environmental performance and techniques by making environmental requirements for this sector more conducive to fair competition. The European Commission is preparing legislation for SMEs similar to the IPPC Directive, but with the main goal being "the development of a complementary framework to integrate pollution control which takes into account the needs of [SMEs]" (IER, 1996). Some of the more general issues specific to environmental permitting for SMEs are summarised in Box 4, below.

Box 4. **Small and medium-sized enterprises and the economic-ecological balance**

In principle, industrial facilities must comply with environmental regulations regardless of their size. However, large enterprises are often the only ones who can invest resources for acquiring the type of technical and policy expertise needed for developing and implementing innovative techniques and measures while at the same time analysing regulations and negotiating the most optimal permit conditions accordingly. The cost and time related to the preparation of application documents, the negotiation of permit terms, and the collection of pre-permit data may discourage smaller industries from innovating in resource use and technologies for environmental purposes. SMEs are characterised by small staff resources and high profit rates and employment turnovers. As underlined by Hans du Mortier, an industry representative of the Association for Surface Finishing Techniques in the Netherlands and member of the industry/government panel on the case study on the metal finishing sector: "For the SMEs, only the economic considerations are a fact of life".

Environmental knowledge and negotiation skills of SME permittees are generally assumed to be very limited. SMEs tend to follow regulations and permit conditions "by the book" so as to avoid enforcement actions and fines. The search for pollution prevention approaches for SMEs is carried out by the regulatory authorities themselves because of the lack of appropriate resources and staff at the enterprise. For the very same reasons, the permitting authority's knowledge of the processes used at the SMEs may be limited as well. Moreover, there may be heavy pressure on authorities to be lenient with SMEs because of their economic fragility and for social reasons such as regional employment, particularly during economic recession.

The specific characteristics of SMEs and the crucial importance of their economics may call for the development of new approaches to further tracking and implementing pollution prevention initiatives. On the one hand, it may be appropriate to define the economic framework which SMEs occupy more broadly. Many facilities are highly dependent on subcontracts from large enterprises, and their economic and environmental credentials should potentially be investigated and negotiated as such. As in the case of the auto industry in North America, there are several good examples where large corporations have taken environmental initiatives by examining their suppliers' behaviour. In addition, environmental targets need to be coupled with timetables that take the SME financial cycle into consideration. Fast production growth periods may lead to high emission rates while economic stagnation may result in many closures or a concentration of the sector. In both cases, counter-arguments are often raised against environmental regulations because of the need to meet the sudden growing demand, or conversely because environmental investments are expected to jeopardise the future of the plant. There is a promising option which attempts to combine permitting with voluntary agreements that encourage individual facilities, especially during periods of strong economic growth and increasing production, to work together on developing appropriate techniques and measures to comply with environmental rules.

4.1.3 The oil refining case study

Oil refining is the process by which the physical, thermal and chemical separation of crude oil generates its major distillation fractions. Through a series of separation and conversion steps, three major categories of petroleum products are manufactured: fuels (motor gasoline, diesel and distillate fuel oil, liquefied petroleum gas, jet fuel, residual fuel, kerosene, and coke); finished nonfuel

products (solvents, lubricating oils, greases, petroleum wax and jelly, asphalt, and coke); and chemical industry feedstocks (naphtha, ethane, propane, butane, ethylene, propylene, butylenes, butadiene, benzene, toluene and xylene). They enter directly or indirectly into the production of many products, such as fertilisers, pesticides, paints, solvents, detergents, anti-freeze, plastics, synthetic fibers, etc. For logistical reasons, refineries are usually sited near crude oil sources (petroleum terminals, extraction areas) and consumers (industrialised zones).

Due to the nature of operations and compounds involved, the petroleum refining industry poses many risks to the environment. The prevalence of volatile chemicals in crude oil is responsible for the high levels of air pollution associated with the industry. Among the major pollutants are aromatic hydrocarbons, including benzene, toluene, ethylbenzene, xylene, cyclohexane, 1,2,4,-trimethylbenzene and ethylbenzene. Ammonia is also released in large quantities. The primary means of release to the environment is through underground injection of wastewater and emissions to air. Components of additives and chemical feedstocks are mainly released as air emissions due to their high volatility. A significant portion of the remaining chemicals are metal compounds, which are typically transferred off-site for recovery disposal. Sulphuric acid is also generated in large quantities and is typically transferred off-site for regeneration.

The five countries that participated in this case study provided different types of permit samples: except for Italy (air only) and New Zealand (air and water only), the permit samples covered all media, whether through integrated permits from Belgium and the United Kingdom or through media-specific permits from the United States. Three out of the five participating countries are EU Member states and EU Environmental Directives set the framework within which the permitting systems in these three countries operate. All countries, except for the USA, have recently changed or are in the process of changing to a multi-media permitting system. The USA has been intensifying its initiatives in the field of integrated approaches, for example through environmental review mechanisms of major stationary sources such as the oil refining industry.

In most cases, BAT-based ELVs were sufficient to ensure that the relevant EQOs would be met. Two of the permits provided by Belgium were an exception to the rule, as more restrictive requirements were included to ensure the attainment of EQOs for aquatic environments. The Belgian permit sample also provided an example of the use of the so-called “bubble-concept” as an integrated permitting tool. This approach is briefly discussed in Box 5, below.

It is difficult to draw general conclusions concerning the technology used in response to the permit requirements from the samples provided for the case study. The number of permits were too small and the processes covered were too diverse. Nevertheless, there are some similarities evident in the technological solutions that were implemented. For example, several of the facilities use systems to monitor and manage the sulphur content of the fuels used. Sulphur recovery units have been installed at all facilities, often with improved efficiency and options such as low-NO_x burners, combined heat and power plants, secondary seals on storage tanks and biological treatment of aqueous effluent. Sour water strippers are used in several cases. Thus, the technological solutions used are generally a mix of internal and external controls, depending on the specific circumstances of the plants. For existing plants, the scope for internal controls is often more limited, and external controls may be the only option. Examples of internal controls include the use of fuel management systems and preventative maintenance and inspection. Examples of external controls include selective catalytic reduction units, tail gas clean-up in sulphur recovery units and dust removal equipment.

Box 5. **Searching for flexibility and cost-efficiency in the oil refinery sector: The air concentration "bubble concept" as an integrated permitting tool in Belgium**

One advantage of the "bubble concept" claimed for the use of integrated approaches is that it allows all environmental releases to be covered in one authorisation and/or ELV, leaving more flexibility to the operator for choosing the most appropriate approach and/or set of methods for meeting the requirements. The "bubble concept" for setting emission limits was first introduced in the United States Clean Air Act of 1977 (OECD, 1989).

The Belgian permit sample provides an example of the use of the "bubble concept" to define stringent ELVs while leaving room for flexibility regarding shares of pollution reduction achieved by each of the four plants located in the same bubble. The overall limit values for each integrated zone or "bubble" are defined in accordance with air quality standards. The emission limits are binding requirements, but emissions may be "traded" between installations as long as the total amount complies with the ELVs. According to P.J. Berckmoes, refining director at Esso Benelux, the concentration bubble concept has had many advantages over other segregated approaches:

- it has proven more equitable since norms are the same for each plant, preventing any competitive distortion between them;
- it has promoted cost effective emission reductions by providing more flexibility, allowing significant economic savings through the substitution of low cost reduction initiatives for traditional high cost after treatment;
- it has favoured lower emissions at equal costs (win-win situations);
- it has minimised operating costs by compensating operational upsets and equipment failures with actions in other plants.

Although there were some similarities in the technological solutions implemented by refineries regulated by segregated and integrated permits, the integrated permits offer more flexibility to operators looking for innovative, cost-effective ways of meeting the requirements.

4.1.4 The iron and steel sector

There are two main production routes in the iron and steel sector. Integrated producers generally make steel from iron ore using coke ovens and blast furnaces (which produce an intermediate product called pig iron) and basic oxygen furnaces (which are used to process pig iron into steel). Non-integrated producers, on the other hand, generally make steel by melting and refining ferrous scrap at smaller scale EAF facilities (often referred to as minimills). In both processes, the molten steel is formed into ingots or slabs that are rolled into finished products. Rolling operations may require reheating, rolling, cleaning, and coating. Iron and steel products include items such as bars, strips, sheets and formed products such as steel nails, wire, rods and pipes. In some instances, saleable products may also include by-product coke and products derived from chemical recovery in the coking process such as coal tar and distillates.

The iron and steel industry is a major source of air and water pollution, generates important quantities of waste materials, occupies large tracts of land, and gives rise to vast mining and waste disposal areas. Environmental challenges for this sector include air pollution control (in particular concerning CO_X, SO_X, NO_X and airborne metals), waste disposal and recycling, and wastewater treatment. With the growing use of scrap as raw material, dioxin emissions have emerged as an issue of concern. The main pollution streams for both integrated and non-integrated mills are air emissions, collected dust, slag and wastewater. As the composition both of iron ore and of scrap varies according to its origins, the content of the emitted dust changes from plant to plant. Dust from primary processes may contain several heavy metals such as cadmium, lead, chromium, nickel, zinc, copper and arsenic. Mercury is also emitted from coke plants. These emissions occur at different places through storage, handling, crushing, sieving and transport of metal-containing materials. At EAF plants, heavy metals and noxious organic substances such as polyaromatic hydrocarbons and dioxins are emitted with process gases during the melting of scrap. Toxic metals can be either alloying elements like nickel and chromium or contaminating elements like lead, mercury and cadmium. Mercury is emitted mainly in gaseous form. Heavy metal emissions also occur from the cutting of scrap, from the converters and from casting.

In the iron and steel case study, the participation of countries from Asia, Europe and North America provides a wide representation of regulatory approaches. National regulations affect the industry at all stages of the manufacturing and forming processes. The increasing cost of energy and the introduction of stricter environmental regulations have led the industry to monitor its level of pollutants and to minimise its impact on the environment. These pressures have led to many initiatives in pollution prevention and control measures. In particular, recycling and other means of reducing material and energy intensities have led to considerable environmental benefits and reductions of costs in this sector. These developments are discussed in more detail in Box 6.

The iron and steel permit samples covered different processes, i.e. iron foundry, integrated plants, and minimills. In all cases, BAT and EQO considerations were balanced to set the optimum permitting requirements. BAT-based ELVs include both pollution prevention opportunities and advanced end-of-pipe techniques to ensure that pollutant releases are reduced, controlled and recycled. The following approaches, measures and achievements were reported by facilities:

- Use of denitration and desulphurising technology;
- Implementation of continuous casting systems;
- Implementation of environmental management practices (e.g. LCA of products, environmental investigations of improved techniques and operations, etc.);
- Use of cleaner fuels;
- Scrap sorting and cleansing;
- Reuse of 90% of scrap and by-products for material inputs or as saleable products; and
- End-of-pipe techniques (filters, scrubbers, electrostatic precipitators, etc.).

In addition to these occasionally isolated changes, permitting has changed the way facilities try to control or prevent pollution in more striking and widespread ways, summarised in Box 7, below.

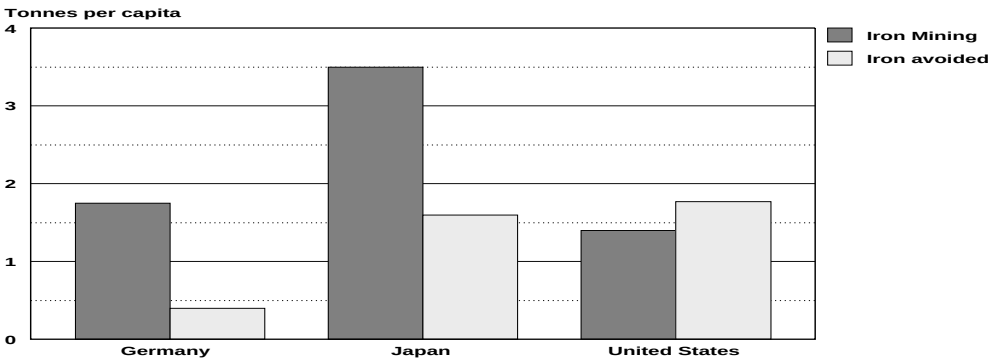
Box 6. **Pollution prevention and resource productivity in the iron and steel industry: compatible objectives**

One of the most striking features influencing the environmental and economic performance of facilities is related to a sharp decline of material intensity in the iron and steel industry. This has been achieved, in part, by innovations such as continuous casting which eliminates a reheating step, and indirectly, by reducing the amount of crude steel needed for each ton of finished steel products. The percentage of continuous cast steel in market-based economies rose from under 10% in 1970 to over 80% in 1995. In addition, increases in process and product efficiencies improved the yield of crude steel for steel products from 0.78 ton in 1974, to 0.84 ton in 1990, and 0.86 ton in 1994 (Angulo, 1995). Energy per unit of manufacturing value added in the iron and steel sector for 10 OECD countries declined by an average of 1.9% annually between 1971 and 1991. A nearly 20% reduction in total specific energy consumption has been achieved since the 1970s (Levine *et al*., 1995).

In addition, over 40% of steel production is now based on recycled rather than virgin materials, making steel the most recycled of all materials. Recycled metals are rapidly moving towards becoming the dominant input to the industry's total metal supply. In 1993, total world consumption of scrap was 435 million tons per year (TPY) which corresponds to the world crude steel production in 1964. Of this total, 385 million tons of scrap were used for steel production, saving 640 million tons of iron ore. Steel generated from scrap requires 60% less primary energy than that produced from ore. Both integrated and non-integrated plants are striving to achieve the highest rate of recycling of by-products and scrap metal. This is being done through a mix of primary and secondary measures, such as using cleaner materials and fuel (low sulphur iron ore and fuel), rationalising production processes (implementing continuous casting operations), optimising operating practices, and improving environmental management. Figure 9 illustrates the savings on iron inputs from recycling for three of the seven participating countries in the iron and steel case study.

Savings from recycled materials and improvement in energy efficiency are prime examples of the positive influence of environmental requirements on the implementation of sustainable, environmentally-sound technologies and operations in the industry. Performance-based ELVs, which incorporate in-plant measures, recycling opportunities and end-of-pipe techniques, are continuously tightened in order to force implementation of best practices in the industry. Integrated approaches are likely to foster new pollution prevention initiatives by addressing steel producers, smelters and refiners as whole entities, thereby eliminating opportunities to transfer pollutants across media.

Figure 9. **Savings from recycling materials**



Source: WRI *et al*., 1997.

Box 7. **Impact of permitting strategies and requirements on pollution control and cleaner technologies**

Pollution prevention and control objectives for toxic releases are reflected in permits by stringent BAT-based ELVs that aim at the near elimination of substances like dioxins or mercury and, eventually, the closure of plant circuits. The analysis of the permittee's responses in the four industrial sectors examined here reveals that the different facilities have implemented similar types of technological measures to meet with permit conditions. Permit requirements have most obviously influenced pollution prevention and control in the following ways:

- by promoting increased use of in-plant measures, for example: shifting from chlorine gas to chlorine dioxide and chlorine-free technologies for pulp bleaching, substituting pellet production for sintering and using cleaner fuel and minerals in steelworks, and increased used of water-based solvents in the metal finishing industry;

- implementation of waste minimisation and recycling as cost-effective ways of complying with permit limits, minimising waste treatment costs and raw material inputs, e.g. recycling of nearly 90% of solid by-product residues in the iron and steel industry, maximising effluent recycling through water reduction and effluent reuse programmes in the pulp and paper sector, internal reuse of scrubber water in metal finishing plants;

- improvements in control and treatment technologies, e.g. tail gas clean-up in sulphur recovery units in the oil refinery sector, widespread application of biological treatment in the pulp and paper industry, division of wastewater streams in metal finishing processes.

4.1.5 Findings from permit samples

Given the wide variations in the local circumstances under which the permits submitted were developed, it is remarkable to note to what degree permitting approaches in different OECD countries (and across different sectors) are similar. In particular, the examination of the permit samples showed that in efficient permitting strategies, optimum environmental requirements are based on both BAT and EQO considerations. All permitting authorities have indicated that BAT considerations were used to set pollution limits and other permit conditions. Flexibility is provided through the preferred use of quantitative performance-based standards, which leave the choice of appropriate technologies and techniques to the operator. Stepwise tightening of ELVs on the basis of timetables is also a prominent feature of permitting approaches.

Obviously, as the four case studies have shown, local considerations do influence the stringency of requirements and provide a partial explanation for the different types of approaches and control techniques implemented by facilities. Table 8 below provides an overview of similarities and differences between permitting approaches.

The convergence of regulatory approaches appears to indicate that effective permitting schemes evolve as the outcome of trial and error and accumulated experience with different situations. Beyond binding national requirements and procedures, permitting authorities have to respond daily to many environmental issues, often with incomplete and uncertain information. Thus, the development of approaches such as balancing BAT and EQO considerations and performing cross-media analyses may be understood as a policy response to a changing environment that

includes both social and environmental aspects. These types of *ad hoc* procedures and the experience they generate are thus an important aspect of the environmental regulatory framework.

While raw materials, type of energy and chemicals are seldom directly regulated in permits, the case studies seem to indicate that some progress has been made in this direction. The use of "best environmental options" in establishing permit conditions appears to be implicitly extending the scope of conventional permitting approaches. Similarly, the trend towards integration in the analysis of and response to industrial activities is also indirectly extending the role of permits. Tools such as environmental impact and life-cycle assessments, by providing a more complete, systems-oriented picture of industrial activities prior to permitting, have meant that in many cases, the impacts connected to choices of energy feedstocks, chemicals and other materials are consolidated, in the assessments, with other types of pollutant releases farther downstream. To the extent that environmental permits take overall environmental impacts into consideration, upstream factors such as choice of energy type are thus brought into the scope of the permit.

Furthermore, an argument for the increased use of both BAT and EQO considerations in setting pollution limits can be drawn from the results of the case studies. At first sight, it appears that most decision-making processes adopt the following sequence: first, emissions are reduced by considering technology-based limits; then, as the case warrants, ELVs are strengthened to ensure compliance with EQO considerations. This would explain why ELVs for similar processes sometimes varied from permit to permit.

Nevertheless, a closer examination of permitting decisions may provide another explanation for these differences. As mentioned previously, technology-based considerations are usually the first criteria used to set permitting conditions. In several cases where the precautionary principle has been adopted and incorporated in legislation, the BAT concept is used to prevent pollution at the source and introduce state-of-the-art technology for new plants. However, while the best sequence in which to apply regulatory instruments seems to be straightforward, in practice, deciding whether to use BAT or EQOs as the primary reference for priority-setting often poses a real challenge for permitting authorities. It is therefore no surprise that some permit samples (as in the iron and steel case study) show that technology-based and environmentally-based considerations have been incorporated into some permits without reference to a pre-established sequence.

Among the different permit samples in the four industrial sectors, the iron and steel case study provided many illustrations of this fact:

-- The Japanese authorities have explicitly recognised that BAT-based limits were used for setting pollution limits in permit samples, although these are not legally stipulated in legislation. The reason for using BAT was the impossibility of determining critical and acceptable loads or levels in the environment and thus of defining release limits based on them.

-- In Finland, oily effluent discharges have been prohibited mostly on the basis of EQO considerations (e.g. avoiding transboundary pollution).

-- In the Swedish permit, the underlying rationale for setting ELVs for sintering operations during the development of BAT-based performance limits for pellet inputs was attainment of national environmental targets for heavy metals and hazardous organic compounds.

Table 8. **Permitting approaches in participating countries**

Similarities in permitting approaches

- EU Member countries must comply with existing and upcoming EU Directives;
- All countries have adopted national EQOs/EQSs, which must be reflected in permits;
- Usually, stricter controls are applied for facilities operating in sensitive ecosystems;
- All countries indicated that they have used BAT, either as a binding requirement or as a guide in setting permit conditions;
- International conventions play an important role in setting BAT principles and environmental targets.
- Permits specify conditions and emission limit values to ensure environmental protection;
- Countries consider both technology- and environmentally-based targets in setting permit conditions;
- Pollution limits are based on the BAT concept; stricter permit limits may be based on EQOs;
- Timetables are used to help alleviate the financial burden of strengthening ELVs and to provide for flexible solutions;
- Choice of technology is left to the operators; and
- The recognition that reductions in pollution released to one media may involve increases to other media has resulted in a trend towards integrated media permitting approaches.

Differences in permitting approaches

- Some countries use an integrated system (Sweden, the United Kingdom, Belgium), or semi-integrated permitting systems (Finland);
- Permitting systems in Korea and Japan are primarily based on EQOs/EQSs;
- In some countries, conditions are set on a case-by-case basis, leading to considerable differences in actual limit values;
- BAT-based limits are binding in some countries (the USA, Germany), but are most often used as guidance by permitting authorities;
- BAT definitions vary between countries and may allow end-of-pipe techniques to be used for reaching specified values;
- Differences in the stringency of ELVs may be significant;
- Permitted values may vary in form, scope and purpose; and
- Different control parameters are used.

The concept of "best professional judgement" is another important aspect of effective permitting systems. Although some systems and related policy outcomes may appear overly rigid, most decisions are nevertheless embedded in a careful and pragmatic examination of all issues at stake. The type of learning and the information which is the foundation of permitting decisions has to be sought as much in legally-stipulated regulations, standards and procedures as in the ingenuity of permit writers and policymakers to establish effective evaluation and assessment procedures. Allowing a place for professional judgement and experience is also important to guarantee flexibility in the face of uncertainties.

The effectiveness of environmental regulations is dependent upon their enforcement. This requires dedicated public authorities and effective informational systems, such as environmental monitoring programmes. Although national standards may provide some safeguards for fair competition under environmental legislation, an environmentally-sound impetus to technological development depends on the ongoing implementation of best environmental options through permitting programmes. As such, case-by-case approaches (for example, as practised in Finland and Sweden) have proven to be effective in ensuring that BAT-based limits influence permitting decisions.

4.2 Evolution of permitting strategies: some examples

In the following section, some of the main permitting strategies and instruments are further analysed using permit samples provided by Finland to illustrate how a combination of regulations and permitting approaches are used in response to evolving environmental issues.

Three Finnish water permits in the pulp and paper sector, covering the period 1982-1996 were selected to show how the implementation of permitting conditions can promote the continuous improvement of pollution prevention and control. The influence of BAT and EQO considerations is assessed by examining permitting conditions and technological responses to evolving pollution impacts from facilities under review. The period studied covers national goals set for the sector for the years 1989-1995.

Although each national permitting approach has distinct characteristics, permitting issues in the Finnish pulp and paper sector are a good example of how effective policy approaches can improve environmental performance of mills. The Finnish pulp and paper industry is among the top producers and exporters of wood products in Europe. It is also regarded as representing state-of-the-art know-how and technology: while doubling its production, the industry has been able to reduce the total discharge of pollutants into water to one-tenth of 1960s levels and sulphur emissions to a mere fraction of past levels (Finnish Ministry of the Environment, 1997).

The Finnish permitting procedure can also be considered representative of current permitting practices. It is usually based on a case-by-case approach that incorporates both BAT and EQO considerations. It should be noted that these procedures are complementary. The search for BAT is understood to be a driving force in the sense that it is both a mechanism to compare plant performance and helps to identify research and development tasks within each firm. In their turn, each firm must assess economic risks and identify win-win strategies as the case warrants. Thus, the case-by-case approach is also perceived as a key component of permitting strategies' ability to integrate local considerations.

In the case of the selected examples, the permits concern discharges to water. The review of the permit samples attempts to analyse how permitting strategies and specific instruments are used in setting pollution limits, but does not examine the issue of cross-media considerations. In addition, the influence of permit requirements on technological response is assessed by examining the relationship between the type of control parameters and the tightening of ELVs on the one hand, and ongoing improvements in reducing environmental releases on the other. The review focuses on issues affecting permitting approaches and requirements in three distinct situations:

-- the use of BAT for gradually tightening ELVs;

-- EQO as a driving force for setting permit conditions; and

-- dealing with violations of permit conditions and non-compliance issues.

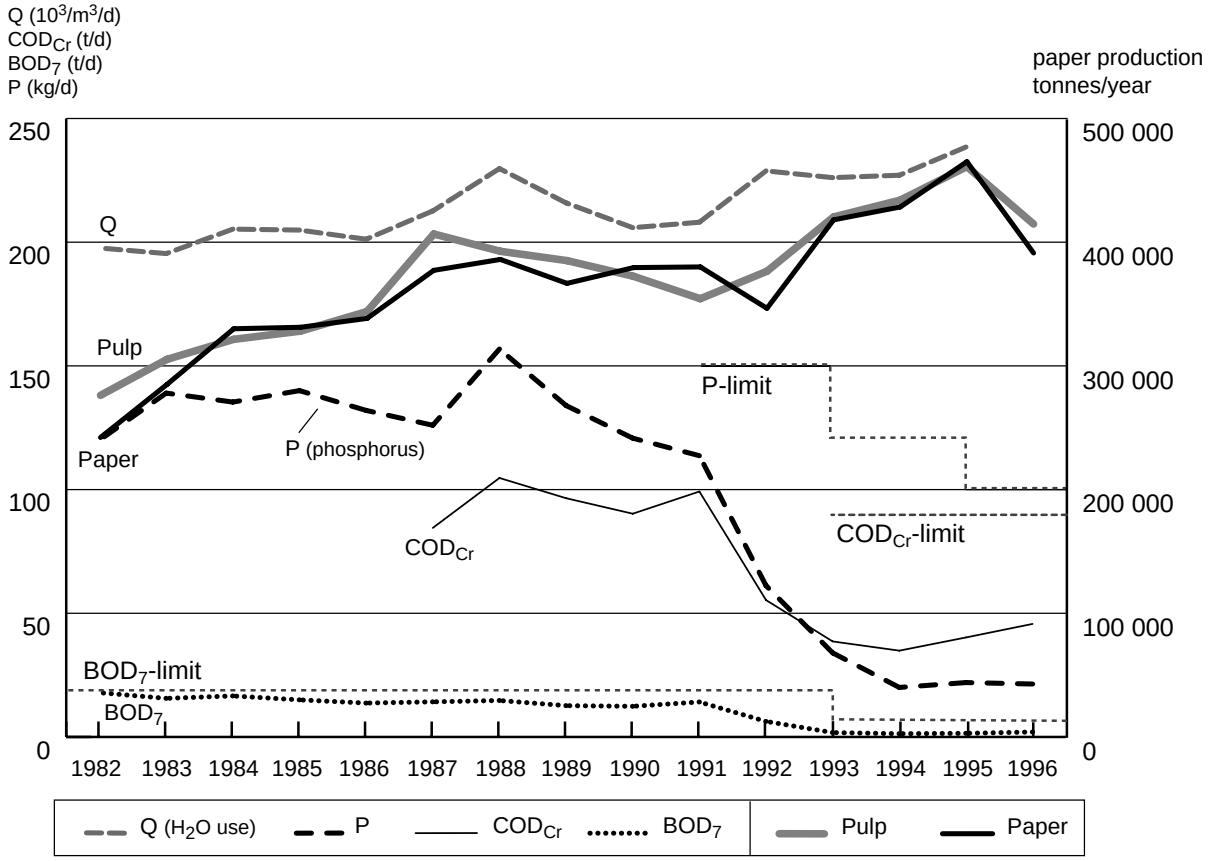
4.2.1 Gradually tightening BAT-based ELVs

The first example concerns a pulp and paper mill with production capacity of 600 000 tonnes per year of bleached kraft pulp and the same amount of wood-containing paper. The renewed water permit came into force in 1990. New ELVs were deemed necessary since the pollution limits and other conditions contained in the 1982 permit had proven ineffective in promoting continuous improvement of pollution prevention. As Figure 10 illustrates, when the old permit was in force, discharges of phosphorus (P) and COD_{CR} more or less followed production rates. It was evident from monitoring results that pollution control techniques and production processes were ineffective in reducing pollutant releases. Mechanical and biological treatment introduced in the 1970s scarcely affected the discharges of nutrients and COD_{CR}.

The permitting authority took advantage of better environmental performance achieved at similar plants within the country and abroad to introduce new control parameters in which stringent pollution limits were set to force implementation of preventive approaches. As can be seen in Figure 10, a stepwise approach was used by the authority to introduce new control parameters (for total P and COD_{CR}) and tighten limits, providing the operator with time to introduce compliance measures. In addition, pollution limits per tonne of production were introduced to ensure proper process and control techniques and plant operations, even when the facility was running under capacity.

A series of major in-plant changes in the course of the 1980s and early 1990s -- the addition of an evaporating plant in 1984, a washing facility in 1988, a bleaching plant and recovery boiler in 1992, and the modernisation of cooking, the softwood pulp line, and recausticising and lime kilns in 1996 -- made it possible to reduce discharges of both organic material (COD_{CR} and AOX) and nutrients (primarily phosphorus). The construction of a well-designed activated sludge treatment plant in 1991 was also important in realising these reductions. The mill benefited from the experience of designing and operating activated sludge treatment plants at other mills. Overall, the result was a dissociation of pollutant releases from production rates that far surpassed expectations.

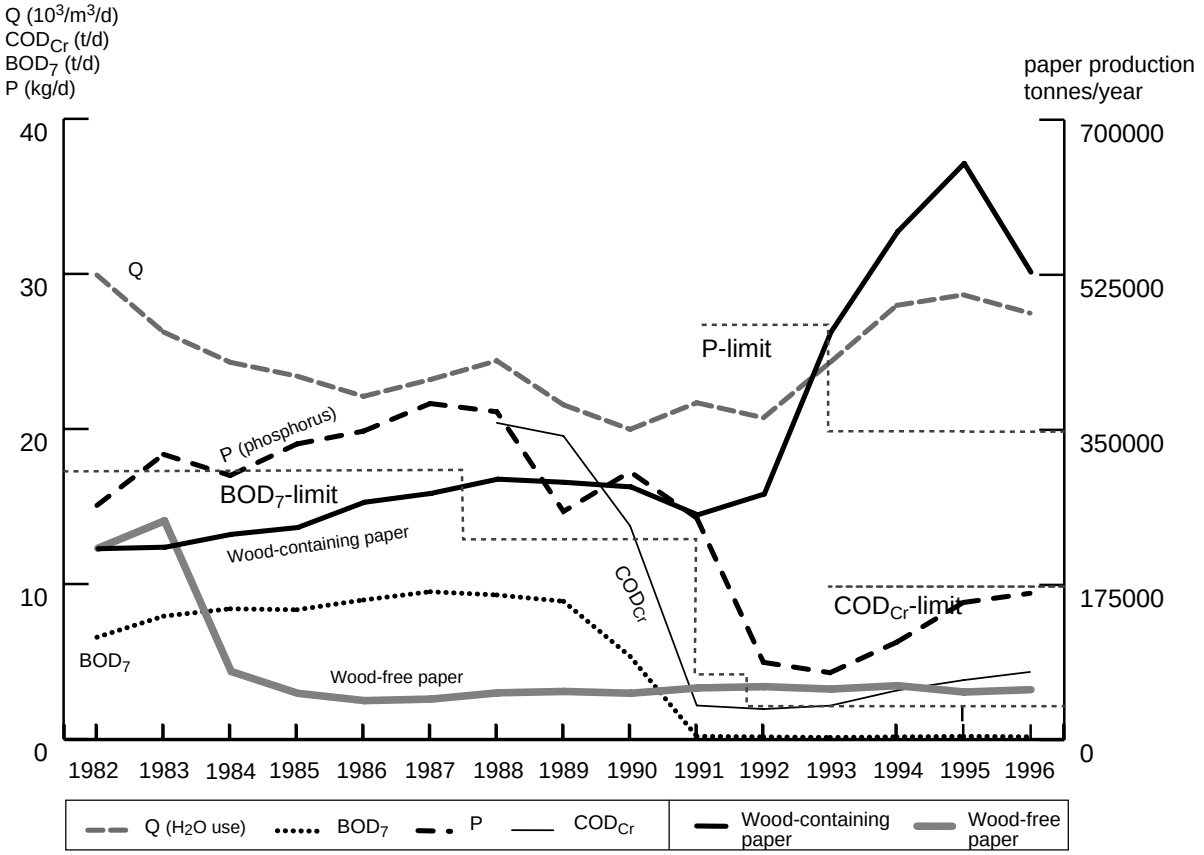
Figure 10. **Decoupling of mill production and discharges after application of BAT-based limits**



4.2.2 Local EQOs as an impetus for setting effluent limits

The second example involves the case of a pulp and paper mill operating near a river with a low flow rate. Production capacities for wood-containing paper and mechanical pulp were as high as 400 000 and 200 000 tonnes per year, respectively, until 1992, and increased to 700 000 and 400 000 tonnes annually in following years. Although the mill significantly reduced discharges by shutting down its obsolete sulphite process in 1981, further reduction of organic matter and nutrient discharges was necessary. The 1989 permit conditions required that the mill investigate ways of reducing the water consumption of the old paper machines. As a result, the water consumption of the old machines was reduced by 15% between 1988 and 1993. The operator took several initiatives such as building a new wastewater treatment plant in 1990 (activated sludge plant with flotation as a tertiary stage) and installing a new paper machine in 1992.

Figure 11. **Decoupling of mill production and discharges under tight EQOs**



As shown in Figure 11, the permitting authority followed a strategy similar to the one noted in the previous example, using a stepwise approach and adding new limits based on production tonnage for tightening up emission limit values. The permit renewal in 1993 allowed for the introduction of more stringent limits for total P and COD_{CR} and limits per tonne produced (10 g/t and 5 kg/t respectively). The major in-plant changes and improved wastewater treatment techniques enabled the operator to augment its production rate while keeping pollutant releases well below established permit limits.

4.2.3 Handling non-compliance issues and reinforcing environmental improvements

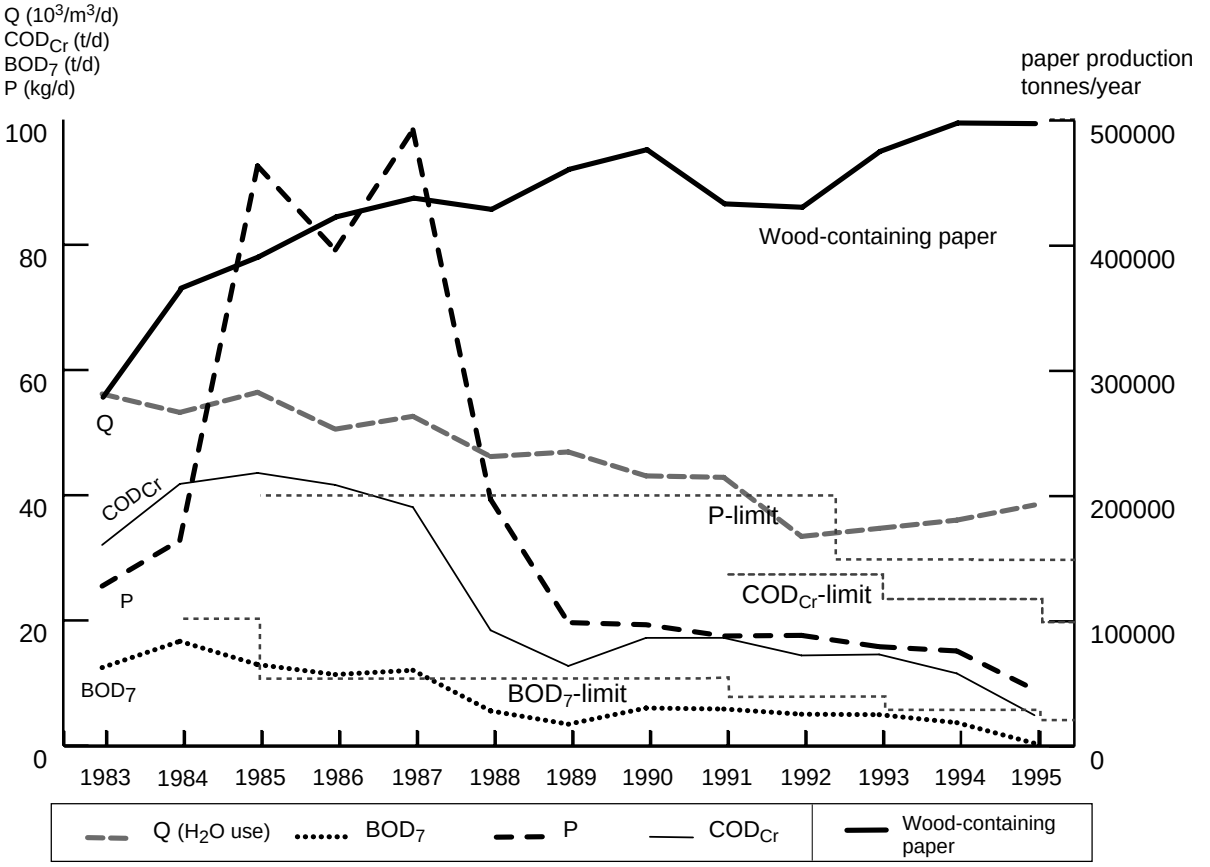
The third example involves the introduction of one of the first activated sludge treatment plants within the pulp and paper sector. Wood-based production capacities for paper pulp stood at 560 000 tonnes annually, while capacity for mechanical pulp was 480 000 tonnes per year respectively. The design and operation of the treatment plant was not adequate to the production

volume, and there were severe problems in operating it. As a result, the facility could not meet ELVs for phosphorus and biological oxygen demand (BOD) during the years 1985-1987 (Figure 12).

As a result of non-compliance with established pollution limits in the 1982 permit, a court case was undertaken by the authority. The enterprise viewed the court case as unproductive and increasing the burden rather than promoting research and development activities to solve the problems. Nevertheless, the operator was able to significantly reduce pollutant releases well in advance of the 1991 application of the current permit, which contained tighter ELVs (Figure 12). The improvements were achieved mainly by increasing the capacity of activated sludge treatment plants (two activated sludge plants were added to the existing one) and improving operating practices. Pollutant releases were reduced well below set permit limits.

Following major in-plant changes (the installation of a new paper machine in 1982 and shut-down of the old paper machine in 1983, transition to peroxide bleaching in 1995), the mill was able to increase its production volume while decreasing, at the same time, pollutant releases for BOD_7, COD_{CR} and phosphorus as well as its water consumption. In addition, lessons learned from designing and operating activated sludge treatment plants were shared within the Finnish pulp and paper industry, therefore contributing to an improvement of environmental quality throughout the country.

Figure 12. **Achieving compliance through enforcement**



4.2.4 Lessons learned

The review of permit samples shows that the selection of permitting strategies and related requirements is influenced by different factors:

-- the degree of uncertainty regarding certain environmental threats and related "best" available technology, for example, the appropriate degree of avoidance or control of persistent toxics or the relative merits of precautionary approaches versus approaches recognising the dilution capacity of the environment;

-- contingent environmental aspects, e.g. inclusion of particular characteristics of local environments into permitting conditions;

-- social aspects, for example, the compliance records of the operator;

-- national goals and targets; and

-- industry's research and development activities and technical development.

As the permit review showed, the learning process reflected in new policy approaches usually begins with the practical experience and judgements of permit negotiators working with specific information concerning the plant under review. Since policy development is to a significant degree based on this practical learning process, the way permitting strategies are applied is subject to constant evolution. The main features of the permit approaches supporting this trend, based on the above examples, are described below.

-- The similarities between emission limit values (taking into consideration differences between the types of production facilities and resulting environmental impacts) indicate that technology-based considerations are first used to establish pollution limits. If necessary, more stringent limits and/or additional conditions may be set according to local circumstances, as in the case of the mill located by a small stream;

-- The data on discharges at other mills within and outside the country, as well as knowledge on how emission levels were achieved, have helped the authority set up-to-date, far-sighted permit requirements. As such, plant-by-plant investigations represent an effective way of collecting information and knowledge on environmental performance and corresponding techniques and industrial practices. Lessons learned from proper design and operation of the activated sludge treatment plant at one of the mills under review have helped improve the environmental performance of other Finnish mills. Thus, the case provides a prime example of effective use of case-by-case permitting in promoting continuous improvement of pollution prevention and control;

-- A stepwise approach for tightening limit values appears to be a proven method for allowing additional time to the operator for complying with upcoming requirements;

-- There are several ways of designing permit conditions and ELVs that allow permitting authorities to provide more flexibility to the operator while ensuring that properly stringent requirements are set. The fact that regulations are not fully harmonised within the sector also keeps the permitting bodies alert in their search for new solutions to address ongoing and emerging problems. For instance, in two of the three examples,

new limits for total phosphorus and COD_{CR} per tonnage of production were added to existing ELVs based on tonnage per day, ensuring that plants are properly run even during low production periods;

-- Self-monitoring and independent compliance checks as well as impact monitoring are key issues for assessing the environmental performance of plants and identifying environmental issues of concerns;

-- In the three examples, the period of negotiation related to the collection of information for the application and before new permit conditions came into force provided the operators with time to adapt to upcoming requirements. As illustrated in Figures 10, 11 and 12, most discharges were reduced far beyond set ELVs, as measures were implemented well before new permit conditions came into force.

Furthermore, the review of the permit samples demonstrates that the use of a generic instrument such as BAT-based requirements helps permitting authorities set far-sighted, progressively tighter performance standards. It also encourages dialogue between regulatory authorities and the industry in defining environmental targets. Finally, it ensures that permitting strategies adapt to evolving and complex environmental and technical issues as well as to national and international developments, keeping abreast of technological improvements and developments in environmental science and technical research and development.

The relationship between permitting requirements and industrial technological response is complex. It is influenced by the mix of policy instruments employed, how they come into play in the permitting process, and the reliability of monitoring and enforcement programmes for ensuring compliance and environmental results. Data on discharges of national and foreign industries are important as well as knowledge on how current emission levels are achieved. As such, BAT notes drafted nationally or jointly by contracting parties to regional conventions have proven to be effective tools for providing guidance to national permitting programmes. Nevertheless, these guidance notes may be obsolete and do not consider local conditions; each state or region must adapt them to their own situation, thereby contributing to the ongoing updating of BAT notes at the international level. Plant-by-plant investigations initiated by the permitting system are therefore essential factors for collecting data on technical possibilities. Indeed, the above examples show that monitoring frequently enough to reveal fluctuations in discharges is highly important for accurate assessments of environmental performance and for identifying priority areas for future work and technical R&D.

It is now generally recognised that there is often a positive correlation between efficiency of resource-use and pollution abatement (Finnish Ministry of the Environment, 1997). However, there is still a long way to go before current production and consumption patterns will become environmentally sustainable. Improvements in environmental performance of facilities are likely to be achieved in small increments. Even so, this approach may often lead to considerable changes in overall environmental impacts. The complex interface between industrial activities and environmental quality provides an additional argument for the critical importance of permitting programmes to monitor these changes. Likewise, careful analysis of past results and sharing of experience between countries may significantly contribute to the dissemination of effective, environmentally-sound strategies.

4.3 Strengths and limitations of permitting approaches

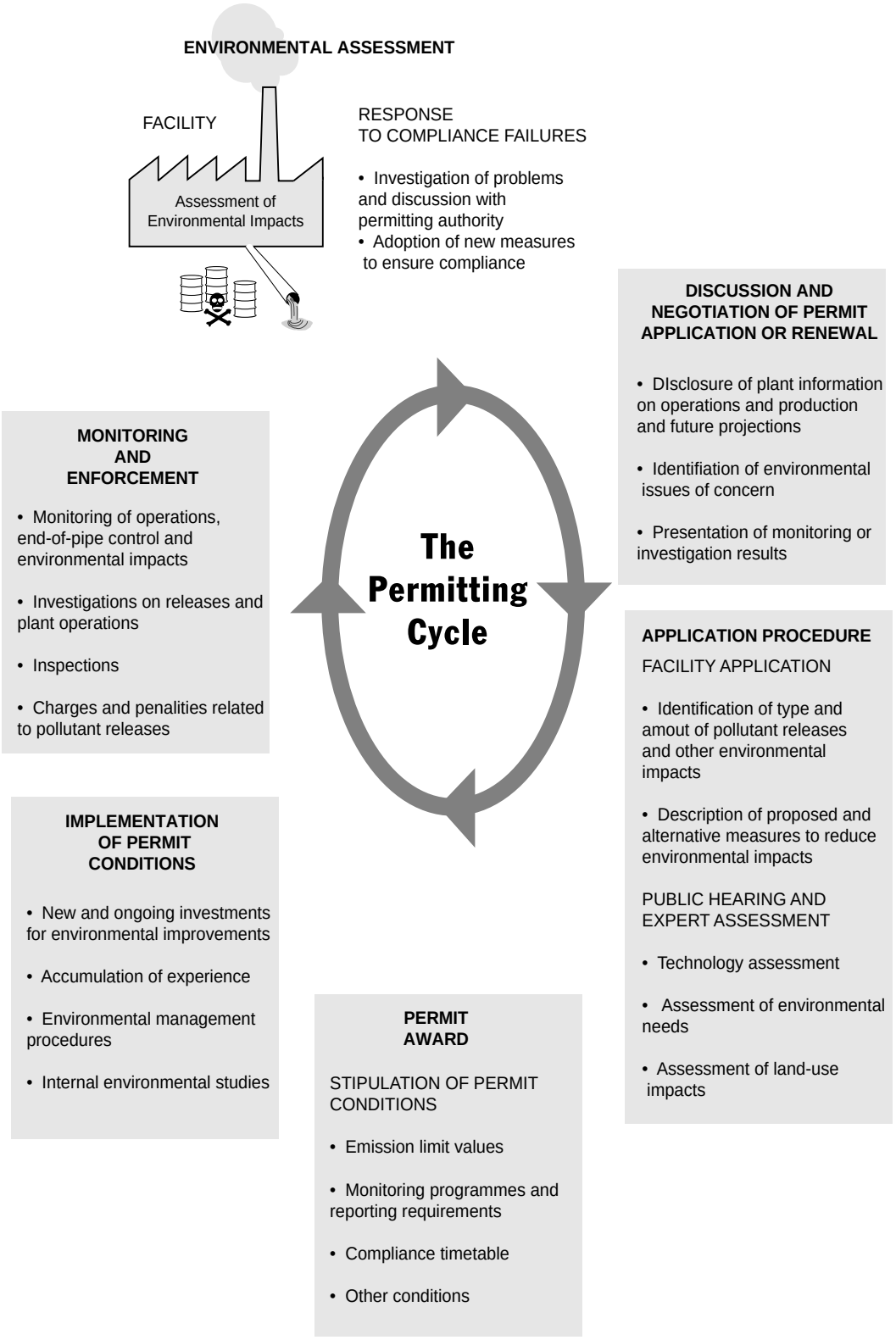
The examination of permit samples for different industrial sectors has demonstrated that the influence of permitting programmes reaches beyond processing permits. If properly administered and enforced, the permitting procedure can be a continuous policy process enabling all involved parties to contribute to improving social understanding of the environmental issues to be addressed and the solutions to be implemented. As illustrated in Figure 13, the permitting system should be thought of as a dynamic, ongoing process, rather than a merely administrative procedure for obtaining an authorisation. In this context, initiatives such as public performance permitting in the United States or the multi-stakeholder approach adopted in the framework of the EU IPPC Directive, are important steps in the right direction. The same holds true for public initiatives aiming at the involvement of the public in permitting decisions.

Nevertheless, many questions remain regarding the adequacy and scope of current regulatory approaches. Permitting systems in OECD Member countries primarily address large point sources, whereas pollution from small and medium sized enterprises and diffuse point sources are not always fully addressed. Permitting in small and medium enterprises remains a mechanism for addressing site-specific issues, and at present is often unadapted to linking these issues to more life-cycle oriented policies or policies that address larger geographic areas. Generally speaking, conventional permitting has not dealt with issues upstream or downstream of the production process (i.e. material and energy supply or use and disposal of products).

Scientific advances and the improvement of environmental monitoring have also revealed the limitations of media-specific pollution control strategies in coping with chronic effects of numerous toxic trace pollutants, such as highly bioaccumulative, persistent substances, the transfer of pollution across media, the failure of the dilution/dispersal approach for regulating hazardous compounds, and the environmental trade-offs associated with end-of-pipe and toxic waste treatment techniques.

To better reflect the diffuse, spread-out and dynamic nature of environmental problems, permitting systems need to establish active links with other policy instruments so as to create a more conducive setting for long-term technological and managerial innovation and foster spontaneous prevention strategies, both within and around a particular industrial process (e.g. upstream or downstream). Permit requirements must also be set within the framework of more comprehensive considerations, all the way up to the global level.

Figure 13. **The environmental permitting cycle for industrial facilities**



Chapter 5:

KEY ISSUES FOR IMPROVING ENVIRONMENTAL PERMITTING

More than thirty years of experience have shown that pollution prevention can be actively promoted through environmental permitting. Permitting remains a basic tool for preventing and controlling pollution from point sources, both to maintain emission reductions and to bring about further improvements. However, there are some major challenges that need to be addressed in order to respond to current problems and move towards attaining long-term environmental objectives. The design and operation of permitting systems and permits need to be further improved so as to: (a) be consistent with the dynamics of environmental quality and technological change for those sources that are already subject to permitting; and (b) if needed, by complementary use of environmental policy instruments, to address the challenges posed by activities that have not yet been subjected to permitting requirements. The following sections address these strategic issues and suggest measures that can contribute to a forward-looking environmental permitting system.

5.1 Increasing the effectiveness of permitting systems

5.1.1 Improving permitting procedures

The design of forward-looking and cost-efficient permits will have to be tailored to site-specific conditions. Flexible, broader and more integrated permits must take into account site-specific and process-specific considerations, in particular, they must possess the following attributes:

-- a system for structuring expert judgement and guiding permitting decisions (i.e. a more comprehensive methodology such as BPEO and detailed guidelines based on BAT [e.g. the BREFs under the EU IPPC Directive]);

-- co-ordination, training and reliability of permitting decision-makers and related staffs (permit writers, technicians, inspectors, etc.);

-- indisputable transparency of the decision-making process and performance evaluation, since transparency is critical when case-specific factors influence the permitting decision;

-- the adoption of long-term environmental goals and related monitoring programmes linked to permitting schemes at plant level;

-- linkages with other policies to reduce the pollution burden from non-licensed facilities or activities (multisource management);

-- improved data collection and assessment (such as LCA, EIA and PRTR);

-- links with other pollution prevention and control instruments (EMS schemes, e.g. EMAS, ISO 14000), economic instruments, voluntary agreements, long-term targets and reduction plans); and

-- a multi-layered system of interrelated requirements and its evaluation over time: more specific requirements may be added on top of less specific requirements, themselves imposed on top of minimum base performance standards, as the case warrants.

A example of one country's efforts to improve the performance of permitting is discussed in Box 8, below.

Box 8. **Improving the performance of environmental permitting: the United States' experience**

Over the past 25 years, the US EPA has been striving to improve regulatory approaches to protect the environment. One of the most successful methods has been its programme requiring industrial and municipal facilities to obtain permits which establish conditions to control pollutant releases to the air, land and water. The implementation of permitting programmes such as New Source Review for air emissions, National Pollutant Discharge Elimination System for water discharges and the Resource Conservation and Recovery Act for hazardous waste management has led to a significant reduction of environmental and public health hazards as well as providing signals to industry to seek new and innovative ways of producing goods and services through environmentally-sound operations. But the ongoing environmental challenge requires both qualitative and quantitative policy changes. Considering other factors, i.e. economic pressures, social justice and competitiveness, the demand is increasingly for more environmental protection at less cost. This requirement has prompted the US EPA to take a strong look at "both the philosophy and practice of its permitting systems, to determine how they can be made to function more effectively while at the same time decreasing costs for environmental agencies and the regulated community" (US EPA, 1996).

This ongoing trend towards improving permitting approaches in the United States has been characterised by the emerging concept of public performance-based permitting. This approach is based on two governing notions:

- the development of performance levels to be required from operators; and
- providing the public with the necessary information so that they can monitor the performance of permitted facilities.

In other words, the objective of this approach is to shift the focus of permitting towards the measurement and assurance of environmental performance while providing more flexibility as to how the industry will comply with the new requirements. Furthermore, the monitoring of performance is increasingly extended in the public arena, including the right of the public to participate in standard-setting and measurement of performance.

This approach is likely to necessitate policy and regulatory changes -- for example, developing innovative permits which will integrate these ideas -- that are expected to significantly improve the operations and performance of permitting systems.

5.1.2 Improving the effectiveness of BAT and EQOs approaches

-- The combined use of technology-based and environmentally-based approaches is a prerequisite to identifying and setting efficient permit requirements;

-- Technology-based requirements appear to be a common, immediate driving force for decisions, but they are themselves driven by the requirement that environmental quality be preserved at some agreed level. Where the pollution burden is unacceptable, unsatisfactory performance rates should lead to forced shutdowns or scale-backs of operations. Conversely, where the quality of the environment is deemed acceptable with regard to some specific substance, BAT-based provisions must secure the appropriate level of protection;

-- The general rule concerning the use of technology-based and environmentally-based requirements is that appropriate emission/discharge limit values are enforced, possibly derived from some BAT-based review. However, from environmental, technological or economic points of view, BAT provisions need not necessarily be the only driving force for making improvements. Additional requirements are to be negotiated to ensure that: (i) licensed processes achieve the best performance beyond current standards, (ii) quality objectives of receiving environments, however defined, are addressed, and (iii) the facility performance is consistent with the limiting capacity of the environment and what the sector can bear.

5.1.3 Long-term goal setting

-- While short-term BAT requirements may be driven by necessity, the attainment of long-term objectives is dependent upon forward-looking policy planning. Permitting must be construed less as a set of requirements that have to be met to ensure compliance and more as a setting conducive to sustained, dynamic innovation and environmental performance;

-- While EQSs need to be complied with in the short term, long-term goals for improving the quality of a local environment need to be factored into permit conditions;

-- Through careful, long-term planning, permitting may evolve from a purely administrative procedure into a comprehensive and forward-looking system for decision-making. In this perspective, permitting must strive to achieve a triple goal: (a) providing clear indications on short- and long-term objectives; (b) providing adequate flexibility for innovators; (c) ensuring that a minimum binding standard is enforced so as to pick up those lagging behind and preserve a level playing field from an economic standpoint.

5.2 Improving environmental cost accounting for industrial facilities

Current accounting systems need to be modified so as to bring to light the cost-effective opportunities for environmental improvements that many traditional policies pass over. Environmentally-oriented cost accounting systems have many benefits in this regard (see Box 9).

They contribute to increasing knowledge of material and energy flows in a given industrial process. They help identify the quantity and type of waste streams, thus allowing better management of treatment and disposal costs. They increase operator awareness of available effluent and waste prevention techniques. They can also provide guidance and prioritisation schedules for pollution prevention and control policies by generating environmentally-oriented cost indices. In addition, environmentally-oriented cost accounting systems are an integral part of the environmental management systems which are increasingly complementing conventional permitting approaches, especially for large firms.

Box 9. **Main advantages of environmentally-oriented cost accounting systems**

1. **Increasing awareness and knowledge in determining material and energy flows, including:**

   - Ensuring that CO_2 emissions, which may lead to considerable future emission costs, are being addressed and reduced cost effectively;
   - Improving knowledge regarding material and energy content of different waste streams to avoid rising costs for treatment and disposal of waste;
   - Improving knowledge of the amount and type of wastewater generated to identify sources and prevention possibilities as well as their cost effectiveness, and consequently, limiting or even lowering the rising costs of wastewater treatment.

2. **The use of environmental criteria as steering tools in cost calculations and budgeting can be assessed with a view to creating an environment-oriented financial management system.**

3. **Such a system may be supplemented by environmentally-oriented cost indices, e.g.:**

   - Proportion of environmental protection costs relative to total costs or production costs;
   - Ratio of environment investment to current environmental protection costs;
   - Proportion/shares of various environmental protection costs (for waste, water, air emissions)

4. **Determination of material and energy-related indicators and indices:**

   - Costs per production unit of avoided environmental pollution;
   - Amount of material and energy used per unit of output;
   - Amount of waste, wastewater and air emissions generated per unit of output.

5. **An environmentally-oriented cost accounting system can be an important pillar of an effective environmental management system as defined by EMAS or ISO 14000.**

6. **Environmentally-oriented cost accounting is an important contribution to sustainable development**

Source: BMU, 1996.

5.3 Extending the scope of integrated permitting systems

The move toward integration will involve the careful application of ongoing practical experience and learning in the field as regulatory authorities and industry begin to integrate several factors both upstream and downstream of their immediate concerns in addressing environmental issues (e.g. implementing methodologies and indicators to deal with cross-media issues). Several OECD Member countries have enacted new laws aimed at promoting integrated pollution prevention and control approaches, particularly EU Member states, which must implement the IPPC Directive in their national framework. Many other countries have adopted programmes which implement several principles of an integrated approach, such as voluntary agreements covering substance use, regional initiatives addressing multiple sources, life-cycle strategies and instruments for increasing knowledge of pollution prevention opportunities, to name just a few. Combining permitting programmes with other policy instruments, such as area-wide strategies, cluster approaches, and product policies is likely to be the most efficient approach for accelerating the move towards integrated environmental strategies.

The integration of different media (air, water and land) into a single permit is expected to have a very positive effect on the technological response of industrial point sources. An integrated permit would compel facilities to move beyond single-media, end-of-pipe thinking towards a more thorough assessment of total environmental impacts. In turn, a better understanding of the industry life-cycle is more likely to lead to cost-efficient, preventative techniques and measures. Likewise, at the policy level, an integrated approach should facilitate the consideration of all environmental aspects of production and consumption patterns, and other activities related to industrial facilities. This will facilitate the involvement of other key players along the industry life-cycle, such as material and equipment suppliers, thereby promoting the development of pollution prevention approaches upstream and downstream of industrial processes through more efficient, forward-looking permit requirements.

5.4 Fostering technological innovation

It was acknowledged that in many circumstances, permitting systems provide static and limited solutions to what are increasingly dynamic, fluid and interconnected issues. By definition, permits grant the enterprise permission to operate according to specific requirements covering an agreed set of environmental issues for a given amount of time. This approach was appropriate for realising the initial, substantial reduction in pollution that took place in OECD countries over the last generation, but remains limited for fine-tuning policies according to fundamental technological and economic development. In this connection, there is a recognised need to better define the relationship between short-term requirements and long-term goals for a sustainable future. The effectiveness of policy planning is largely dependent upon the ability of countries to produce and apply technological solutions for environmental purposes. A major issue in that regard involves the incorporation of technological change and consumption patterns into the permitting process. [10]

Performance-based ELVs are generally regarded as a fundamental means to allow facility operators to choose the best methods of compliance while favouring technological innovation. Supporting the ongoing development of technological innovation and promoting further

---

[10] The current size of the global environmental market has been estimated at between $200 billion and $300 billion per year. Variations are related to differences in definitions and data (Papameletiou, 1995).

improvement requires a variety of approaches such as taking into account the economic cycles of industry and rewarding plant operators who develop innovative approaches for preventing harmful releases. Efficient policies for reducing environmental risks also require a careful assessment of the different factors involved. This assessment must be based on some measure of environmental results, whether it is a question of measurements of pollutant concentrations or of quantifications of benefits to human health and environmental quality. Permitting must ensure good environmental performance, not compliance for its own sake. An important step is developing monitoring programmes which can provide an accurate picture of the concrete environmental results expected from prescribed measures. Likewise, accounting systems capable of better identifying the cost savings which might result from implementation of environmental protection measures need to be developed.

Most countries have indicated that some form of assistance for environmental improvements is provided to industry, mainly in the form of support for research into new technologies. Otherwise, state assistance is generally limited to the provision of information and guidance. Within the European Union, state assistance is allowed under specific circumstances for investments relating to economic expansion or for environmental purposes. The relevant criteria are that the project should involve:

- going beyond legally binding EQOs;
- the adaptation of existing plants (operating for at least two years before the new legislation came into force) to new standards;
- investments aimed at the rational use of energy or improvement of processes;
- exceptional investments aimed at considerable savings or recycling of raw materials with a demonstrable positive effect on the environment;
- exceptional investments aimed at the improvement, in terms of the environment, of the quality or durability of products; or
- exceptional investments aimed at the improvement of fire safety, product safety and worker safety in production processes.

There is also a growing interest among OECD countries in defining environmentally-oriented procurement guidelines in order to take full advantage of the enormous public expenditures for promoting and supporting “green” technologies and products.

5.5 The critical role of public involvement

Systematic provision for public involvement in the permitting process is the keystone of an effective programme. The short and long-term questions affecting environmental quality, full access to amenities, and the conservation of biodiversity are matters of public decision. Permitting programmes must first of all operate within a sound regulatory framework, but experience has shown that the implementation and enforcement of permit requirements is dependent upon the public’s access to information and participation in the decision-making process. This is particularly true for encouraging facilities to take steps that go beyond the minimum acceptable abatement measures, and for bringing local and global concerns to bear upon the permitting process.

Informational instruments, such as Pollutant Release and Transfer Registers (PRTRs), are emerging as a central element of pollution prevention and control initiatives through the public accountability of the environmental performance of industrial facilities. Effective public participation and leadership in the environmental field is dependent upon reliable and transparent mechanisms for pollution monitoring and compliance data. As such, an immediate challenge is to develop environmental registers for an integrated assessment of the cross-media effects of anthropogenic activities and pollution.

Chapter 6:

CONCLUSIONS AND RECOMMENDATIONS

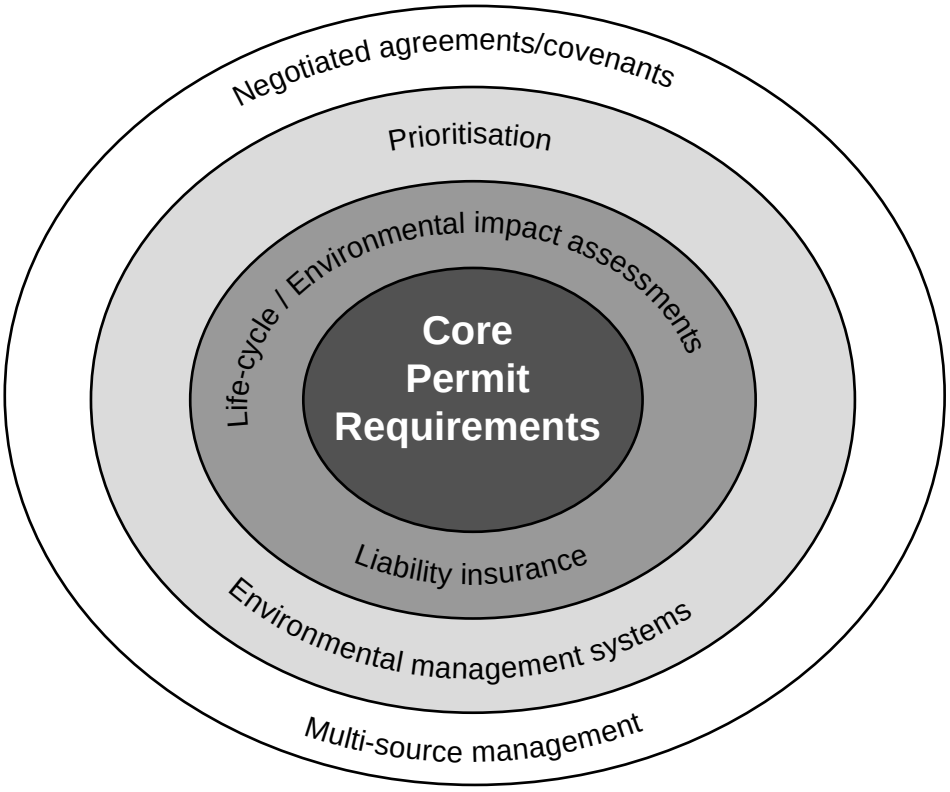
6.1 Objectives and achievements of the permitting process

Environmental requirements for industrial permitting have one prime objective: to ensure an environmentally sound operation of the permitted facility. As government-sanctioned tools for pollution prevention and control, permits have undeniable advantages in terms of legitimacy and transparency, especially by comparison with voluntary or incentive-based instruments. It is recognised that permitting requirements have played a major role in the pollution reductions achieved at point sources over the past two decades. Therefore, permitting programmes still represent a central policy strategy for preventing and controlling pollution, both to preserve the achievements in pollution prevention and control and to bring about further reductions. If properly administered, the implementation of ELVs and EQOs through permitting mechanisms can contribute to the protection of human health and the environment while simultaneously helping to preserve conditions of fair economic competition.

However, as growth progresses and industrial activities increase in volume, continuous improvements in environmental performance will be necessary to keep reducing pollution in the face of the growing number of sources. This will require efforts on the level of national and international environmental programmes, but also depends upon a successful search for solutions by individual facilities and environmental personnel at the lower levels of government agencies. The incorporation of ecological, technological, economic and social parameters in permitting decisions is a difficult problem which is often best resolved by pragmatic, case-by-case decisions and compromises.

Permitting authorities should move to ensure that permit requirements keep pace with the growing public awareness of global environmental issues. Accordingly, permits should be able to control several dimensions and integrate a growing number of criteria (see Figure 14). For maximum effectiveness and cost-efficiency, they should combine fixed environmental standards with supplementary requirements (e.g. reduction or elimination of emissions of toxic substances), as warranted by a particular situation.

Figure 14. **Extending permitting**



In this context, there is growing evidence for the need to revise and improve some of the main tools associated with environmental permitting. The assessment of current permitting systems and practices in OECD Member countries indicates a clear trend towards developing new policies and practical approaches. The search for new approaches is fuelled by a significant consensus on many of the key issues and shortcomings associated with current environmental permitting. In the face of increasingly complex situations where ecological, technological and economic considerations interfere, environmental permitting needs to offer enough flexibility for the development of more comprehensive and innovative approaches while at the same time setting effective safeguards against reckless abuse of the environment. The design and operation of permitting systems needs to be further improved so as to adapt to the changes in environmental quality and technology for those sources that are already subject to permitting. The challenge is to take the environmental permitting process beyond the level of purely administrative decisions so that the granting of permits can contribute in a co-ordinated way to a policy mix that favours continuous technical innovation and improved environmental performance.

6.2 Strengthening the links with other policy instruments

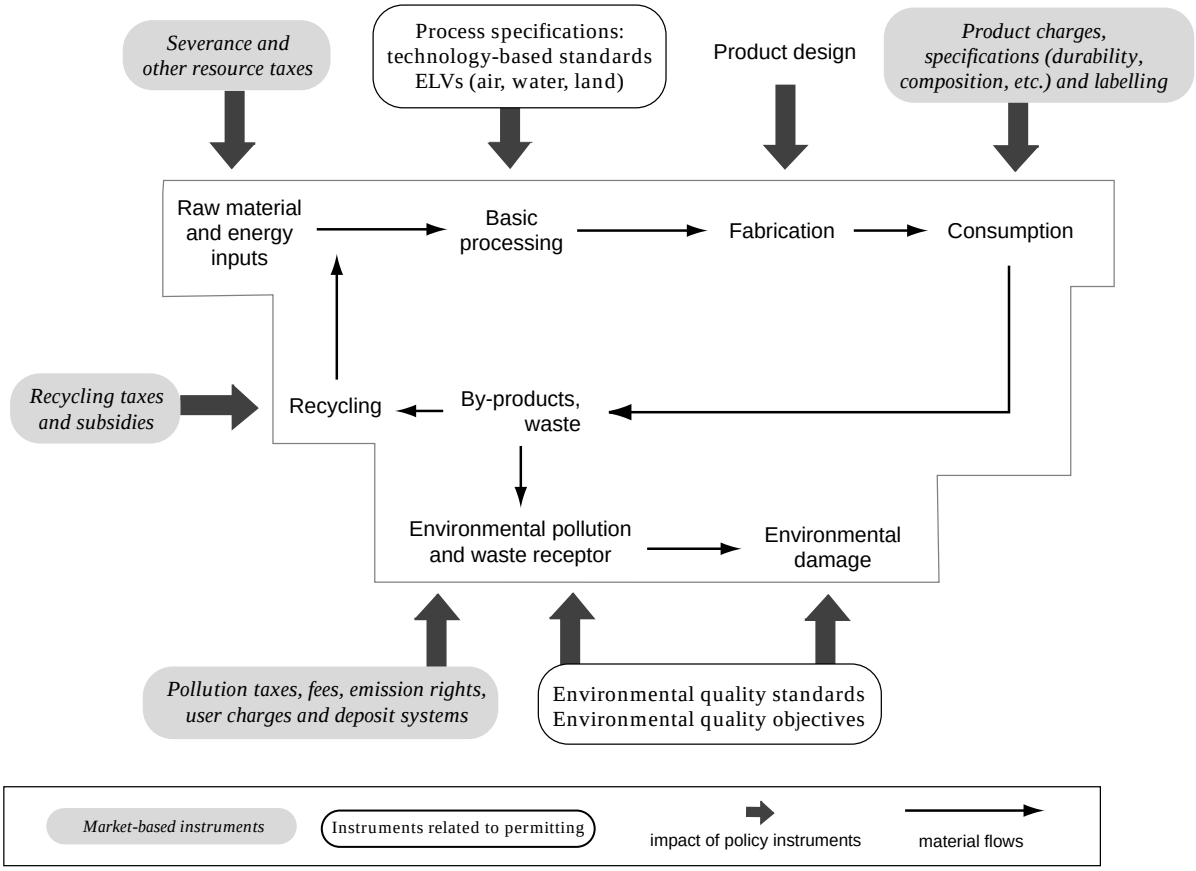
Permitting systems do not operate in isolation. The quality of permitting decisions depends upon a country's overall system of environmental standards and objectives, and upon the quality of the environmental assessments upon which they are based. They also depend upon a government's ability to elicit information about and assess technological developments. For the administration of permitting systems to be brought in line with the changing nature of environmental challenges, specific environmental and technological standards and objectives should continue to be reflected in the core of permit requirements. Moreover, their combined use is necessary to avoid the pitfalls of scientific uncertainty and technological cycles.

The development of a more pragmatic approach to address the issue of the scope of permitting, as well as the relationship between short-term and long-term conditions, will not be simple. It will depend upon how different circumstances are analysed, such as economic growth rates, the nature of industrial development and the associated pressures on the environment. Permitting strategies should be devised and implemented so as to fully benefit from the interaction with the ongoing development of new policy instruments (i.e. LCA, EMAS, discharge fees, green taxes, etc.). The incorporation of other policy instruments into permitting strategies has been experimented with in some countries. This has allowed the impact of permitting to extend beyond its immediate, limited boundaries. In some OECD countries, government authorities have had some experience de-emphasising traditional permit requirements in licensing procedures, focusing instead on environmental quality and technology-based standard-setting and assessment of environmental performance. This approach seeks to incorporate long-term environmental objectives into quantified reduction targets for substances and products through negotiated environmental agreements. The growing interest in voluntary agreements (VAs) is generally related to the recognition that the objective of sustainable development patterns requires a package of different types of complementary policy instruments, involving both command-and-control and voluntary instruments. A key feature of VAs is to trigger positive industry actions and break the pattern of private-sector reaction to regulations. In due course, the willingness of sectors of industry to negotiate agreements with public authorities on emission reduction targets, product improvements, waste minimisation and recycling goals, etc., in advance of regulations may allow for simplified permitting schemes, less burdensome administrative procedures and greater flexibility in the selection and development of cost effective means for reaching environmental objectives.

Indeed, environmental issues such as global warming, acid rain and depletion of natural resources, which involve a high degree of economic, scientific and technological uncertainty, often require a more flexible approach than prescriptive regulations. However, environmental agreements should not be used as a means for deregulation, but rather as implementation tools and elements of wider policy strategies. Effective strategies must be based on quantified environmental objectives and related monitoring and reporting of results. Recently, in many countries, VAs have been negotiated for emission targets and EQOs have been implemented in the fields of noise, water and air quality, waste reduction, recovery or recycling, and for energy efficiency. This approach, however, may not be suitable for every source and type of industrial pollution. Permitting schemes must simultaneously ensure that polluters who would not normally have the will or means to amend their ways abide by certain basic requirements. Likewise, contracting parties to VAs must take into account the possibility that "free riders" may take competitive advantages from the charges imposed on the industries involved in the agreements. In this context, the implications of VAs must be assessed on a case-by-case basis to ensure that appropriate measures (e.g. threat of new legislation, economic and administrative incentives to participants, etc.) will address these problems.

Thus, through policy mixing, links can be established between a permitted process and non-permissible activities, thus covering upstream or downstream issues pertinent to the targeted process (see Figure 15) (Pearce, 1990). In addition, liability for pollution occurring outside (upstream or downstream) of the production process can be incorporated into permitting through extended producer responsibility (EPR) mechanisms. Reduction plans and targets can be combined with permitting requirements. In conjunction with other economic instruments, environmental requirements can be designed and implemented so as to minimise negative competitive effects on industry and to take into account the specificity of sectors and environmental effects.

Figure 15. **Policy instruments for addressing material flows**



Source: adapted from Pearce, 1990.

6.3 The components of effective permitting policies

In the final analysis, dynamic, forward-looking permitting systems are based on four pillars: environmental science, available technology and techniques, economic considerations and public awareness.

-- As part of the permitting process, the collection, assessment and comparison of data on environmental quality helps prioritise key issues and provides the rationale for adopting reduction and prevention measures. Adequate comparison of data is dependent on harmonised measurement and statistical procedures within and across sectors.

-- Permits need to take into account the dynamic nature of technological change, encouraging plant operators and enterprises to go beyond mere compliance and apply innovative, environmentally-sound technologies and techniques.

-- Economic considerations contribute to the efficiency of permit decisions, but the limited nature of traditional economic assessment can prevent permits from providing clear, long-term signals to all economic actors in order to optimally allocate resources. A more dynamic and effective approach will require methodologies and indicators to assist authorities trying to incorporate economic considerations at various levels. The BAT concept, in which economic considerations are already incorporated, provides a good tool for permitting authorities in this regard. Finally:

-- Whatever the circumstances, the appropriate involvement of the public is an increasingly important factor of permitting. Public access to the permitting process must be comprehensive and systematic so as to ensure transparency and legitimacy. This is particularly critical for the surveillance of site-specific requirements. The use of informational instruments such as Pollutant Release and Transfer Registers and other disclosure mechanisms is a valuable tool in this regard.

In conclusion, environmental permitting programmes have proven to be a powerful instrument to address and reduce some of the environmental impacts of industrial point sources. As the complexity of environmental problems has increased, so have the scope of the of policy principles and strategies conceived to cope with them. By introducing a precautionary approach in the determination of environmental requirements, permitting strategies have contributed to the development of technical measures which prevent and eliminate pollution at source. By recognising pollution prevention as a top priority, permitting programmes have helped ensure that the best available techniques and technologies are identified and implemented and that environmental regulations do not interfere with fair competition between different enterprises and different countries.

However, as both the impacts and complexity of environmental issues are increasing, much remains to be done to achieve truly sustainable forms of economic development. Beyond the need to control the full material cycle of human activities, regulatory approaches and instruments must be designed so as to ensure that environmental needs and economic objectives are balanced.

The results from this study on environmental requirements for industrial permitting have shown that this may be achieved by an optimal balance between environmental quality objectives and the development of eco-efficiency techniques. In addition, there is a need to better define the relationship between short-term needs (whether based on environmental or economic objectives) and

long-term goals for a sustainable future. OECD Member countries must ensure that environmental standards and objectives will drive the development of innovative techniques and technologies towards continually better protection of the environment and efficient use of natural resources.

The review of permitting approaches and instruments pursued in this study has demonstrated the creativity of Member countries in coming up with innovative, forward-looking solutions to environmental problems. The review of permit samples has further shown that the achievement of environmental objectives depends on a comprehensive and transparent policy process involving the ensemble of relevant actors in the pursuit of ambitious social goals. The pursuit of measures to increase information exchange and mutual understanding of the various experiences in OECD Member countries should be encouraged to add momentum to this ongoing process.

REFERENCES

ANGULO, F. (1995), "Implications of the Globalisation Process in the Metallurgical Industry", *First Global Consultation on Environmental Management in the Metallurgical Industry*, UNIDO, Vienna, 16-18 October.

BMU; Bundesministerium für Umwelt, Natur und Reaktorsicherheit (German Federal Environmental Agency) (1996), *Kosteneinsparungen durch Umweltschutz? Handbuch Umweltkostenrechnung*, ed. Bundesumweltministerium und Umweltbundesamt, Verlag Franz Vahlen GmbH, München.

EC; European Commission DG XI and Danish Environmental Protection Agency (1997), "Study on Pollution from Industries Not Covered by the IPPC Directive", Final report, November 1997, Brussels, Belgium.

Finnish Ministry of the Environment (1997), "The Finnish Background Report for the EC Documentation of Best Available Techniques for Pulp and Paper Industry", Ministry of the Environment, Helsinki, p. 136.

HARRIS, H.J. *et al*. (1990), "Ecotoxicology and ecosystem integrity: The Great Lakes examined", *Environmental Science and Technology*, May 1990.

IER: *International Environment Reporter* (1996), "Commission Preparing Legislation Similar to IPPC for Small, Medium-Sized Enterprises", *International Environment Reporter*, October 16, 1996, page 917.

JACKSON, T. (1991), "The Principles of Clean Production", *Seminar on the Principles of Clean Production*, Stockholm, 23-24 April 1991.

LEVINE *et al*. (1995), "Efficient Use of Energy Utilizing High Technology", *World Energy Council*, London.

LUKEN, R.A. (1990), *Efficiency in Environmental Regulation: A Benefit-Cost Analysis of Three Approaches*, Kluwer-Nijhoff Publishing, Boston.

MIERHEIM, H. (1994), "Policies and Strategies on Hazardous Air Pollutants in Germany", *International Symposium on Hazardous Air Pollutants*, Tokyo, Japan, December 1994.

MIERHEIM, H. (1998), "The Role of Economic Considerations in Environmental Permitting", Proceedings of the OECD Workshop on Environmental Requirements for Industrial Permitting, May 1996, OECD, Paris.

OECD (1989), "Economic Instruments for Environmental Protection", OECD, Paris.

OECD (1993), “Advanced Emission Controls for Power Plants”, OECD, Paris.

OECD (1995), *Control of Hazardous Air Pollutants*, OECD, Paris.

OECD (1997), *The World in 2020: Towards a New Global Age*, OECD, Paris.

PALMER, K., OATES, W.E. and P.R. PORTNEY (1995), “Tightening Environmental Standards: The Benefit-Cost or the No-Cost Paradigm?”, *Journal of Economic Perspectives*, Vol. 9, No. 4, Fall 1995, pp. 119-131.

PAPAMELETIOU, D. (1995), “ Clean Production Technologies: Figuring Out Key Issues for the Future”, *IPTS Technology Watch Report*, Seville.

PEARCE, D.W. (1990), *Economics of Natural Resources and the Environment*, Harvester Wheatsheaf, United Kingdom.

PORTER, M.E. and C. Van der LINDE (1995), “Toward a New Conceptualisation of the Environment-Competitiveness Relationship”, *Journal of Economic Perspectives*, Vol. 9, No. 4, 1995, pp. 97-118.

TANA, J. and K.J. LEHTINEN (1996), “The Aquatic Environmental Impact of Pulping and Bleaching Operations: an Overview”, Finnish Environment Institute, Helsinki.

TIETENBERG, T. (1996), *Environmental and Natural Resource Economics*, Harper Collins College Publishers, United States, pp. 548-549.

US EPA (1996), “Final Draft of Concept Paper on Environmental Permitting and Task Force Recommendations”, US EPA Permits Improvement Team, Washington D.C.

Van DUNNE, J. (1992), “Legal Issues Arising from the Rhine Contracts”, *Environmental Contracts and Covenants* (Conference Proceedings), Rotterdam, Netherlands.

WRI *et al*. (1997), *Resource Flows: The Material Basis of Industrial Economies*, World Resources Institute, Washington, D.C.

YAKOWITZ, H. (1995), “Assessing the Cost Effectiveness of Cleaner Production”, OECD/DNME Workshop, Paris, 13-14 November 1995.

OECD Workshop on the Use of Best Available Technologies and Environmental Quality Objectives (Paris, May 1996)

Policy Analysis:

-- *Environmental Requirements for Industrial Permitting: Approaches and Instruments*, OECD, Paris, 1999.

Sector Case Studies:

-- "Environmental Requirements for Industrial Permitting: Case Study on Pulp and Paper Sector", OECD, Paris, 1999.

-- "Environmental Requirements for Industrial Permitting: Case Study on Iron and Steel Sector", OECD, Paris, 1999.

Workshop Proceedings:

Proceedings of the OECD Workshop on the Use of Best Available Technologies and Environmental Quality Objectives, OECD, Paris, 1999.

Reference Guide:

Regulatory Approaches in OECD Countries, OECD, Paris, 1999.

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 1999 03 1 P) ISBN 92-64-16193-7 – No. 50526 1999

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 1999 03 1 P) ISBN 92-64-16193-7 – No. 50527 1999

OECD proceedings

Environmental Requirements for Industrial Permitting

Vol. 2 – OECD Workshop on the Use of Best Available Technologies and Environmental Quality Objectives, Paris, 9-11 May 1996

ENVIRONMENTAL REQUIREMENTS FOR INDUSTRIAL PERMITTING

Vol. 2

OECD Workshop
on the Use of Best Available Technologies
and Environmental Quality Objectives,
Paris, 9-11 May 1996

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

© OECD 1999
Permission to reproduce a portion of this work for non-commercial purposes or classroom use should be obtained through the Centre français d'exploitation du droit de copie (CFC), 20, rue des Grands-Augustins, 75006 Paris, France, Tel. (33-1) 44 07 47 70, Fax (33-1) 46 34 67 19, for every country except the United States. In the United States permission should be obtained through the Copyright Clearance Center, Customer Service, (508)750-8400, 222 Rosewood Drive, Danvers, MA 01923 USA, or CCC Online: http://www.copyright.com/. All other applications for permission to reproduce or translate all or part of this book should be made to OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France.

FOREWORD

The OECD project on Environmental Requirements for Industrial Permitting came at a time of heightened interest in new strategies and tools for improving the environmental performance of industrial sources, such as integrated approaches, life-cycle assessment, eco-management auditing schemes, and the expanded use of economic instruments and voluntary agreements in support of regulatory mechanisms. Accordingly, the project sought to review experiences with environmental permitting and suggest how various combinations of regulatory strategies may be applied to improve current approaches. It examined in particular the relationship between national permitting policies and resulting trends in control technologies and pollution prevention techniques used by industry to ensure compliance.

This report is Volume 2 of the project publications. It presents the proceedings of the OECD workshop on environmental permitting held in Paris on 9-11 May 1996, which brought together representatives of government and industry from more than 20 Member countries.

The project was carried out by collecting and analysing information on permitting approaches of various OECD Member countries. It included three distinct phases: (i) a survey of the permitting legislation, regulations and practices in OECD countries; (ii) the preparation of case studies in four industrial sectors (pulp and paper, metal finishing, oil refining, and iron and steel); and (iii) the international workshop on environmental permitting presented here.

The project publications come in three volumes covering each of these phases: Volume 1 contains the policy study of the entire project; Volume 2 includes the proceedings of the international workshop and the summaries of the sectoral case studies; and Volume 3 presents the results of the survey on regulatory approaches. The case studies on the iron and steel and the pulp and paper sectors include detailed country profiles, and therefore, are published as separate OECD documents. The results presented in the project publications reaffirmed the critical importance of environmental permitting for preventing and controlling pollution, and stressed its importance for further reducing pollution from industrial facilities.

The report is published on the responsibility of the Secretary-General of the OECD.

ACKNOWLEDGEMENTS

The OECD would like to acknowledge the important assistance and support provided by government officials and experts from OECD Member countries during the preparation of this report. The project was also supervised by the "BAT-EQO" Advisory Panel, which included Delegates to the Pollution Prevention and Control Group from the following participating countries: Karel de Brabander and Bruno de Kerckhove (Belgium), James Riordan (Canada), Robert Droop and Jan Suurland (Netherlands), Antero Honkasalo (Finland), Horst Mierheim (Germany), David Mottershead (United Kingdom), Rick Picardi (United States), and Leopoldo Rubinacci (European Commission). Valuable input was also obtained from experts participating in the OECD Workshop on Environmental Requirements for Industrial Permitting held in Paris in May 1996. The amount of information gathering, fact checking and updating necessary to produce the survey and analysis of permitting approaches for these countries was substantial, and a great number of specialists in Member country administrations were instrumental in helping ensure that this was done in a thorough and accurate manner.

The workshop proceedings were compiled and written by the Pollution Prevention and Control Division of the Environment Directorate. The main responsibility for this work rested with Alain Rajotte and Laurent Renevier, under the direction and editorial oversight of Peter Wiederkehr. Environment Canada, the Ministry of Environment of the Netherlands, and the Department of Environment of the United Kingdom, respectively, were responsible for carrying out the case studies on the pulp and paper, metal finishing, and oil refining sectors. Input, assistance and advice by past and present colleagues in the Environment Directorate are also acknowledged. Emily Neighbour, Freda O'Rourke and Lyndia Levasseur ably provided editing and logistical assistance. Layout and preparation of the final draft was provided by Blake Ferris, an independent consultant to the Environment Directorate.

The proceedings were revised and approved by OECD's Pollution Prevention and Control Group.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **11**

1. WORKSHOP KEYNOTE PRESENTATIONS **23**

ACHIEVING THE BEST FOR THE ENVIRONMENT AND FOR THE FUTURE
Dr. David Slater, Director, Pollution Prevention and Control, UK Environment Agency 25

ENVIRONMENTAL REQUIREMENTS FOR INDUSTRIAL PERMITTING
Dr. Jürgen A. Philipp, Federation of the German Industry and Thyssen Stahl AG 31

WHAT DOES THE ENVIRONMENT NEED FROM A PERMIT?
Ann Hillyer, West Coast Environmental Law Association, Canada 41

THE IPPC DIRECTIVE: IMPLEMENTATION AND ISSUES
Leopoldo Rubinacci, European Commission, DG XI, Brussels 49

2. PRESENTATION OF THE SECTORAL CASE STUDIES **53**

2.1 Iron and steel case study 54

Sector overview
Alain Rajotte, OECD Secretariat 54

ISSUING A PERMIT FOR A STEEL PLANT ON THE BASIS OF BAT-DRIVEN EMISSION LIMIT VALUES: A SWEDISH EXAMPLE
Hans Lannerblom (Swedish EPA)
Kjell Lundström (SSAB Oxelösund Ltd) 60

2.2 Metal finishing case study 64

Sector overview
Geertjan Smits, TEBODIN, the Netherlands 64

ISSUING PERMITS FOR SMEs OF THE METAL FINISHING INDUSTRY: A DUTCH EXAMPLE
Stephan Daamen (Dutch Water Board)
Hans Du Mortier (Association for Surface Finishing Techniques) 68

2.3 Oil refining case study 71

Sector overview
Christine Hemming, Chrysalis Environment Consulting, United Kingdom 71

ISSUING PERMITS FOR OIL REFINERIES ACCORDING TO THE "CONCENTRATION BUBBLE" CONCEPT: A BELGIAN EXAMPLE
Philemon Berckmoes, Esso Benelux 74

2.4 Pulp and paper case study 75

Sector overview
David Halliburton, Environment Canada 75

ISSUING PERMITS FOR PULP AND PAPER PLANTS IN A MORE SENSITIVE ENVIRONMENT: A CANADIAN EXAMPLE
Ian Mackenzie, Alberta's Standards Specialist, Canada 82

2.5 Outcome of the case study presentations 83

3. WORKSHOP SESSIONS 85

3.1 Session 1 – Combining BAT and EQO in permitting requirements 87

THE COMBINED USE OF TECHNOLOGY-BASED REQUIREMENTS AND ENVIRONMENTAL MEDIA REQUIREMENTS IN SETTING GOOD PERMIT CONDITIONS
Lex de Jonge, Ministry of Housing, Spatial Planning and Environment, the Netherlands 93

3.2 Session 2 – Achieving pollution prevention through permitting approaches 99

HOW CAN POLLUTION PREVENTION BE ACHIEVED MORE EFFECTIVELY THROUGH PERMITTING SYSTEM MECHANISMS?
Emelie Enckell-Sarkola, Finnish Environment Institute, Finland 105

3.3 Session 3 – Integrated permitting systems and approaches 111

THE SWEDISH INTEGRATED PERMITTING SYSTEM
Ulf Bjällås, National Licensing Board for Environment Protection, Sweden 115

3.4 Session 4 – Incorporating economic considerations into permitting decisions 124

THE ROLE OF ECONOMIC CONSIDERATIONS IN ENVIRONMENTAL PERMITTING
David Mottershead, Department of the Environment, United Kingdom
Dr. Horst Mierheim, Federal Environment Agency, Germany 129

3.5 Summary of discussions and recommendations 137

4. CLOSING SESSION: CONCLUSIONS ON WORKSHOP DISCUSSIONS 141

4.1 The limits of permitting systems 142
4.2 Remaining issues 143

ANNEXES : WORKSHOP PROGRAMME AND PARTICIPANT LIST..... 145

ABBREVIATIONS USED IN THIS REPORT

AOX:	adsorbable organic halogens
BAT:	best available technology/techniques
BREF:	BAT reference document
BATNEEC:	best available techniques not entailing excessive costs
BDT:	best demonstrated technology
BOD:	biological oxygen demand
BOD_7:	biological oxygen demand over 7 days
BPEO:	best practical environmental option
BPO:	best practicable option
CAA:	Clean Air Act (USA)
CEPA:	Canadian Environmental Protection Agency
COD:	chemical oxygen demand
CWA:	Clean Water Act (USA)
EAF:	electric arc furnace
EIA:	environmental impact assessment
ELV:	emission limit value
EMAS:	ecomanagement and audit scheme adopted by EU Council; requires specific reporting
EMS:	environmental management systems
EPA:	U. S. Environmental Protection Agency
EPR:	extended producer/product responsibility
EQO:	environmental quality objective
EQS:	environmental quality standard
EU:	European Union
HAPs:	hazardous air pollutants
HELCOM:	Helsinki Commission on the Protection of the Baltic Sea
IJC:	International Joint Commission on the Great Lakes
ICPR:	International Commission for the Protection of the River Rhine
ISO 14000:	the International Organisation for Standardisation's (ISO) voluntary environmental management scheme for industry
IPC:	Integrated Pollution Control Act (the United Kingdom)
IPPC:	Integrated Pollution Prevention and Control (EU Directive)
LAAPC:	Local Authority Air Pollution Control (the United Kingdom)
LCA:	life cycle assessment
LRTAP:	Convention on the Long-Range Transboundary Air Pollution
NGO:	non-governmental organisation
OSPARCOM:	Oslo and Paris Commission for the Protection of the North Sea and the North East Atlantic
PAH:	polycyclic aromatic hydrocarbons
PM_{10}:	particulate matter of 10 micron size
PRTR:	pollutant release and transfer registers
RCRA:	U.S. Resource Conservation and Recovery Act
SMEs:	small and medium-sized enterprises
SS:	suspended solids
TA Luft:	Technical Instruction on Air Pollution Control in Germany
TSP:	total suspended particles/particulates
UNEP:	United Nations Environmental Programme
UNIDO:	United Nations Industrial Development Organisation
US EPA:	United States Environmental Protection Agency
VLAREM I & II:	Flemish Implementation Decree (I & II) on Environmental Protection
VA:	voluntary agreement

EXECUTIVE SUMMARY

Background

In late 1993, the Pollution Prevention and Control Group (PPCG) of the OECD's Environment Policy Committee (EPOC) initiated a project on the use and implications of environmental and technological requirements for limiting harmful environmental releases from industrial sources.

The main objectives of the project were to:

— increase mutual understanding among Member countries of how environmental requirements for stationary sources are established and applied on the basis of technology evaluation and environmental quality objectives, particularly in industrial permitting decisions;

— review policies on the use of best available technologies/techniques (BAT), environmental quality objectives (EQOs) and standards (EQSs) with a view to developing policy recommendations for their combined use in the framework of environmental regulation and permitting; and

— promote more integrated and preventive approaches to environmental permitting of industrial facilities through the combined use of the BAT and EQO concepts, and the expanded use of clean production technologies and techniques.

The provision of permits to industrial facilities is a pillar of the regulatory process for controlling industrial pollution. The requirements included in permits are often based on an assessment of a range of technological options, but they may also be based on an appraisal of the local environment into which releases occur. The technological and environmental quality approach are best used together, in a complementary manner. Used in isolation, each approach has certain weaknesses.

The wave of environmental management that began in OECD countries in the early 1970s resulted in a number of important improvements. Reductions in the discharges and emissions of many polluting substances were significant. Nevertheless, further improvements will be necessary in order to meet environmental quality standards and longer-term sustainability objectives. Policy instruments require assessment to ensure that they are encouraging pollution prevention and technological innovation, and work together with other instruments to improve environmental performance over the whole life cycle of production and products. A new paradigm is emerging according to which effective regulatory action in the field of the environment is no longer regarded as a hindrance to economic development, but which on the contrary, can simultaneously improve both environmental and economic performance. As a prerequisite, the appropriate incentives should be developed and implemented, notably in the area of permit conditions.

The OECD's project on Environmental Requirements for Industrial Permitting provided the much-needed opportunity to examine the impact of industrial permitting policies. The first phase of

the project reviewed general policies and regulatory approaches for controlling pollution, focusing on the relationship of BAT and EQOs/EQSs in setting permit requirements. The survey of country policies provided general information on the use of both types of requirements within the permitting and regulation systems of the participating countries. To illustrate the case-by-case application of policies, case studies were carried out in four industrial sectors: iron and steel, metal finishing, oil refining, and pulp and paper. This second phase of the project sought to examine specific examples of the use of technology-based and environmental quality based requirements in permits and their implications for technological choices and environmental performance.

The programme culminated with the organisation of the international workshop on Environmental Requirements for Industrial Permitting which was held on 9-11 May 1996 at the OECD in Paris. This report presents the workshop proceedings. The workshop brought together nearly 100 government experts, regulators, permit writers, industry permit holders and other private sector representatives from OECD Member and Observer countries in Europe, North America and the Asia-Pacific region, representing a broad range of regulatory and permitting policies, practices and experiences. Workshop participants were given ample opportunity to exchange information and experiences on some of the key issues and questions that had been identified throughout the project.

Four key questions of strategic significance for the development and implementation of efficient environmental permitting strategies and requirements were addressed throughout the project:

1) *What is the most effective use of technology-based requirements and environmental quality objectives in permit conditions?*

Permit requirements based solely on either BAT or EQOs criteria may lead to sub-optimal environmental performance of permitted facilities or may entail unnecessary costs to achieve compliance. Nevertheless, countries always use some environmental or technological criteria as a basis for the establishment of permit conditions. Depending upon the environmental priorities in a given area or for a given facility, permit criteria may be based on different combinations of principles. Clarifying when and how these principles should be applied is an important prerequisite for ensuring optimal permitting procedures and requirements.

2) *How can pollution prevention be achieved more effectively through permitting mechanisms?*

The effectiveness of environmental requirements depends to a large degree upon three procedural steps: (a) the identification of environmental issues to be dealt with through the application procedure; (b) the adoption and implementation of emission limits for preventing and controlling harmful releases and/or activities to avoid degradation of environmental quality, including the timetable to reach compliance with the requirements; and (c) the negotiation of procedures such as monitoring programmes and environmental assessments to ensure compliance with permit requirements. Each of these steps was analysed during the project, with a view to providing new insights on the potential of permitting mechanisms to ensure environmental quality and contribute to continuous environmental improvements in industrial operations.

3) *What is the most appropriate approach for taking economic considerations into account in permitting or standards-setting procedures?*

Economic considerations affect permit requirements, both at the standards-setting and permitting stage. There are differences, however, in how and at what level of the process economic factors are taken into consideration. These discrepancies can have unintended effects on competitiveness both within and among countries. Moreover, economic considerations may lead to sub-optimum permit requirements due to conservative or otherwise inadequate cost accounting systems that neglect the influence of environmental factors on productivity and efficiency. More attention to this question is needed, especially regarding how better mutual understanding between permitting authorities and operators, increased transparency of decision-making processes, and clear guidelines from permitting authorities could substantially improve the effectiveness of environmental permitting.

4) *What are the challenges related to integrated permitting and how can these be met most effectively?*

Growing evidence shows that the traditional division of environmental regulations into distinct groups addressing pollution of water, air and land separately limits the effectiveness of environmental policies and fails to take full advantage of technological innovations. Many countries recognise the current administrative limitations and are now moving towards integrated permitting systems or mechanisms to address cross-media transfer and globalisation of pollution, irreversibility of environmental effects and other emerging problems. Throughout the project, selected countries' practices were assessed with a view to identifying the most appropriate strategies for accelerating the move toward integrated pollution prevention and control approaches.

These questions were at the core of the review effort throughout the various phases of the project. Accordingly, they are also discussed at length in the summary policy report which summarises the main findings of the industrial permitting project[1]. Readers interested in practical background information on the regulatory framework in which permitting decisions are taken can also turn to the Reference Guide on industrial permitting, another OECD publication which provides an overview of the laws, regulations, policies and practices governing permitting approaches in twenty Member countries[2].

Highlights and major findings from the workshop

The purpose of the international workshop on Environmental Requirements for Industrial Permitting was to provide a forum for the exchange of concrete information and experiences on the use of technological and ecological criteria, as well as on other major aspects of current regulatory approaches. The workshop participants also sought to examine the benefits and shortcomings of those practices in order to identify the best combination of instruments for setting permitting conditions. Considering the broad range of regulatory and permitting policies, practices and experiences of participants, the outcome of workshop discussions represent a significant step toward a mutual international understanding of the strengths and weaknesses of current environmental regulatory approaches. As such, the broad consensus which emerged from the workshop discussions illustrates the will of countries to move towards environmentally sustainable development paths. It further indicates the most critical issues which must be addressed in order to move toward this end.

---

[1] *Environmental Requirements for Industrial Permitting*, OECD, Paris, 1998.
[2] *Regulatory Approaches to Environmental Permitting in OECD Countries – A Reference Guide*, OECD, Paris, 1996.

The main findings and recommendations from the workshop discussions, and were subsequently discussed and approved by the PPCG, and are presented below. They fall into four broad categories:

— the general purpose and effectiveness of permitting systems;

— the forces that govern permitting decisions;

— the opportunities for increasing the effectiveness of permitting systems and approaches;

— the limits of permitting systems.

General conclusions

Workshop participants reached a high level of consensus regarding the effectiveness of permitting systems used in OECD Member countries. They recognised the critical role of permitting in implementing pollution prevention and control efforts and underlined the need for permitting approaches to evolve. Specifically, participants agreed that:

— There is a general view that permit systems have been highly effective in achieving substantial reductions in emissions and discharges from industrial point sources of pollution in OECD countries over the last 30 years. However, much remains to be done to achieve and maintain a satisfactory level of overall environmental quality.

— Evolving trends in permitting have sought to move from pollution control strategies, primarily based on the use of the environmental resources, toward approaches aimed more at pollution prevention. Although permitting systems have had success controlling and abating pollution, the increasing complexity and scope of environmental problems on the one hand, and new technologies, production processes and material uses on the other, continue to require the ongoing development and diffusion of innovative prevention technologies and techniques.

— Permitting systems have a direct impact on industry's potential to produce innovative pollution prevention technologies and techniques. While earlier permitting approaches focused on the control of by-products released by industrial operations (e.g. end-of-pipe techniques such as scrubbers, filters or secondary treatment plants), recent trends point to the increased use of requirements aimed at preventing pollution at the source and waste minimisation (e.g. gradual phase-out of toxic substances, closure of mill effluents, recovery and recycling of residues, etc.). Concurrently, the technological response of industry to permit requirements is more and more characterised by in-plant (internal) measures (e.g. material substitution, process innovation and modification, energy and recycling techniques, environmental management practices).

— Industrial case studies and workshop discussions showed that permitting procedures contribute to effective approaches and instruments for identifying problems and selecting appropriate requirements. Indeed, four decades of experience in environmental permitting programmes have generated a great deal of insight on how to prepare, negotiate, and settle the critical information leading to acceptable authorisations for industrial

operations. The workshop sessions devoted to the study of the case studies illustrated several of the prominent features of the permitting systems used in OECD countries:

- the use of investigative programmes identifying the relationship between input materials, industrial processes and practices, output releases and environmental quality (as permit conditions for monitoring and compliance purposes and/or through instruments such as environmental impact assessments, life cycle inventory);

- the use by permitting authorities of a range of mechanisms (e.g. emission limit values [ELVs] for specific substances, environmental samplings) to ensure that the environmental quality is not impaired while offering a cost-efficient, administrative procedure for compliance purposes;

- the use of performance-based ELVs to increase the operator's flexibility in selecting the appropriate prevention and abatement measures and technologies;

- the use of specific conditions and requirements to target toxic, harmful releases and activities that may impair human and ecosystem health;

- the use of timetables for gradual strengthening of ELVs in order to bring about the continuous improvement of plant performance.

— Workshop participants were unanimous in stressing that permitting systems remain at the core of environmental legislation. Permitting programmes still represent a central policy strategy for preventing and controlling pollution, both to preserve the achievements in pollution prevention and control and to bring about further reductions. As government-sanctioned tools for pollution prevention and control, permits have undeniable advantages, especially by comparison with voluntary or incentive-based instruments. The implementation of standards through permitting mechanisms contribute to the protection of human health and the environment, for instance through minimum safeguards. Permits grant legitimacy to environmental decisions as they relate to industrial operations. Through various information and participation mechanisms, they provide transparency for the public. Likewise, as a tool linking economic development and environmental protection, permits play a major role in ensuring that conditions of fair economic competition is not distorted at the expense of the quality of the environment. In this regard, through implementation and enforcement mechanisms of minimum requirements, they provide safeguards against reckless polluters.

— However, permits need to evolve from purely administrative decisions and find their place in a dynamic process conducive to sustained innovation and environmental performance. The design and operation of permitting systems and permits needs to be further improved so as to (a) be consistent with the dynamics of environmental quality and technological change for those sources that are already subject to permitting; and (b) address the challenges posed by sources that have not until now been subject to permitting requirements.

— Environmental requirements for industrial permitting have a double objective: to allow performance and operation of the plant while at the same time protecting the environment. It has been recognised that the reduction objective has been successfully

achieved for a large number of the sources to which permitting requirements have been applied over the past two decades. However, because of the diminishing marginal effects of reduction programmes from those traditional sources, the emphasis is increasingly being laid on the protection side of permitting systems.

— The workshop participants observed that there is growing evidence of the need to revise and develop some of the main tools associated with environmental permitting. In this regard, the assessment of current permitting systems and practices in OECD Member countries revealed a definite trend toward new policies and practices.

— The search for new approaches is fuelled by a significant consensus on many of the key issues and shortcomings associated with environmental permitting. In the face of increasingly complex situations where ecological, technological and economic considerations intersect, traditional mechanisms for permitting industrial facilities need to offer the flexibility necessary for the development of innovative approaches while at the same time offering minimum safeguards against reckless abuse of the environment.

The driving forces behind permitting decisions

Workshop participants reached agreement on a series of points concerning the types of requirements that enter into permitting decisions. In particular, they addressed the issue of combining technology- and environment-based requirements into optimal permitting decisions and they underlined the need to include permitting decisions in the framework of long-term pollution reduction schedules. They arrived at the following conclusions and recommendations:

BAT and technology-based requirements

— BAT is a legal or regulatory requirement in many OECD countries, but not in all of them. There does not exist a uniform definition of BAT and the existing definitions are quite broad, indicating that BAT is more of a policy principle for driving decision-making than an unequivocal engineering reality. The development of BAT notes is an important step in the direction of a common definition of BAT. Yet, BAT notes remain non-binding precisely because they cannot account for all specific permitting situations.

— Workshop discussions and the information reviewed throughout the project revealed that there are often substantial differences in the understanding and the meaning of BAT. BAT can refer to the legal provisions and administrative procedures governing the setting of standards and permitting requirements. In addition, the term BAT also often refers to actual release limit values (e.g. ELVs), expressed either as binding requirements or as guidelines. Last, BAT is used interchangeably with the idea of technology-based permit requirements. However, unlike BAT considered as a legal and administrative provision, technology-based permitting requirements are used in all the countries reviewed. They can indeed be based directly on the legal BAT principle, but not necessarily. They may also be derived from standards (e.g. ELVs), which in turn may or may not have been themselves based on the BAT principle. The consensus emerging from the workshop, however, was that the principle of BAT should always be the driving force for setting standards and permitting requirements.

— Given the risk and complexity surrounding many environmental problems, technology-based requirements and standards are the most effective way to implement the precautionary principle in practice.

— Workshop participants also took note of the economic aspects of the BAT concept. In particular, they concluded that:

  – although there was no agreement on a possible common definition of BAT, there was a broad consensus that BAT requirements implicitly take economic considerations into account through their availability requirements;

  – BAT requirements for new and existing installations should be identical, with only compliance conditions (e.g. enforcement timetables) differing;

  – a strong signal was given that, for reasons of economic competition, industry has a preference for common emission limit values.

— Workshop participants also noted that the review of permitting practices in OECD Member countries had revealed that BAT does not sufficiently allow for the incorporation of waste generation requirements into permitting decisions.

Environmental quality

— For the sake of administrative efficiency, it is recognised that technology-based requirements cannot be set in isolation. Environmental quality standards and objectives govern the stringency of the requirements. Thus, all countries surveyed have mechanisms for limiting emissions and discharges according to some ambient-quality schedules. These mechanisms are based on an understanding of the carrying capacity of a given environment, taking several factors into account (such as the hazardous nature of a substance, the number of sources, specific physical or weather features or the sensitivity of a receiving ecosystem).

— Therefore, the development of technology-based requirements should be based on good monitoring and assessment of environmental quality. Ambient-quality monitoring programmes are indispensable to identify pressing issues and assess the results of a policy. They are crucial to orient the process toward the most important and urgent problems while avoiding costly supervision programmes. Monitoring is particularly critical in relation to cross-media issues. Beyond that, it may increase the level of flexibility allowed to industry through performance-based standards by partially substituting environmental results for end-of-pipe monitoring.

— The quality of the environment cannot be based solely on statistical measurements or the computerised simulation of a pollution plume, for instance, but on real assessments of the structure and the functional integrity of ecosystems. The implementation of such measures may offer the possibility of rewarding plants achieving good performances by reducing end-of-pipe monitoring and allowing the resulting savings to be channelled into research and development for cleaner processes and techniques. The same type of incentives could be offered in enforcement programmes with operators that exhibit good faith.

— However, as the scientific understanding underpinning environmental quality is not complete and because of the significant economic distortions that it would entail, an all-EQS policy cannot be substituted for the reduction of emissions and discharges at the source.

BAT and EQS/EQO

— Despite differences among official policies, most national permitting approaches authorise the complementary use of best available technology requirements (BAT) and environmental quality standards and objectives (EQS/O). In practice, the combined use of BAT and EQO requirements is observed.

— Technology-based and environment-based considerations are incorporated in permitting decisions according to no pre-established or uniform sequence. Technology-based requirements appear to be a common, immediate driver for decisions, but they are themselves driven by the requirement that environmental quality be preserved at some agreed level. When EQOs are breached, more stringent emission limit values should be enforced. Where the pollution burden is unacceptable, unsatisfactory performance rates should lead to forced shutdowns or scale-backs of operations. Conversely, where the quality of the environment is deemed acceptable with regard to some specific substance, BAT provisions must serve as minimum requirements.

— The general rule concerning the use of technology-based and environment-based requirements is that some minimum emission/discharge limit value is enforced, possibly derived from some BAT-based standard. From an environmental, technological or economic point of view, BAT provisions need not necessarily be the only driver. Additional requirements are negotiated at the permitting stage to ensure that (a) the licensed process achieves the best performance beyond the established minimum standard, (b) the quality of the receiving environment – however defined – is preserved, and (c) the performance of the process is consistent with what the company can bear technologically and economically.

— The effectiveness of permitting is linked to the types of requirements prescribed in decisions and the conditions attached to the implementation of the requirements. A permitting decision is thus an exercise in handling several variables and limiting factors at one time and crafting a regime that is optimal for the operation of an industrial process. This optimality can only be achieved at the permitting stage.

— The relative limits of optimal policy approaches (i.e. BAT, EQO, cost-benefit) provide evidence that permitting strategies must be based on a thorough evaluation of all of the issues at stake. For one thing, cross-media issues introduce the possibility of trade-offs – in the short run at least – which must be dealt with at the permitting level. It follows that any decision-making process which involves a mix of empirical facts, interests and values must be grounded into well-defined objectives and procedures. In other words, it may be more reasonable within the framework of policy-making to prescribe long-term goals than to base a strategy and its related requirements solely on the belief of the objectivity and/or optimality of hard facts. Thus, reconciling different approaches and interests, and benefiting from their interactions, is dependent upon pragmatic considerations and upon balancing all of the issues at stake on the basis of clear

objectives. Therefore, policy planning to build coherent strategies for economic development and environmental protection is fundamental to ensure that the appropriate requirements are designed and implemented.

— On the other hand, the difficulty of reaching a satisfactory level of hard facts does not mean that science has to be subordinated to policy. While everybody recognises the need to implement the precautionary principle, this does not mean that accurate scientific assessment of environmental challenges does not need to be attempted. Each situation may call for a different set of investigations, instruments and requirements. It can be the science-based understanding of an environmental issue, a breakthrough in technological feasibility, an economic evaluation of the alternatives at hand, or pressure from the active participation of public groups. Most likely, it will be a combination of all four factors. The challenge is to design a policy process which will provide a decisional road-map for evaluating the type of uncertainty at hand as well as the best sequence of instruments and expertise to deal with it.

Increasing the effectiveness of permitting

Workshop discussions also focused on the need to improve the effectiveness of permitting mechanisms and approaches. Workshop participants reached the following conclusions and recommendations on the use of permitting to induce pollution prevention and foster innovative solutions to environmental problems.

Improving permitting procedures

In order to correspond more closely to the changing nature of environmental challenges, a more comprehensive and forward-looking system of permitting needs to be developed, incorporating the following features:

— An integrated (multimedia) approach: the emergence of integrated approaches, which are causing institutional changes toward multi-media permitting practices, is expected to stimulate pollution prevention initiatives over a longer timeframe. However, integrated permitting entails trade-offs between several BAT options for which no systematic methodology exists.

— The adoption of long-term goals and monitoring programmes linked to permitting schemes at plant level.

— Links with policies to reduce pollution burden from non-covered sources (multi-source management).

— Links with other instruments: permitting strategies should be devised and implemented so as to fully benefit from interaction with the ongoing development of new policy instruments for pollution prevention and control (in particular LCA-based EIA, EMS schemes [e.g. EMAS, ISO 14000, BS], negotiated voluntary agreements, targets and reduction plans, economic instruments). The incorporation of other policy instruments into permitting strategies has been attempted in some countries. It allows the impact of permitting to be extended beyond its immediate, limited boundaries. Thus, through life-

cycle instruments, links can be established between a permitted process and non-permissible activities (upstream or downstream of the targeted process, e.g. suppliers and clients). Liability for pollution occurring outside of the production process can be incorporated into permitting through EPR mechanisms. Reduction plans and targets can be combined with permitting requirements. In some cases, voluntary or negotiated agreements can be associated with permitting so that environmental strategies may transcend the sometimes contradictory objectives of environmental protection and economic development, and move toward comprehensive planning for sustainable production and consumption.

— The main goal of policy is to strive for facts which will support good decisions, not for the sake of economic and/or ecological optimality *per se*. In this perspective, initiatives such as the development of BPEO-type mechanisms for the comprehensive evaluation of permitting situations and for the prioritisation of issues should be encouraged.

In addition, a more forward-looking and cost-efficient permit needs to be tailor-designed. Flexible, more encompassing permits are needed in order to take into account site-specific and process-specific considerations. The following requirements are critical:

— A system for structuring expert judgement and guiding permitting decisions (such as BPEO); not simply a generic concept like BAT provisions, but a more comprehensive methodology. Workshop participants stressed the importance of writing decisions that can be supported by some justifiable rationale expressed in guidelines and methodologies.

— Co-ordination, training and reliability of permitting decision-makers and related staff (permit writers, technicians, monitoring, inspection).

— Indisputable transparency of decision-making and performance evaluation; transparency is pivotal when case-specific determinants influence a decision. A good permitting programme will be inefficient if it does not have a comprehensive strategy for public participation and involvement. Experience had shown that the implementation and enforcement of permit requirements – as well as environmental performance which goes beyond binding rules – is highly dependent upon the right of the public to be informed and associated with the decision-making process. Although many countries have been moving in this direction in recent years, new initiatives are needed to make sure that the public is fully involved. In particular, the will to better integrate local considerations into the permitting process often depends upon the full participation of the concerned communities. In that regard, it must also be remembered that the right to a safe environment, both in the short term and in the future, is a matter of public decision.

— A multi-layered system of requirements: more specific requirements may be added on top of less specific requirements, themselves imposed on top of minimum base performance standards, as the case warrants. Polluting substances and disturbances need to be prioritised according to some clear schedule on which the stringency of permitting decisions should depend.

— A system for addressing the economic dimension of permitting decisions. The incorporation of economic considerations into permitting decisions is both necessary and complex. Some countries strive to establish guidelines and statutory provisions governing

the inclusion of economic considerations. Those countries that use the BAT principle make reference to economic feasibility at the legislative and regulatory stage, either explicitly (with the use of the BATNEEC principle) or implicitly in their definition of the availability of a technology or technique. As with technological considerations, economic issues are best dealt with at the permitting stage; legal definitions are imprecise at best. Different degrees of hazard lead to different permitting responses. In practice, the general rule is that the basic economic situation of an enterprise or an industrial sector is taken into account but that its actual cashflow situation will not be the determinant.

Long-term goal setting

— While BAT appears to be the driving force for achieving improvements in pollution prevention, its use needs to be governed by comprehensive environmental protection plans with clear objectives and targets. While short-term requirements may be driven by necessity, the development of long-term objectives is dependent upon policy planning. Permitting must be construed less as a set of requirements that have to be met to ensure compliance with some standards and more as a open-ended process conducive to sustained, dynamic innovation and environmental performance.

— The distinction between environmental quality objectives (EQO) and environmental quality standards (EQS) is a case in point. While standards need to be complied with in the short run, the long-term objectives for improving the quality of a receiving environment need to be factored into the permitting decisions.

— Through such careful, long-term planning, permitting may evolve from a purely administrative procedure to a comprehensive and forward-looking system for decision making. In this perspective, permitting programmes must strive to achieve a triple goal: (a) providing clear indications on short- and long-term objectives; (b) providing adequate flexibility for innovators; (c) ensuring that a minimum binding standard is enforced so as to encourage the turnover of obsolete equipment and processes which do not perform well environmentally and ensure a level economic playing field.

Fostering technological innovation

— It was acknowledged that permitting systems may provide static and limited solutions to what are increasingly dynamic, fluid and interconnected issues. By definition, permits grant the authority to operate according to an agreed set of requirements covering an agreed set of environmental issues for an agreed amount of time. This approach was appropriate for effecting the initial, substantial reduction in pollution that took place in OECD countries over the last generation, but limited for fine-tuning policies according to fundamental technological and economic development. In accordance with the evolving nature and importance of environmental issues, it was felt that BAT should be defined and enforced as a dynamic principle incorporating possible changes in technology and environmental performance.

— There is a recognition of the need to better define the relationship between short-term requirements and long-term goals needed for a sustainable future. The effectiveness of policy planning is largely dependent upon the ability of countries to produce and apply

technological solutions for environmental purposes. A major issue in that regard involves the incorporation of technological change into the permitting process. The use of performance-based standards are generally regarded as a fundamental principle for allowing the operator to choose the best methods of compliance while favouring technological innovation. In that respect, regulatory approaches must develop new policy initiatives with the potential to remove barriers in permit programmes that inhibit technological innovation.

— Indeed, supporting the ongoing development of technological innovation and promoting further improvement requires different approaches such as taking into account the economic cycles of industry and rewarding plant operators that develop innovative approaches for preventing harmful releases. Efficient policies for reducing environmental risks also require a careful assessment of the different factors involved. This assessment must be based on some measures of environmental results, ambient-based and/or benefits-based. Permitting must ensure good environmental performance, not compliance for its own sake. One issue is to develop effective monitoring programmes that will provide an accurate picture of the environmental results and/or the issues related to some prescribed measures.

1. WORKSHOP KEYNOTE PRESENTATIONS

In OECD Member countries, environmental permitting of industrial facilities involves a wide range of stakeholders. Each of them have different interests to promote and defend. Industrial facilities are at the core of the permitting process since their activities are subject to environmental authorisation. Governments and licensing authorities issuing legislation and rules are also prime actors in permitting. Non-governmental organisations (NGOs) such as environmental defence and consumer protection groups may have an equally important role to play, although their recognition and level of involvement in decision-making processes vary among OECD countries. Finally, international organisations and conventions also have a major interest in industrial permitting insofar as regulations and the standards implemented through permitting procedures affect the transboundary movement of pollutants and, indirectly, on the global competitiveness of industrial businesses.

In keeping with this understanding, the four main categories of stakeholders involved in industrial permitting decisions in OECD countries were represented at the workshop. In addition, each one of these categories was given the opportunity to present their ideas on permitting in a series of introductory speeches. In the keynote address, Dr. David Slater, Director of Pollution Prevention and Control at the United Kingdom's Environment Agency, presented the views of government and examined the role of permitting within the range of instruments for environmental protection available to legislative, regulatory and administrative authorities. In his speech, Mr. Slater took stock of the range of tools available for government environmental decision-makers (regulation, market mechanisms, voluntary agreements) and presented the advantages of an integrated approach to pollution prevention and control drawing on all those tools. The basis for an effective integrated approach remains a full and transparent regulatory system providing a level-playing field for industry through the establishment of release limit values. Drawing on the British experience, Mr. Slater examined the advantages and disadvantages of establishing release values solely on the basis of technological requirements or solely as a response to ambient quality considerations. The implementation of integrated approaches such as the UK's Best Practicable Environmental Option (BPEO) appears to offer the benefits of continual improvement in processes, the adoption of clean, waste minimising technologies, cross-media environmental protection and public accountability. In addition, a combination of regulatory instruments, market mechanisms and voluntary agreements can provide the most suitable setting for environmental protection.

Dr. Jürgen A. Philipp, a representative of the German steel-making company Thyssen AG and of the Federation of the German Industry (Bundesverband der Deutschen Industrie e.V.) presented the views of the industry in the second introductory address to the workshop. Mr. Philipp discussed the importance of permitting in pollution prevention and control, with a particular focus on the expectations of industrial companies. After examining the process of permitting and examining potential and actual areas of problems for industry, Mr. Philipp identified the principles upon which permitting must be grounded (e.g. commensurability with the required needs, implementation of the precautionary principle). Echoing Dr. Slater's address and drawing upon the experience of industrial companies in Germany, Dr. Philipp stressed that permitting obligations should not be based solely on

BAT or on EQO/S alone. As provided in the EC's IPPC directive, the conditions set in permits should be in the form of basic BAT-based limits complemented with additional requirements imposed by local environmental quality and the obligations to reduce cross-frontier pollution. Mr. Philipp, however, deplored that the directive forfeited the creation of a uniform system of industrial permitting in the EC. He concluded his speech by listing the aspects of permitting processes that were of prime significance for industry (such as transparency and reliability, cost assessment and duration).

Ms. Ann Hillyer, barrister and solicitor with the West Coast Environmental Law Association, a Canadian non-profit environmental organisation, presented the views of NGOs in the third introductory speech. In her address, Ms. Hillyer, focused on the changes needed to effect a shift in environmental policy towards pollution prevention. She stressed the importance of an appropriate legal framework and the need for stringent standards grounded in the precautionary principle. Compliance needs to be encouraged through standards set far in advance, and monitored through transparent mechanisms, implying meaningful public participation. In addition, Ms. Hillyer recognised that compliance would be increased if the economic benefits associated with pollution prevention were actively demonstrated and pursued. She illustrated these themes with the example of pulp mill effluent regulations applied in the Canadian province of British Columbia which have contributed significantly to increasing the environmental performance of this heavily polluting industry.

Mr. Leopoldo Rubinacci, Administrator at the Directorate-General for Environment, Nuclear Safety and Civil Protection (DG XI) of the European Commission, delivered the final introductory speech. Mr. Rubinacci presented the latest developments in the adoption and implementation of the EU's integrated pollution prevention and control (IPPC) directive. He described how the new directive would work in practice, and in particular, how environmental and technological requirements as well as economic considerations would combine in permitting procedures. At the time when Mr. Rubinacci addressed the workshop, however, the IPPC directive had not yet been adopted in its definitive form by the EU Council of Ministers. The following summary is largely based on the presentation given by Mr. Rubinacci at the workshop and additional material provided by the European Commission since the IPPC directive was adopted in 1996.

ACHIEVING THE BEST FOR THE ENVIRONMENT AND FOR THE FUTURE

Dr. David Slater,
Director, Pollution Prevention and Control, UK Environment Agency

Thank you ladies and gentlemen for the opportunity to contribute to the debate on the relationships between environmental requirements for industrial permitting and the types of technological responses induced.

Let me start by stating that I believe that effective environmental protection and enhancement can only be delivered by the use of a range of tools. Voluntary initiatives, market forces and appropriate regulation working together can deliver local, regional, national and international objectives and requirements. In my presentation, I would like to explore the range of forces working together to identify the most environmentally benign solution for each industrial process or activity. In particular, I would like to draw attention on how working together they can deliver an integrated approach to pollution prevention and environmental protection in the UK and in Europe.

These elements have contributed in the UK to the evolution of environmental regulation and the most recent development, namely, the creation of the United Kingdom's new Environment Agency for England and Wales. It has a responsibility through protection and enhancement of the environment to contribute towards the achievement of sustainable development. I have a direct interest and responsibility for the achievement of this objective as Pollution Prevention and Control Director of the Environment Agency.

Environmental regulation

Full, effective and appropriate regulation is required to deliver environmental protection. Industry must have a level playing field and secure equal and fair treatment within each industrial sector. Operators and the public require transparency in the operation of the regulator and the regulator must explain its priorities and targeting. From these secure regulatory foundations, the operator can determine priorities and actions, develop voluntary initiatives, secure better control of the process and ultimately achieve an increased ability to avoid unexpected incidents and accidents.

Release limit values and environmental objectives

The control of point sources by the use of release limit values is well developed and in water and air pollution regulation because the source is easily identified and monitored, any action required can be easily identified. Industries which are significant polluters of the environment or are potentially, significant polluters of the environment, require a permit to operate and conditions are included in the permit to secure and improve pollution controls. The conditions are normally expressed in terms of emission limits, identifying how much pollutant may be released into the air or into the water. That is easy.

Difficulties begin to arise when determining whether the limits should be based upon the environmental quality objective approach or the emission limit value approach. The pollution concentration which is tolerable or acceptable in the receiving environment is used to determine the release limits. Provided that the release limits are not breached, the environmental quality objective is secured. The maximum level of reduction which could easily be expected based upon the current state of technology, taking account of costs, is used to set emission limit values in the second approach. The latter approach is often linked with well known phrases such as "state-of-the-art technology" "best available techniques" and "best practices".

Neither approach can be operated in isolation. Environmental quality objectives are often insufficient on their own to tackle serious pollution problems and can be seen as a "license to pollute". Conversely strict release limits based on "best available technology" can impose excessive costs, or result in pollution or problems in other media or locations if account is not taken of wider economic and environmental considerations.

The starting point in environmental protection must be the precautionary principle. Industry must be held responsible for reducing polluting releases as far as reasonably practicable. Operators should be the experts on the process. Therefore, the starting point is normally the emission limit value approach based upon the application of an assessment of available technology taking into account economic costs. When such measures are inadequate to protect the environment and achieve environmental quality objectives, additional controls are required. However, this will only achieve the best solutions for a single medium. It also tends to deliver end of pipe solutions with little incentive for the operator to agree the primary process.

Integrated pollution control

I would now, therefore, like to turn to the development of an integrated approach to pollution control and to use as a model the experiences in the UK of the medium specific control of waste, water and air pollution and identify the benefits of the creation of a single regulatory body.

In the UK we have brought together the Waste Regulation Authorities which were part of local authorities, Her Majesty's Inspectorate of Pollution and the National Rivers Authority. We have created a body that takes a holistic view of the environment and applies a co-ordinated, integrated approach to its task.

Management of the water environment and the improvement for water quality has been achieved through the application of integrated river basin management. This consists of taking a total view of the basin, of the terrain that nourishes it, and the human activities that it supports. Catchment management plans are developed in close consultation with all users to balance interests that are often in competition, while safeguarding the health of the river itself. This concept has gained general acceptance and we are looking to integrate air, land and ground-water issues with it.

Historically, waste regulation in the UK has been undertaken by local authorities. They have benefited from handling waste as a local issue. They have a detailed knowledge of local industry and waste disposal operators. Controls have been very descriptive, defining for example the detailed daily regime for the receipt, handling and burial of waste at a landfill site. Bringing them together in one organisation gives us an opportunity to establish a national, strategic approach to waste management and regulation.

Her Majesty's Inspectorate of Pollution has been responsible for the implementation of cross media integrated pollution control to over 2,000 industrial processes and the application of

the requirement to achieve the Best Practicable Environmental Option (BPEO). It is the wider application of this integrated approach that I would like to focus on.

The UK approach of integrated pollution control is reflected in the draft Integrated Pollution Prevention and Control (IPPC) Directive. This requires competent authorities to establish emission limit values for industries based upon the Best Available Techniques. However, where the approach is not sufficient to meet environmental quality standards, additional measures will be required. Conversely, where local circumstances allow less stringent measures while maintaining a high level of protection for the environment, the emission limit values can take into account the geographical location and local environment and conditions of the process.

The approach of the IPPC Directive is more sophisticated than other EC directives. For example, the bathing water Directive and the proposed ecological quality for water Directive do set emission limit values, but are principally concerned with the occasions when additional measures are necessary in order to meet established quality criteria.

The integrated approach requires that techniques are available. It does not set standards which are not readily achievable with contemporary technology and which require innovation. Therefore the regulatory system must regularly review what is available on a global scale and consider its application for each process at each site.

The integrated approach offers the following benefits:

— continual improvement – prior authorisation subject to the conditions and limitations including a programme for the improvement of existing processes and the review of permits;

  — clean technology/waste minimisation – use of the best available techniques not entailing excessive cost supported by the provision of guidance and the drive for cleaner technology, not end of pipe solution;

  — total environmental protection – ensuring that substances which are unavoidably released to the environment are released to the medium in which there is least damage, the ability of the receding environment to absorb the pollution is assessed. In the UK this is taken further with the requirement to identify and use the Best Practicable Environmental Option (BPEO) which has minimal adverse impact on the environment taken as a whole;

  — public accountability – the regulatory process from application to authorisation to regular returns of the results from monitoring, and enforcement action is open to public scrutiny and comments.

I would like to spend some time on the benefits of a formal assessment procedure to identify the BPEO. The UK Environment Agency has developed a method for identifying and prioritising releases and combining effects of releases to all environmental media in a single integrated environmental index. Environmental options can be considered on economic grounds and the most environmentally benign cost effective solution can be identified. Best practice guides on the assessment of the BPEO for a range of industry sectors are currently being prepared.

The Environment Agency and industry are constantly re-evaluating standards and techniques relevant to the regulated processes. We have already seen the benefits in the UK from this productive integrated approach. Examination of the process in preparation for its permitting and subsequent review has made many organisations reappraise their processes and

in so doing introduce savings. The evaluation of environmental performance, identifying all inputs and outputs, undertaking a mass balance, has led the way to cleaner technology, waste minimisation and significant environmental improvements. This has supported the contention that “environmental sense means business sense”. A pilot exercise looking at emissions, efficiencies and economics (3Es) has identified significant financial and environmental benefits for six companies in the north of England.

As I said earlier, however, the challenge is to devise the optimum mix of regulatory, voluntary and market place measures that achieve optimum environmental protection. All these measures are necessary and have a significant impact.

Market mechanisms

Economic instruments can take a variety of forms: taxes or charges on emission; direct product charges or taxes; tradable permits; and subsidies to encourage producers or consumers. A market based approach may allow the required reduction in pollution to be achieved at the lowest cost. In particular there are areas where market based approach will be particularly effective:

— the environmental damage in question is relatively widespread with a large number of potential sources;

— there is a wide range of possible techniques for abatement and significant variation of abatement costs across different polluters;

— it will be difficult and time costly for regulators to determine differences in abatement costs; and

— the transaction charges of market based instruments would be low.

In other circumstances, market mechanisms are not so effective, for example:

— in addressing local factors;

— where it is difficult to prove a cause or connection between the pollution and the harm caused;

— where the level of use of polluting products or process is very insensitive to change in prices; and

— where a high tax level may appear inequitable and encourage cheating.

A market based approach may encourage innovation since those being charged for environmental damage would have a continuing incentive to develop new production technologies. Similarly, regulation encourages innovation, creating new markets for technologies to control pollution. Market instruments therefore can contribute towards the delivery of continual improvement provided they are adjusted to drive the technology forward. Supply and demand may respond to additional costs by the provision of cleaner technology and waste minimisation. Market instruments have the benefit of transparency and therefore general acceptability in operation.

Voluntary agreements

The key to the success of the integrated approach to pollution prevention and control is the management and operation of the organisation. Effective committed management delivers a successful industry. To be effective organisations must have management systems tailored to deliver quality to the customer, environmental performance, health and safety, and an assessment of occupational health.

These management areas are not exclusive, the synergy between them can bring mutual benefits. An organisation which wishes to assure itself of regulatory compliance and of consistency of delivery with management policies including the environmental policy, and a need to demonstrate such compliance to others, must have standards to work to and achieve.

As a total commitment to the environment, not just for compliance with legal and regulatory requirements, many companies have recognised the benefits of implementing an effective Environmental Management System. Many companies and organisations are achieving the new Environmental Management Standard BS 7750 and registration under the EC Eco-Management and Audit Scheme Regulation.

Across Europe and the rest of the world, companies and organisations with real foresight are looking over the horizon to the pending international standards. General guidelines on principles, systems and supporting techniques for environmental management systems and a specification are covered in the new international standards ISO 14004 and ISO 14001 respectively. Debate is well under-way on international standards on environmental auditing and environmental performance evaluation.

These Environmental Management standards focus on the relationship between the organisation and its immediate environment. Like process authorisations, these standards are site specific. However, their limits must be recognised. The standards do not identify specific environmental performance indicators or require the identification of specific numerical limits. Two organisations carrying out similar activities could have different environmental performance yet comply with the requirements.

There are important initiatives by individual industries. For example, the commitment to “Responsible Care” by the Chemical industry. They are to be encouraged, and regulators should look forward to the success of these initiatives as they deliver improvements. Good public relations must be accompanied by specific public commitments and deliveries against targets.

As may be seen, there is a high level of consistency between the regulatory requirements of an integrated approach to pollution control and the voluntary requirements of environmental management standards. In particular, the drive for continuous improvement, and the use of the best technology taking into account costs. By the achievement of environmental standards, the regulator may be provided with an indication of the commitment of the organisation and its management to continual improvement and to its achievement of, and progress beyond, compliance with legislative requirements.

The key to voluntary environmental management systems appears to be “aspiration”. This is the aspiration to be proactive about environmental performance, to be seen to be so and, doubtless, to profit by it. The regulatory system, with all its force for continuous improvement, cannot induce such aspiration by way of command and control.

Nevertheless, the regulatory system is necessary to protect society and the environment from the activities of those who do not share this aspiration. It is also necessary for other reasons, such as regional or national environmental considerations or delivery of international

obligations. This is recognised in the site-related, voluntary systems by means of a general requirement for compliance with environmental regulations.

The net effect of regulatory, economic and voluntary mechanisms, working together is, therefore, to provide maximum influence for improvement of environmental performance, with the regulatory and economic systems pushing where necessary and with the voluntary systems going beyond the basic requirements of regulations.

Conclusions

The objectives of sustainable development and environmental protection are most effectively achieved by way of a combination of tools. The complementary features of regulation, market instruments and voluntary initiatives cater well for the variety of circumstances presented by large and small enterprises, by organisations more or less committed to continuous improvement and by the need to see the environment in a wide regional, national or even international context.

An integrated approach to pollution regulation provides a clear regulatory framework within which industry must operate. The obligation on the operator to justify his process against the impact on the environment. Achievement of environmental quality standards as well as emission limit values. Public accountability and transparency which generate public confidence. The integrated approach to pollution control in the proposed Integrated Pollution Prevention and Control Directive will help to promote sustainable development through high quality, integrated environmental protection, management and enhancement.

ENVIRONMENTAL REQUIREMENTS FOR INDUSTRIAL PERMITTING

Dr. Jürgen A. Philipp
Federation of the German Industry and Thyssen Stahl AG

Ladies and Gentlemen,

I would like to thank you for the invitation to speak at, what in my estimation, is an important Workshop of the OECD's Pollution Prevention and Control Group, founded in 1992. The working group has set itself the exacting task of examining, and further developing, the application of Best Available Techniques (BAT) and Environmental Quality Standards (EQS) in legislation with the aim of achieving integrated protection of the environment.

The main topic of today's event is environmental requirements for industrial permitting. I would like to limit what I have to say strictly to this central topic of industrial pollution control, although there is obviously the temptation to use today's opportunity for a comprehensive statement on environmental protection from the standpoint of industry. Without any more ado, I would therefore like to turn to the topic of today's Workshop.

To take an up-to-date look at the chosen topic, it is necessary to examine developments in Community law and, consequently, the currently deliberated draft of Council Directive 96/EC relating to the integrated avoidance and reduction of environmental pollution, although this directive of the European Union will be dealt with in the further course of the Workshop. The aim of this directive is an integrated environmental concept, which has as its goal the avoidance, or at least the reduction, of emissions that are discharged into the air, water and soil, giving due to consideration to waste management, as well as the goal of high overall level of protection for the environment. The instrument chiefly considered in this respect is regulation of the permissible emissions, which can be fixed

— by means of a permit issued in the form of a written decision to the installation operator, or

— by means of binding requirements and regulations of the EU member-states or of the European Union.

At this point, we will concern ourselves particularly with the first-mentioned possibility.

Installations requiring a permit

It is understandable that such a far-ranging set of instruments for improving the protection of the environment can encompass only particularly relevant installations – a concept that should find the unlimited support of industry. A great number of member-states, including the European Union in future, define under their respectively applied regulations those installations which require a permit. The present Workshop is concerning itself with the industrial activities of paper

and cardboard making, surface finishing with metallic coatings, oil refining, and iron and steel making.

Permitting of industrial installations and economic development

A permitting process for industrial installations will essentially encompass the following phases: filing of an application; processing; decision-reaching. The filing and processing of an application are intrinsic organisational components of an industrial permitting process which, in the EU, should continue to be dealt with in uncomplicated and subsidiary fashion in future and, in the light of the development in the Federal Republic, therefore be organised on a national and *Land* level. An important discernible trend of development in this respect is the public's increasing involvement, which undoubtedly appears desirable, but also entails the risk of an growing politicisation of permitting processes. The crucial part of the permitting process is, however, the decision, with its accompanying imposed conditions and their monitoring.

Requirements have to be realistic for a commercial or industrial activity, which necessitates a basic consensus regarding the set aims of the social groups involved. All groups believe themselves to be committed to the principles of a sustainable development of environmental protection which , however, is evidently understood in very different ways. We hold the view that we should agree to the definition of such a basic consensus as was published recently by the Department of the Environment in the UK, and to which attention was drawn by E. Hutton a few days ago at an event of the Institute of Materials on the topic of environmental protection:

> "Sustainable development does not mean having less economic development; on the contrary, a healthy economy is better able to generate the resources to meet peoples' needs for a better quality of life, and new investment and environmental improvement often go hand in hand. Nor does it mean that every aspect of the present environment should be preserved at all costs. What matters is that decisions throughout society are taken with proper regard to their environmental impact."

The definition:

— speaks out in favour of economic development;

— sees in a healthy economy the prerequisite

  – for a better quality of life;

  – for new investment; and

  – for environmental improvement;

— warns that environmental measures should be taken not at any price, but rather by weighing up costs and benefits; and

— underlines that all socio-political decisions are to be taken while considering their impact on the environment.

This definition's overriding statement, in our estimation, is that it construes economic development as a precondition for the solution of existing socio-political problems as well as for a healthy prosperity, and therefore contradicts the ideas of groups who seem to have set themselves the goal of denying mankind the infrastructure and technical possibilities that are obviously needed to overcome the problems already being faced today and, increasingly, those

in the next century. We all know from experience that this assessment concurs with reality. The standard of the environment in the former German Democratic Republic (GDR) convincingly demonstrated that economic prosperity is also an indispensable precondition for a highly developed state of environmental protection.

The goals of a healthy and worthwhile environment and of economic prosperity require a balancing of ecology and economy in terms of legislation. The conceptions of industry regarding the permitting and legal protection of its activity and the ideas on environmental conservation must hence be brought into harmony in the industrial permitting process if the set goals are to be achieved.

The following requirements emerge in this respect from our point of view:

— stipulation of environmental protection measures that are commensurate with the actual needs;

— required measures to be based on the precautionary principle;

— prudent management of all non-renewable material and energy resources;

— proportionality of the means employed in relation to the environmental improvements still to be accomplished, while also allowing for other requirements of human society.

Conditions imposed in industrial permitting

The main point of industrial permitting is to define the measures that are to be laid down in the decisions. The legal trend over the past few years has shown that agreement largely exists that general requirements placed on industrial installations where the protection of the environment is concerned can and should appropriately be imposed in the form of so-called basic obligations. Examples of this include Article 3 of the IPPC Directive and § 5 of the Federal Immission Control Act of the Federal Republic of Germany. These general requirements apply on their own; as a rule, however, they additionally need to be put into more concrete terms in relation to installations, the drafting of which is the subject of considerable differences of opinion. The IPPC Directive provides, for example, that:

— emission limits may be extended or replaced with equivalent parameters or equivalent technical measures;

— emission limits or equivalent parameters and equivalent technical measures should be based on the best available techniques (BAT);

— the use of a certain technique or technology should not be required; and,

— when the emission limits are fixed, [the following factors] must be taken into consideration:

  – the technical condition of the installation concerned;

  – the geographical location; and

  – the local environmental conditions in each case.

When the emission limits are fixed, however, it is necessary:

— to take precaution in each case to reduce as far as possible widespread or cross-frontier environmental pollution; and

— to provide for more extensive requirements if environmental quality standards necessitate this.

We are of the opinion that, because of the existing limitations, such a range of instruments can only conditionally meet the needs of a progressive national or EU environmental policy. In fact, the requirements of the IPPC Directive signify the revocation of

— Council Directive 84/360/EEC dated 28 July 1984 relating to the abatement of air pollution caused by industrial installations;

— Council Directive 76/464/EEC dated 4 May 1976 relating to pollution as a result of the discharge of certain hazardous substances into the water bodies of the Community; and

— the 4 and 5 Environmental Action Programme of the European Community –

and hence a clear step backward in comparison with the regulatory situation so far. The directive is unsatisfactory in terms of its material contents and only inadequately takes account of the principle of precaution and prevention laid down in Article 130 r for the environmental policy of the Community.

Please do not misunderstand me at this point. Being also a representative of what is still an important industrial sector, I would not like to encourage harmonisation with the objective of carrying over undesirable trends in environmental policy from the Federal Republic to other Europe countries and of establishing a harmonised level of requirements that may be harmful on the whole for European industry, given the increasing globalisation of the markets. On the other hand, in aiming for a harmonisation of ecology and economy, we should however commit ourselves to instruments that, also in this regard, ought to ensure greater common bonds and fruitful collaboration for the future.

If the existing national regulations, supranational agreements and directives, and practical aspects of the permitting processes are considered, then differences are found which ultimately are so great that the various systems are no longer comparable. The Case Study on the use of BAT and EQO in industrial permitting: Iron and Steel Industry, conducted by the OECD for the steel industry, for example, also substantiates this finding in our view. Looked at from this standpoint, the IPPC Directive, which has been prominent in the development of environmental protection in the European Union, represents a compromise that probably embraces all the national systems used by the EU member-states for industrial permitting. With it the opportunity of creating a substantively uniform system of industrial permitting supported by all the EU member-states in the European Community would be forfeited to begin with, unless it were still possible to achieve substantial changes.

BAT and EQO/EQS

A central issue in the practical implementation of industrial permitting processes is the definition of the material requirements. Here, apparently, there are two opposing and irreconcilable schools of thought which take:

— a primarily technical as well as installation-specific approach (BAT); or

— a directly environment-oriented approach based on environmental standards or objectives (EQSs and EQOs, respectively).

It is our view that neither of these approaches alone can bring about a solution of the existing problems. This assessment is also reached given the difficulty of linking human-toxicological and eco-toxicological impacts with the level of ambient air quality values in each case, and the necessity in permitting processes of monitoring the impacts of additional emissions on the ambient air quality values, as well as the impacts that these, in turn, bring about. It is not possible here to deal with all these aspects in depth, such as, for example, also in regard to antagonistic and synergistic effects, the definition of tolerable effects, etc. However, there ought to be agreement between the state administrations, science and industry that, within the context of dealing with an individual case – which is what is involved in industrial permitting practice – such a procedure entails a complexity that cannot be coped with in the time frame allowed in permitting processes.

For these reasons, we think that the requirements to be placed on the installations must in principle be defined in terms of installation-specific emission values, with generally the same substance – and material-related emission values also appearing possible for a great number of installations. What we propose in this respect is by no means an adoption of the so-called clean air directives, but the broadening of the hitherto usual contents of the best available techniques. The so-called BATs should therefore directly include also:

— emission limits below which values must not fall, even when allowing for special local circumstances; and

— the parameters and measures that may be available under local conditions.

We regard the advantage of such a strategy as being that the industrial operator remains necessarily free in his choice of the measures to be applied. On the other hand, it is difficult to imagine a system that ties the permit requirements neither to measures nor to emission values. In any case, there can be no doubt that a system of requirements which is tied first and foremost to emission values is more effective than a system oriented around environmental objectives, a finding which already emerges from the results of control monitoring.

A system of emission limitation derived from the aforementioned ideas might be organised for the air quality control requirements approximately as follows. This proposal is founded on the provisions that:

— a permit for an industrial activity is tied to the fulfilment of basic obligations by the operator;

— installations should in principle be subject to emission requirements that are geared to overriding targets in regard to globally and particularly relevant, widespread and cross-frontier environmental pollution;

— emission limit values must be imposed for carcinogenic and difficult-to-degrade, highly toxic organic substances, while making exhaustive use of the possibilities offered by the BATs, and be suitably incorporated in the permit conditions; and

— from the outset, the BATs directly include emission limit values for particularly environmentally relevant substances and materials that may be roughly equivalent to those substances and materials listed in the IPPC Directive, Annex III, and for which there are already plans to impose emission limit values in accordance with Article 18(1) of this directive.

Emission limit values for other substances and materials could be set in accordance with applicable national targets and in this respect be formulated preferably on the basis of location-related requirements. The best available techniques (BATs), provided that they are suitably worked out, are of central importance in such a concept. We can imagine that the imposition of emission values at a European level will be hindered by experiences made in the Federal Republic as a result of the way the state of the art is defined there.

> "The state of the art as used in the Federal Immission Control Act means the state of development of advanced processes, of facilities or of modes of operation which is deemed to indicate the practical suitability of a particular technique for restricting emission levels. When determining the state of the art, special consideration shall be given to comparable processes, facilities or modes of operation that have been successfully proven in practical operation."

This definition and its enshrinement in law ties the imposition of environmental protection measures in industrial permitting processes in the Federal Republic essentially to technical development. In practice, when the rules and regulations were laid down, it was forgotten that the measures of what is to be applied technically must conform to the principles of necessity and proportionality, and this also remains to be taken into consideration in future for the drafting of the BATs. When taking a look at the IPPC Directive, it has to be regretted from the viewpoint of industry that, in the catalogue of criteria given in Annex IV regarding the drafting of the BATs, express mention of the proportionality of the means to be applied and of economic suitability has been omitted, although these aspects are also contained in the definition of the BATs.

The manifest difficulties of deriving emission requirements from environmental standards and objectives have already been discussed. The drafting of emission requirements on the basis of EQOs or EQSs also remains uncertain in view of the precautionary principle. In many cases, it is not possible to attribute emissions and ambient air quality values, with the result that, for these environmental impacts at least, the imposition of emission limit values on such a basis is irreconcilable with the precautionary principle. Considerations on ambient air quality nevertheless remain indispensable within the context of the proposed system, as such an examination of the air quality values must provide an answer to

— whether the installation in question can at all be erected at the envisaged location; or

— if more far-reaching requirements must be imposed which go beyond the level of requirements conforming to BAT.

The application of the described system requires the fulfilment of several preconditions and urgent further work with the aim, above all, of arriving at a uniform understanding of the most important concepts:

— Unanimous definition of the emission limit values including the measuring requirements;

— Setting of emission limit values and technique descriptions by the BAT, with it being left to the operator, where binding emission limit values are concerned, to use the technique of his choice to comply with the emission requirements;

— Elaboration of systems to describe and assess ambient air quality and pollution of the air, water, and soil; and

— Requirement of binding models to describe transmission mechanisms in the various media which make it possible to predict ambient air quality on the basis of emission sources.

In general it should be borne in mind that it cannot be incumbent on the permitting process to define or update emission values. Such a procedure overloads the permitting process and ultimately undermines the safety of investment decisions. Such a basic system can also be applied to the discharging of waste water, in which respect a differentiation should be made, for practical purposes,

— also according to the endangering potential of the substances contained in the waste water, as in the case of air quality control; and

— as a rule, between requirements relating to direct discharge into water bodies and to discharge into downstream wastewater treatment and disposal facilities.

Based on the currently known state of development, it ought to be possible to largely take account of local circumstances where the requirements for waste recycling and waste disposal are concerned. It is quite conceivable that the disposal and recycling of residual materials is dictated by local circumstances, depending on the state of the existing infrastructure, such that requirements to dispose of and recycle wastes can be put into more concrete term primarily in the form of general operator obligations, and that any necessary conditions must be imposed particularly on the operators of waste disposal and recycling facilities.

If it is not yet possible to resolve the question of actually harmonising industrial permitting processes, it is however indispensable to extensively harmonise the definitions used, in particular where the BATs, EQOs and EQSs are concerned. The goals mentioned here additionally derive from the necessary consistency of the systems that are required, for example by the IPPC Directive, which entails a definition of such basic elements as the ambient air quality and emission values. The flow of information between the member-states and the European Union, to which high importance is attached in the pertinent directives, including the exchange of experiences between the member-states, appears more than open to question if the basic harmonisation process is not vigorously pressed ahead.

Industry's requirements to be considered by the national environmental agencies

We must realise that not only governments, public administrations and citizens have, and must have, requirements that have to be considered in industrial permitting processes, but that industry itself equally must have requirements regarding the organisation and implementation of such permitting processes. These derive from the enterprises' obligation towards the community, the owners and their employees, who need a secure basis for their long-term future decisions, which also increasingly include cross-frontier environmental protection issues.

In the second part of my discourse, I would like to turn my attention to the requirements which industry, in my estimation, must equally address to the authorities of all the states which are committed to a free market economy. Responsible corporate action requires a minimum degree of certainty for planning and decision-making. In the field of environmental protection, this includes in our view especially:

— the transparency and reliability of the conditions and requirements to be expected;

— the ability to estimate the capital expenditure needs and the operating costs resulting from pollution control measures;

— reliable conceptions of the duration of permitting processes; and

— protection of the validity of already issued permits in regard to utilisation of the installations under the existing requirements decided upon in the permitting process.

Two outstanding points should be highlighted within the scope of this paper:

— time duration of the permitting processes; and

— protection of the validity of already issued permits.

An important aspect of industrial activity is the timely realisation of innovations and the reaction to market demands. The time interval between the decision to act technically and the initiation of production has become a significant location factor. This problem, which in the Federal Republic has led to extensive discussion about accelerating the permitting processes, can hardly be effectively resolved within the framework of international relations or supranational co-operation, however. Concerned is a complex of questions which has to be tackled at national or even regional level between the political groups, administration and industry. According to experiences in the Federal Republic, factors which have an appreciable effect on the duration of permitting processes, apart from the time taken by the authorities for processing, are above all:

— the intervention of experts;

— the involvement of the public and ensuing legal proceedings;

— the exerting influence of politics, above all at the municipal level;

— the scope and detailedness of the required application documentation; and

— the inclusion of special issues, such as the examination of environmental compatibility, occupational safety, and safety-critical technology.

In the Federal Republic, permitting processes are in our estimation particularly delayed by:

— the permitting mechanisms for new installations also being applied to so-called modification permits;

— the inflexibility of administrative procedures;

— the authoritarian attitude of the authorities; and

— the detailedness of official investigations.

Article 13 of the Joint Standpoint on the IPPC Directive requires the member-states to take the necessary measures so that the appropriate authorities regularly review and, if necessary, update the permitting requirements. A number of criteria are listed in this respect which at all events trigger a review. The European Parliament has replaced such periodic reviews based on pollution control requirements with a review which is to be carried out in the first 10 years after the start-up of the installations, followed by every five years.

It is our view that any time limitation placed on the validity of already issued permits should lead to an acceleration of the permitting processes. Given the high state of environmental technology achieved nowadays, it ought in principle to be practical to set a time span in which the installation can be operated according to the standards laid down when the permit is issued. Such limited-term protection of already issued permits cannot however be rigidly applied, but should be determined on the basis of the utilisation time of the installations in question. It would

be benefiting for the currently deliberated IPPC Directive to open up the way for such validity protection arrangements in future.

Summary and outlook

In summary, the following can be said on the question of industrial permitting from the viewpoint of environmental protection:

— Environmental protection is a responsibility concerning every group of society which has to be tackled by means of industrial permitting, with the aim of creating adequate controls for mankind's protection as well as good ecological conditions.

— The objective of industrial permitting should be the assurance of environmentally compatible industrial activity whose performance must be tied to regulatory requirements.

— The requirements to be imposed from the viewpoint of global, regional and local environmental protection should be laid down on the basis of available, reliable, scientific facts with the aim of taking adequate precautions.

— Global requirements should be met with globally fixed measures.

— International and supranational requirements must ensure that environmental dumping is avoided, i.e. that the population and ecology are protected at all locations by means of adequate precautionary measures. National and regional arrangements must not diminish or impair such protection, which must be developed further on the basis of today's general socio-political evaluation of environmental protection and the means that are available.

— Any vigorous emphasis of environmental protection should include

  – the imposition of, and compliance with, emission values geared to the principles of the BAT;

  – consideration of the ambient air quality and other impacts caused by emissions on the basis of generally valid criteria, and

  – observance of the precautionary principle, with the aim of improving the environment situation over the long term.

— Responsible administrative measures by the appropriate authorities and the responsible use of material and personnel resources by industry should be geared to co-operation which has as its objective not only the protection of the environment but also economic development.

— On the monitoring and verification side, the aim should be pursued of replacing administratively imposed requirements with operator control and of leaving or returning responsibilities for control monitoring and environmental management to industry as its own domain.

It is our view that the OECD will adopt an instrumental roll particularly within the framework of organising the industrial permitting processes. International discussion shows increasingly that considerable disagreement exists

— on the definition of essential basic components as well as

— on the organisation of industrial permitting.

We can imagine that the OECD may have an important role to play in this field.”

WHAT DOES THE ENVIRONMENT NEED FROM A PERMIT?

Ann Hillyer
West Coast Environmental Law Association, Canada

Today's environmental imperatives are propelling us into an era where we must rethink our approach to environmental protection. We are challenged to examine what protecting the environment means and to rigorously scrutinise the tools we use to ensure that protection. The need to achieve the greatest possible environmental benefits from environmental protection measures, such as the industrial permitting process, has never been greater. In the words of the World Business Council for Sustainable Development,

Developed countries will have to cut their use of energy and other raw materials – and their impact on the environment – more than 10 times over in little more than a generation, if the needs of the world's growing population are to be met without destroying the planet.[3]

Perhaps this stark conclusion would be less surprising if it had come from a deep ecology group. But today it is clear that addressing our grave environmental problems has become a priority for every quarter of society. We are even beginning to see that solving environmental problems can unearth significant economic opportunities.

For some time, we have known that pollution prevention is a powerful concept which, when properly implemented, can dramatically shift the way we use resources and significantly limit our impact on the environment. To translate this opportunity into reality involves finding ways to transform permit system mechanisms to achieve pollution prevention more quickly and effectively. This paper focuses on several themes essential to this transformation:

— The importance of an appropriate legal framework to encourage preventing pollution rather than simply controlling it after it occurs.

— The need for tough standards that protect the environment, rooted in the principles of precautionary, preventative action, even if the technology does not yet exist to achieve the standards.

— The need to set legally enforceable standards far in advance of the date for compliance and phased them in where appropriate.

— The necessity of clear, accurate monitoring and compliance information that is routinely made available to all interested parties.

— The importance of meaningful public participation.

— The need to recognise and ambitiously pursue the economic benefits associated with pollution prevention.

---

[3] FUSSLER, Claude, "Shrinking the Human Footprint", *Our Planet*, Vol. 7, No. 6, 1996, page 9.

To illustrate these themes, the pulp mill effluent regulations in effect in British Columbia will be examined. These regulations have contributed substantially to moving the industry from being a heavily polluting industry to one achieving significant improvements in environmental performance.

Legal framework for pollution prevention

We need to establish a strong regulatory framework in order to "prompt" the necessary shift in thinking – a regulatory regime that articulates the principles of pollution prevention and adopts the precautionary approach.

The appropriate legal framework for making the shift from permitting pollution to preventing pollution should take both a visionary approach and an evolutionary approach. The visionary approach requires use to decide on clear ambitious objectives for the future – and then requires us to backcast to the present to understand the magnitude of the change we envision for the future. The evolutionary approach requires us to rigorously assess where we are now and identify the most promising opportunities for environmental improvement. We need to do both. It does not make sense to develop a vision and then not have a plan to guide us to achieve that vision. And it does not make sense to just start taking action without an idea of what we want to achieve.

Pollution Prevention planning should adopt the visionary approach in at least two key areas:

— identifying regulatory parameters that need to be set far in advance of the date when compliance is required, allowing maximum time for innovation in achieving compliance, and

— setting legally enforceable targets for eliminating or sunsetting classes of substances, such as persistent, bioaccumulative toxics.

The evolutionary approach thoroughly assesses the present performance of an operation and looks for every available opportunity to improve environmental performance. Examples of tools that employ the evolutionary approach include:

— using the best available technology in setting permit requirements,

— using staged reduction standards that match steps to minimise polluting substances with predicted technological improvements, and

— ensuring compliance information is routinely made available to monitor the performance publicly.

An appropriate legal framework sets the stage for designing more specific legal instruments, such as industrial permits for individual facilities or sector-wide regulations, which foster innovative process and design changes that prevent and eliminate pollution at the source.[4] The strength of the legal framework is significantly enhanced through ensuring that pollution prevention is properly defined to focus on preventing pollution before it happens. An appropriate definition of pollution prevention will define it as improving housekeeping, changing production processes, extended use and reuse in a process, reformulating or redesigning products,

[4] For numerous examples of where this approach has been applied, see Curtis Moore and Alan Miller, *Green Gold*, Beacon Press, Boston, 1994.

materials substitution (especially substituting non-toxic or less toxic substances for toxic chemicals), manufacturing modifications, and eliminating the use of specific targeted substances.[5]

Tough standards that protect the environment

The primary reason for environmental standards is to protect the environment. There is no shortage of examples of situations where lax regulatory standards or regulatory gaps have led to environmental catastrophes, frequently resulting in huge clean-up costs. Achieving the dramatically reduced environmental impact reflected in the statement from the World Business Council for Sustainable Development will, among other things, require stringent environmental standards to govern permitting of industrial facilities, standards that are based on the precautionary, preventative approach and are strictly enforced.

Getting the maximum environmental protection from regulations and permits requires setting strict rather than lax standards. Current commentators argue that companies can handle lax regulation incrementally, often with end-of-pipe or secondary treatment solutions.[6] Put another way, if environmental quality standards are sufficiently stringent, appropriate technology will be developed to meet those standards.

One consequence of recognising that standards should be driven by the need to protect the environment, not by the best currently available technology, is that we need to develop standards that reflect different approaches for pollutants associated with different levels of environmental concern. For substances with serious ecological impacts, such as bioaccumulative or persistent toxics, employing commercially proven best available technology (BAT)[7] alone is not a satisfactory response, unless current BAT results in the elimination of those substances.[8] Standards that require the elimination of persistent toxic substances according to an urgent and realistic timetable offer excellent opportunities to drive fundamental process changes rather than simply tightening up existing processes. Regulatory tools should drive the development of technology and processes that result in the elimination of classes of the most environmentally problematic substances. They should address the issue of scientific uncertainty squarely and prevent regulators and industry from engaging in endless rounds of intensive scientific debate on a substance by substance basis.

In setting standards, it is important to remember that end-of-pipe limits do not limit the response to end-of-pipe solutions. Tough end-of-pipe environmental standards are needed to motivate innovative, efficient environmental performance throughout an operation and give operators the opportunity to decide how to meet the standards most effectively.

As well as driving to an environmentally sound vision of the future, regulations need to set the minimum acceptable standards for present environmental performance. And current regulations need to be strictly enforced to adequately protect the environment and to maintain a level playing field among sector participants.

---

[5] For a discussion about the importance of an appropriate definition of pollution prevention, see the *Final report of the Pollution Prevention Legislative Task Force*, September 1993, Environment Canada; and *Great Lakes Pollution Prevention Bibliography, A Project of the Great Lakes Pollution Prevention Centre and the Canadian Institute for Environmental Law and Policy*, March 1995, Part 1. Important waste minimization measures, such as out-of-process recycling, should be encouraged but are not included in the definition of pollution prevention.

[6] PORTER, M.E. and C. van der LINDE, "Green and Competitive: Ending the Stalemate", *Harvard Business Review*, September-October 1995 at page 124.

[7] While there are a number of definitions for BAT in use, many incorporate the notion of commercially proven technology.

[8] See Ann HILLYER, *Comments on Ministry of Environment, Lands and Park Policy for Setting Criteria and Standards*, West Coast Environmental Law Association, March 1995.

Further, it is clear that pollution prevention is not a substitute for environmental regulation – it should be the outcome of effective regulation. Voluntary measures, often effective complements to regulations, also are not appropriate substitutes for legally enforceable standards. In discussing the need for complementary tools, a Vice President of Dow Europe points to the need for both incentives and regulations:

"It is like the Tour de France. There you have a prize, an incentive to lead. But you also have a car at the back, picking up stragglers and disqualifying them. Governments need to have a set of carrots and incentives up front to entice the business community, but they also need to have the pick-up truck of minimum legal standards coming up behind."[9]

A recent survey involving Canada businesses revealed that regulations continue to be cited as the leading motivator for taking environmental action – and rank substantially higher than voluntary measures in governing behaviour.[10]

Set standards far in advance of compliance

Properly conceived regulations can be powerful levers for effective change. As noted above, regulations need to promote preventative design and foster innovation. This requires regulators to be much proactive in setting stringent standards for the future and also requires using pollution prevention model to reach those standards. Regulators do not need to tell industry how to get there, but need to set clear regulatory requirements about the required outcomes.

Optimally, regulations should be employed to improve environmental performance in the future, not just to deal with existing environmental problems. Setting ambitious regulatory standards – far in advance of the date they come into effect – promotes innovation in technology and process design and allows for maximising environmental and other benefits. It allows operators the time to assess their operations holistically and discover opportunities for efficiencies that might otherwise go unnoticed. Sufficient time to redesign systems encourages a comparison of the costs and benefits of a number of options and promotes opportunities for making improvements in unregulated areas where change may be needed. And steps to prevent pollution frequently yield other environmental improvements, such as reducing consumption of raw materials.

Setting the standards far enough in advance allows for ample but well-defined phase-in periods that offer the potential of matching required reductions in discharges to emerging technological improvements. It also permits appropriate planning for capital investment cycles.

Access to monitoring and compliance information

The strength of pollution prevention initiatives can be enhanced through accountability to the community in which permitted facilities operate. We face a significant challenge in developing reliable, transparent and easily understood mechanisms to document and report on pollution monitoring and compliance data. Reporting on the state of compliance with environmental regulations is an excellent way of advertising the success of pollution prevention initiatives – and of shaming laggards into compliance with permit standards.

---

[9] FUSSLER, *Op. cit.*
[10] KPMG Canadian Environmental Management Survey, 1994.

British Columbia routinely releases a comprehensive environmental non-compliance report listing operations that failed to meet environmental protection standards in permits or regulations. It is the only province in Canada to do so. The province's Minister of Environment recognises its value in effective enforcement of standards:

> "The non-compliance report is one of the most effective tools we have to get operations and individuals to adhere to B.C.'s environmental protection laws. No one likes to see their name in the paper for something as serious as harming the environment."[11]

British Columbia also routinely releases a publicly available report detailing the province's latest environmental charges and penalties, listing the total number of convictions and fines levied during the period covered by the report. Both reports are released directly to the media and to other interested parties every six months. The programme is now in its sixth year. The routine release of this information, as opposed to requiring the public to make information requests, provides a strong incentive for industrial permit holders to comply with environmental standards and contributes to a well-informed public less suspicious of environmental performance.

Today's consumers are demanding environmentally sound products as well as products that are manufactured without causing environmental degradation. In many cases, consumers are willing to pay a premium for those products. Further, some consumers have displayed a distinct willingness to boycott products altogether when concerned about the environmental record of the producer. Purchasers large and small want to be able to verify environmental product claims with solid, quantifiable information, preferably information that is generated at arm's length from the producer. Environmental monitoring and compliance data offers a unique opportunity to support environmental marketing claims. This data is a matter of public record and removes some of the scepticism about a company telling only the good news about its environmental track record.

In addition to government initiatives, some companies have adopted innovative approaches to monitoring their progress toward environmental improvements. For instance, the Boeing Company has instituted a single, company-wide measure for rapidly gauging its progress in engaging pollution prevention: the hazardous waste generated per year per factory employee.

Meaningful public participation

There is a great deal to be gained by involving community and environmental organisations in permitting exercises involving pollution prevention planning and implementation. This will provide access to local expertise and build community support for pollution prevention initiatives. But this must be meaningful involvement based on full access to information and serious consideration of public input.

The public is entitled to participate in developing the means to meet environmental challenges, since it must live with the environmental impacts of production processes. Time and again a well-informed public has provided an invaluable driving force in accelerating environmental improvement.

---

[11] *Province of British Columbia News Release* 330-20: ELP96/97-003, April 10, 1996.

Economic benefits of pollution prevention

There is growing consensus regarding the positive links between a strong environmental record and strong economic performance, between pollution prevention and economic efficiency. In a recent paper published in the *Harvard Business Review*, Michael Porter and Claas van der Linde commented on the relationship between strong environmental programmes and economic performance, stating that:

> "Properly designed environmental standards can trigger innovations that lower total cost of a product or improve its value. Such innovations allow companies to use a range of inputs more productively – from raw materials to energy to labour – thus offsetting the costs of improving environmental impact and ending the stalemate. Ultimately, this enhanced resource productivity makes companies more competitive, not less."[12]

It is almost becoming trite to articulate the numerous benefits of adopting pollution prevention. The most obvious benefit is that it can lead to a cleaner environment and a lower human health risk – both significant economic implications. However, many other benefits are available:

- reducing energy and resource use
- minimising waste disposal costs
- reducing the need for pollution control equipment
- increasing productivity
- complying with regulations more easily
- reducing liability regarding environmental problems
- reducing liability for worker's health and safety
- improving the company's image in the community
- improving competitiveness through increased efficiency.

The benefits exist. The challenge is finding the most effective way to realise them.

As well, the forces of the marketplace must be harnessed to accelerate the pace of adopting the pollution prevention ethic. Market forces – such as the tax system and government and private sector procurement policies – are extremely useful in promoting ecologically beneficial behaviour.

The example of BC's pulp mill regulation

The British Columbia pulp mill effluent regulation illustrates these themes. British Columbia has a large pulp and paper industry. Of the 26 mills in the province, 23 release effluent directly into the environment. Seventeen mills produce bleached pulp using chlorine compounds and all but one of those uses the kraft process.

---

[12] *Op. cit.*

The provincial pulp mill effluent regulation – which continues to draw world-wide attention – requires pulp mills that use chlorinated compounds to eliminate adsorbable organic halogens (AOX)[13] produced in the bleaching process by December 31, 2002. This regulation became law on July 1, 1992, more than ten years prior to the date for compliance. At the time this standard was set up, pulp mills in B.C. were subject to a variety of federal and provincial regulations, including an AOX limit of 2.5 kg per tonne of air dried pulp produced. This provincial limit was reduced to 1.5 kg per air dried tonne of pulp produced, effective December 31, 1995.

Pulp mills in Canada are also regulated by the federal government, whose standards were strengthened significantly in the last few years as well. The *Canadian Environmental Protection Act* prohibits mills from discharging detectable levels of dioxins and furans. The federal *Fisheries Act* governs the discharge of biologically oxygen demanding substances (BOD), total suspended solids and toxicity. It also requires mills to participate in an environmental effects monitoring programme which is aimed at determining whether or not current regulatory standards are adequate to protect the environment.

The regulatory response followed what can only be described as an environmental catastrophe in British Columbia in the late eighties. Since the late 1988, the Canadian government has closed hundreds of kilometres of British Columbia coastline to shellfish harvesting because of dioxin and furan contamination from pulp mills. These shellfisheries' closures were accompanied by a number of health advisories warning people not to consume certain species of fish over set limits, some types of diving ducks and water birds, and a general advisory against eating the livers of any bottom fish caught near coastal mills. These closures and health advisories resulted in a groundswell of environmental concern in the province and demands that the government take steps to deal with the situation. Many shellfishers lost their source of livelihood due to the closures. Aboriginal peoples, many of whom live in the vicinity of pulp mills, lost a major food source.

Compounding these problems was the fact that the British Columbia pulp and paper industry had a history of routine non-compliance with existing regulatory standards. And at the time of the first shellfishery closures, pulp mills in British Columbia were not subject to regulations governing chlorinated organic compounds, including dioxins.

Since the introduction of improved regulatory standards, the British Columbia industry has achieved dramatic improvements in environmental performance in a relatively short period. In many cases, the improvements have been better than expected and have occurred ahead of schedule.

The regulation requiring the elimination of AOX has been a significant driving force in cleaning up the industry and offers a useful model for regulating in other areas. Some of the obvious benefits of this approach include:

— incorporating the precautionary approach and the preventative approach principles into the regulation making process,

— using long term planning by setting the standard far in advance of required compliance and allowing the time for the development of appropriate technology involving solutions to other environmental problems associated with pulp mill effluent,

[13] AOX is the term used to describe a family of chemicals, including more than 300 that are produced in bleached pulp mill effluent when chlorinated compounds are used in the bleaching process. Many of these chemicals are highly toxic, remain in the environment for many years, and accumulate in the food chain.

— targeting a legal limit of zero discharge of a class of substances, avoiding intensive debate and expensive regulation on a compound by compound basis, and

— taking advantage of emerging market opportunities.

Since the implementation of the AOX regulation, the pulp mill industry in the province has realised a number of specific environmental and other benefits:[14]

— reduced environmental impact from pulp and paper mills,

— maximisation of environmental gains when process changes made to meet AOX limits yield improvements in discharge levels of other parameters,

— achieving regulatory compliance largely ahead of schedule,

— significant improvements in environmental performance in most parameters,

— some reopening of shellfisheries,

— reduced public pressure on the industry,

— well positioned to take advantage of emerging market opportunities for totally-chlorine free pulp.

In addition to these benefits, when the industry eliminates the use of chlorinated compounds as bleaching agents to meet the standard of eliminating AOX, it will make a significant leap toward being able to operate effluent free pulp mills. Current research into environmental problems associated with pulp mill effluent has unearthed other serious problems – clearly pointing to the need to keep pulp mill effluent out of the environment altogether. The British Columbia AOX regulation moves the industry closer to that goal.

Conclusion

In conclusion, we need to remember that pollution prevention is a powerful concept and the industrial permitting process should be designed to maximise opportunities to prevent and eliminate pollution at its source. Pollution prevention is an important building block in transforming polluting, over-consuming societies to sustainable societies and in ensuring that industrialisation in developing countries does not follow an unsustainable path.

Pollution control and waste management institutions, laws and regulations that were established over the past decades are still needed, but they cannot be relied upon to protect our ecology effectively by themselves. Our laws, policies and incentives need to move us to preventing pollution and environmental degradation, rather than trying to manage pollution or remediate damage after the fact. Environmental standards must drive permit setting to a system that is smarter, more efficient, more harmonious with our ecosystem, and makes more sense. The first step, as always, is to let go of outmoded thinking.

[14] While it is not possible to attribute all the gains as resulting from one cause, the AOX regulation clearly has been an important factor in improving the environmental performance of the industry.

THE EUROPEAN IPPC DIRECTIVE: IMPLEMENTATION AND ISSUES

Leopoldo Rubinacci
European Commission, DG XI, Brussels

In 1996, the Council of Ministers of the European Union adopted Council Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC) which became binding for 15 OECD Member countries. The IPPC Directive is of particular relevance insofar as it addresses many of the items scheduled for discussion at the present workshop: best available techniques, the combined use of BAT and EQOs, multimedia permitting and the incorporation of economic considerations into permitting decisions.

The IPPC Directive sets a general obligation for the operators of some listed industrial activities to take "all appropriate preventive measures against pollution". Additional obligations apply in the area of waste management (prevention, recovery and disposal), energy efficiency, accident prevention as well as end-of-operation site remediation. These obligations require the application of "best available techniques" (BAT).

The term "best available techniques" is defined in some details in the Directive:

> ""Best available techniques" (BAT) shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole:
>
> — "techniques" include both the technology used and the way in which the installation is designed, built, maintained, operated an decommissioned,
>
> — "available" techniques shall mean 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" shall mean most effective in achieving a high general level of protection of the environment as a whole."

The definition of BAT is sufficiently broad to include not only technological hardware, but also operation and maintenance. The definition also provides for a holistic approach to environmental protection, requiring multimedia assessments and solutions. Finally, the definition makes explicit reference to the need to take into consideration economic costs and benefits when making decisions under the IPPC regime.

Integrated BAT is developed in the framework of the IPPC information exchange programme and is used as a reference for Member states when setting their own emission limit

values (ELVs). Under IPPC, the European Commission is required to organise “an exchange of information between Member States and the industries concerned on best available techniques, associated monitoring, and developments in them.” The results from such exchange are to be published in the form of BAT Reference Documents (BREFs). The Commission is scheduled to continue holding sector-specific BAT information exchange consultations to cover by the year 2001 all the 33 industrial sectors included in Annex 1 of the Directive.

In practice, the exchange of information is conducted on the basis of existing material such as existing BAT notes (published under the regime of previous, medium-specific EC environmental protection directives), surveys from industry and other information. The European IPPC Bureau carries out much of the technical work, including initial drafts of the BREFs. Drafts are then examined and adopted as BAT Reference Documents in the framework of ad-hoc forums by representatives of EU Member States, industry and non-governmental organisations.

BAT Reference Documents developed under the aegis of the European Commission contain information on technologies to be used but also cover design, construction, maintenance, operation and decommissioning of installations. Alongside their environmental performance, the economic performance of the reviewed technologies and techniques is also considered and included in the published BREFs. The economic evaluation of candidate BATs covers both the investment and operating costs of the considered abatement techniques, and incorporates efficiency-induced savings. However, a full cost-benefit analysis of candidate BATs is unrealistic at the level of an industrial sector and many of the economic issues involved in permitting are to be dealt with at the local level.

Integrated BATs defined in BAT Reference Documents require decisions on the environmental trade-offs involved in the use of various techniques. The European Commission has decided not to establish quantitative weightings to interpret the consequences of various environmental criteria under various situations, an approach deemed unrealistic and subjective. Nor has the Commission left it entirely with permitting authorities to decide on the ranking of environmental options on the basis of local conditions. Instead, the BREFs should contain guidance on the importance of environmental effects.

BREFs are not legally binding. However, the intent of the Directive is to draw up a list of reference techniques to define the environmental performance that is achievable in each of the concerned sector. Integrated BATs defined in BREFs are used as a reference for setting emission limit values in standards or permits. It is not interpreted as a requirement to install a particular type of hardware or implement a certain type of management. The typical BAT usually makes reference to several technological solutions in each industry. Under IPPC, integrated BAT is a dynamic concept encompassing the latest developments in pollution prevention and control technology and “a high general level of protection of the environment as a whole.” Accordingly, BAT needs to be optimised for the overall impact (i.e. multimedia) of pollution rather than for a specific environmental effect.

The IPPC Directive does not set uniform Community-wide emission-limit values but BAT is the basis for setting ELVs as a condition in the integrated permitting procedure. Although national authorities refer to BAT Reference Documents in setting ELVs, technical considerations as well as local environmental and geographic conditions are also considered. Decisions about BAT are consensual, with all actors involved. Under IPPC, permit revision schedules usually include new techniques.

In addition to information on the installation and its activities, an integrated permit under IPPC must contain information on emission sources, conditions of the site, the nature and quantities of emissions, the likely environmental impact induced by the activity, proposed

abatement techniques, waste prevention and waste recovery measures and emissions monitoring programme.

In conclusion, it can be said that the answers to some of the questions posed by the OECD Industrial Permitting Workshop can be found in the IPPC Directive adopted by the European Union. However, some are still lacking a clear answer such as the possible development of multimedia BATs and the incorporation of economic considerations in the BAT Reference Documents. Finally, the IPPC Directive has some inherent limitations in that it addresses only a restricted spectrum of environmental issues and that some types of installations (for instance smaller installations) are not covered under the regime.

2. PRESENTATION OF THE SECTORAL CASE STUDIES

During the second phase of the OECD project on Environmental Requirements for Industrial Permitting, a series of case studies were conducted. The purpose of the case studies was to accumulate practical evidence on the use of "best available techniques/technologies" (BAT) and of environmental quality standards/objectives (EQS/EQO) in setting permit requirements.[15] Case studies were not intended to be exhaustive evaluations or definitions of what should be the "best" environmental requirements or industrial processes in any absolute sense. The main purpose was to analyse how BAT and EQO provisions were being applied in a few representative industrial sectors, and how the technological response by industry sources might be affected by environmental permit conditions.

Case studies were conducted in four industrial sectors: pulp and paper, iron and steel, oil refining, and metal finishing. These sectors were selected on the basis of their economic importance within several Member countries and of their environmental significance. For instance, the metal finishing sector was chosen as a representative example of industries characterised by small and medium enterprises (SMEs). Each case study was conducted with a view to provide an illustration of some central issues concerning industrial permitting.

The case studies were based on the review and analysis of permits provided and information derived from questionnaires addressed to regulatory authorities and permittees. Participating countries gathered the necessary information and ensured co-ordination with industry, while four lead countries were responsible for providing technical assistance, organising and analysing material from the surveyed industry and from permitting authorities in each of the four case studies. Collected permit samples and related information on permit issuance processes and on the incorporation of BAT and EQOs into permitting decisions formed the basis for the case study reports.

Since permits were in limited number and did not cover all media, it was not possible to draw any specific conclusions on the relative benefits and shortcomings of the permit requirements on technological responses (in particular, on the relative merits of integrated, multimedia permitting versus conventional, medium-specific permitting). In addition, facilities selected often varied in size and age, technological processes, and physical factors of location (some were located in sensitive ecosystems, in urban areas, in industrial sites or near international borders). Moreover, it was decided not to focus on the numerical values, but on the permitting mechanisms used in setting permit conditions. Thus, responses provided by both the permitting authorities and permittees involved in the case studies were the main basis for the analysis.

However, collected permits provided sufficient information to demonstrate current trends in environmental regulation and the technological responses associated with these developments. A

[15] Two of the four industrial case studies (iron and steel, pulp and paper) have been published as OECD documents and are available from the OECD Secretariat.

literature review on the main environmental, regulatory and technological issues for the concerned industrial sectors added to the significance of the results of the case studies. In addition, the case studies benefited from the first phase of the BAT-EQO Review in which the general policies and approaches of OECD countries were reviewed and summarised.

At the workshop, the conclusions from each of the four industrial case studies were examined. In each case, a small panel of presenters summarised the details of each of the case studies, highlighting the general principles and key policy approaches governing the permitting strategies of participating countries. Each panel of presenters included the writers of the case study reports (representatives of the regulatory authorities of the lead countries, of the OECD Secretariat or consulting firms) as well as industry managers. In each case, the issues raised by the case studies were presented from the point of view of permit writers as well as from that of industries subject to permitting.

2.1 Iron and steel case study

The iron and steel case study was presented by **Alain Rajotte**, **Hans Lannerblom** and **Kjell Lundström**. Acting as a lead co-ordinator for the study, **Mr. Rajotte**, independent consultant to the OECD Secretariat, presented the overall conclusions from the case study, in which seven OECD Member countries participated. **Mr. Lannerblom**, senior technical officer at the Swedish Environmental Protection Agency, presented a summary of the discussions that took place in 1992 between Sweden's National Licensing Board for Environment Protection and the Oxelösund steel plant, which provided a specific illustration of how BAT-based emission limit values are incorporated into permitting decisions. **Mr. Lundström**, environmental control manager at the Swedish steel-making company SSAB Oxelösund AB. presented the views of SSAB Oxelösund AB on permitting in general and on the particular example of the permitting process applied to the Oxelösund facility, a good example of an integrated steel plant. The presentations by Mr. Lannerblom and Mr. Lundström provided a clear and insightful illustration of a controversial case regarding the use of BAT-driven strategy for determining permitting requirements.

Sector overview
Alain Rajotte, OECD Secretariat

The iron and steel case study was drafted on the basis of country profiles presenting the industrial sector, the various processes used in the industry as well as the regulatory framework in which permitting decisions are taken. In addition, a series of permit samples provided practical illustration of the issues faced by permitting authorities. The following table provides a summary of the information used in each of the participating countries.

The steel case study highlighted some key sets of issues, in particular the transfer of pollutants across environmental media, the combined use of technology- and environment-based considerations as well as the influence of technology-based requirements in practice on technological solutions. The main findings are summarised below.

Participating countries	Information basis		
	sector profile	*regulatory framework*	*additional information*
Finland	✓	✓	*1 integrated permit (air, waste, noise)* *1 water permit* *1 notification*
Germany	✓	✓	*1 provisional decision*
Japan	✓	✓	*2 water permits* *2 air permits*
Korea	✓	✓	*1 water permit* *1 air permit*
Sweden	✓	✓	*1 integrated permit*
United Kingdom	✓	✓	*1 integrated permit* *1 air permit*
United States	✓	✓	*1 air permit*

Environmental quality and permitting mechanisms

As can be noted from the above table, the permit samples provided by participating countries consisted of fully-integrated, semi-integrated and media-specific permits. In implementing the European Union's IPPC Directive, the co-ordination of the issue of licenses for air, water and hazardous waste emissions represents a transitional period towards an integrated, multimedia permitting system. The intent is to consider steel producers, smelters and refiners as single entities, thereby eliminating opportunities to transfer pollutants across media. This trend toward an integrated approach to permitting is not limited to Europe. Indeed, in the United States, the Source Reduction Review Project has identified, among others, the iron and steel industry as a legitimate candidate for which a more integrated approach to rulemaking is warranted. Besides, while permitting approaches in Japan and Korea have been typically based on EQOs/EQSs, the analysis of permits reveal that technology-based considerations increasingly influence the permit limits set. Some of the commonalties and differences in the permitting approaches used in the surveyed countries are outlined below.

Similarities in permitting approaches

— Four of the seven countries are EU Member states and must comply with existing EU directives;

— All countries have adopted national EQOs/EQSs, which permits must comply with;

— All countries consider both technology- and environmentally-based standards in setting permit conditions;

— Except for Japan and Korea, international conventions play a important role in setting BAT and environmental targets.

Differences in permitting approaches

- BAT limits are binding in the United States and Germany;
- BAT is used as guidance in Finland, Sweden and the United Kingdom;
- Permitting system in Korea and Japan are based on EQOs/EQSs;
- BAT definitions vary between countries and may, or may not, allow for end-of-pipe techniques to be used for reaching specified values;
- There may be differences in the way countries allow economic considerations to play a role in the negotiation process

Iron and steel sector profile

The iron and steel industry is by far the largest and most important metallurgical industry in the world.[16] In the last 30 years, its technological development has been characterised by the dominance of integrated steel production joined later by the electric-arc-furnace (EAF), which accounted for respectively 60 and 32% of the world production of crude steel in 1994.[17] Integrated producers generally make steel from iron ore using coke ovens, blast furnaces (which produce an intermediate product called pig iron), and basic oxygen furnaces (which are used to process pig iron into steel). Non-integrated producers, on the other hand, generally make steel by melting and refining ferrous scrap at smaller scale EAF facilities (often referred to as minimills). In both processes, the molten steel is formed into ingots or slabs that are rolled into finished products. Rolling operations may require reheating, rolling, cleaning, and coating. Iron and steel products include items such as bars, strips, sheets and formed products such as steel nails, wire, rods and pipes. Depending on the equipment used, salable products may also include by-product coke and products derived from chemical recovery in the coking process such as coal tar and distillates.

The iron and steel industry is a major source of air and water pollution, generates important quantities of waste materials, occupies large tracts of land, and gives rise to vast mining and waste disposal areas. Environmental challenges for this sector are the control of air pollution (in particular CO_x, SO_x, NO_x, and metals), waste disposal and recycling, and waste water treatment. Recently, dioxin emissions have become an issue of concern with the growing use of scrap as raw materials. The main pollution streams for both integrated and non-integrated mills are air emissions, collected dust, slag and waste water.

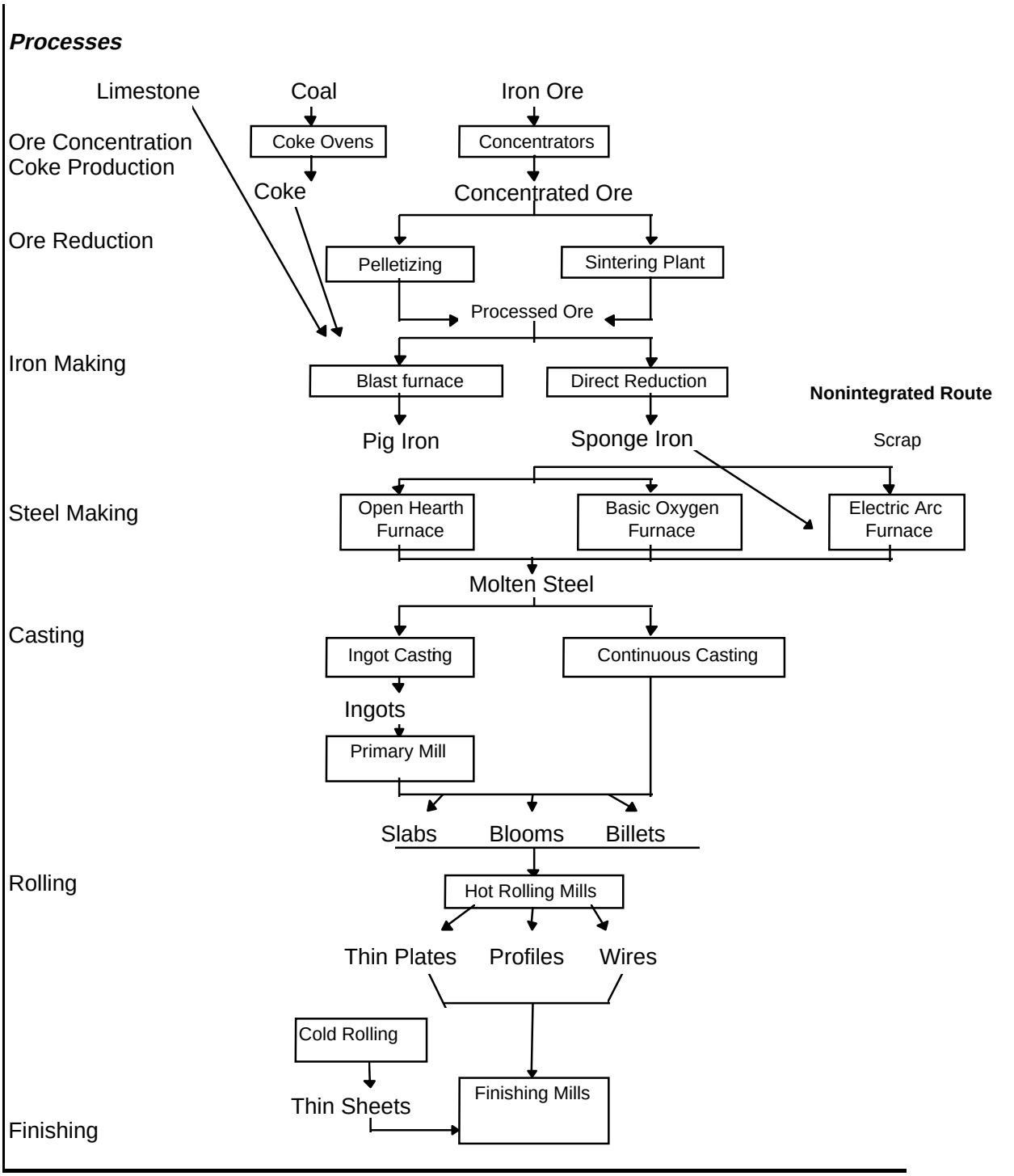
As both the composition of the iron ore and scrap vary according to their origin, the contents of the emitted dust change from plant to plant. Dust from primary processes may contain several heavy metals such as cadmium, lead, chromium, nickel, zinc, copper and arsenic. Mercury is also emitted from coke plants. These emissions occur at different places through storage, handling, crushing, sieving and transporting of metal-containing materials.

---

[16] Christmas, I., "The Steel Industry's Central Role in Sustainable Development", *Main Presentations at the First Global Consultation on Environmental Management/Cleaner Technologies in the Metallurgical Industry*, UNIDO, Vienna, Austria, 16-18 October 1995, pp. 5-9.

[17] Angulo, F., "Implications of the Globalization Process in the Metallurgical Industry (Issue Paper)", *Ibid.*

Main production routes in the iron and steel industry



Pollution prevention through investigative programmes

Although the implementation of electric arc furnaces (EAFs) has resulted in significant environmental improvements in many areas (i.e. recycling of scrap and residues, resource recovery and energy savings), emissions of dust during scrap smelting operations are increasing. It is estimated that 30-50% more dust are generated by EAFs compared to open-hearth furnaces. According to estimates made within the framework of BAT guidance work among contracting parties to OSPARCOM, the average dust emissions is thought to be somewhat between 0.5 and 1.0 kg/tonne, 0.5 being used as a conservative value to make sure that the relative importance of the sector is not exaggerated. Considering assumptions on the metal content in dust from the smelting of different types of steel[18], it was expected that total emissions had rose to 6 tonnes of mercury, 6 tonnes of cadmium, 500 tonnes of lead and 3 500 tonnes of zinc in 1993. Heavy metals such as nickel and chromium were not considered although emissions are expected to be high. Dioxin emissions are also becoming a matter of regulatory concern, although only two permit samples (Sweden and Germany) included requirements aiming at the reduction of releases.

ELVs have been used world-wide by permitting authorities to ensure that dust emissions are being kept under control. However, some permit samples in the case study also underscores the importance of selective efforts when sum parameters such as total dust and smoke, while providing flexibility to the operator, do not always ensure that all of the pollutants are under control. As such, the Swedish EPA has imposed target limit values for mercury and dioxin emissions which in turn have pushed the association of steel producers to investigate the influence of the quality and pre-treatment of scrap input on dioxin and other organic pollutant emissions.[19] The potential for emission reduction by different types of control technologies was also investigated. The project identified many factors which, if properly understood, could help prevent and/or reduce substantially hazardous emissions:

- Scrap content influences combustion efficiency and the formation of organic compounds during smelting, indicating a correlation between material input and pollutant output.
- Although the content and volume of emissions may be related to material input, the preparation of scrap appears to provide only marginal improvements.
- Test trials have shown that adsorbents injection into the off-gas systems allows for a good separation of chlorinated compounds (e.g. dioxins, chlorobenzenes, chlorophenols) and mercury. However, costs are high and dust collection may be problematic depending on the type of adsorbents used.

This type of investigation provides useful insights for identifying cost-efficient pollution prevention measures for reducing hazardous emissions. It also illustrates that a closer co-operation between suppliers and buyers represents a cost-efficient avenue for improving the environmental performance of steel producers. As such, appropriate purchasing guidelines, such as information on undesirable materials in scrap metal, could help reduce emissions through a better environmental control of material input. Likewise, regulatory control over hazardous industrial compounds, such as chlorinated oils and emulsions, may help reduced emissions in the long run, notably as a result of the growing share of cleaner scrap metal. These requirements illustrate in turn a trend in regulatory thinking where environmental management and cradle-to-grave approaches are being used increasingly to seek better cost-efficient ways of eliminating/reducing harmful substances and releases.

[18] Estimates were based on the following content of metals for the smelting of different types of steel: a) merchant iron and low-alloyed steel: 25% Zn, 4% Pb, 0.04% Cd; b) stainless steel and other alloyed steel: 2% Zn, 1% Pb, 0.005 Cd. Estimates for mercury emissions (approximately 10% of mercury is captured by fabric filters) was averaged at 0.2 g/tonne (Communication with André Ulmgren, Swedish EPA, 1996-10-16).

[19] "Effect of Scrap Preparation on Emissions and Steel Composition", *Jernkontorets Forskning*, Sweden, 1994-02-14.

At EAF plants, heavy metals and noxious organic substances such as polyaromatic hydrocarbons and dioxins are emitted with process gases during the melting of scrap. Toxic metals can be either alloying elements like nickel and chromium or contaminating elements like lead, mercury and cadmium. Mercury is emitted mainly in gaseous form. Heavy metal emissions also occur from the cutting of scrap, from the converters and from casting.

In addition, the iron and steel industry generates vast quantities of by-products and waste materials. Conventional integrated steel plants produce 0.5 ton of solid waste per ton of crude steel, whereas minimills generate 20 kg/ton.[20] However, nearly 90% of the solid by-product waste generated in steel production can be recycled, either by treatment, as raw materials or salable products. Nevertheless, environmental problems related to toxic releases, either in the form of solid by-products or emissions, remain significant. In the United States, although reported on-site releases by the steel industry dropped by 42.7% between 1988 and 1992, the total amount of reported toxic waste has not declined because the waste transferred off-site has increased from 3.7 billion pounds in 1991 to 4.7 billion pounds in 1993.[21] Emissions from fugitive sources are also significant in this industry as it involves multiple production units and the storage of vast quantities of minerals.

Technological response to permitting requirements

Environmental regulation affects the industry throughout all stages of the manufacturing and forming processes. The increasing cost of energy and introduction of stricter environmental regulations have pushed the industry to monitor its level of pollutants as required by law and to minimise their impact on the environment. These environmental pressures have led to some of the following initiatives and projects in the development of pollution prevention and control measures:

— Denitrification and desulphurisation technology;

— Implementation of continuous casting systems;

— Implementation of environmental management practices (e.g. product LCA, environmental investigation for improved techniques and operations, for instance on the relationship between scrap sorting and pollutant releases);

— Use of cleaner fuels;

— Scrap sorting and cleansing;

— Reuse of scrap and by-products as material inputs or salable products;

— End-of-pipe control techniques (filters, scrubbers, electrostatic precipitators, closed-loop systems);

— L-shaping of facilities and tree planting to address wind dispersal of dust.

---

[20] Angulo, F., *Op. cit.*
[21] *Toxic Releases Inventory,* United States, 1993.

ISSUING A PERMIT FOR A STEEL PLANT ON THE BASIS OF BAT-DRIVEN EMISSION LIMIT VALUES: A SWEDISH EXAMPLE

Hans Lannerblom (EPA) and Kjell Lundström (SSAB Oxelösund Ltd)

A. Government's view: the Swedish National Licensing Board for Environment Protection, presented by Hans Lannerblom

The selected facility for the case study is SSAB Oxelösund AB, which is the only Swedish primary iron and steel plant with conditions based on technology of today. The permit for this plant was issued in 1972. However, after a request from the Swedish EPA for a review of the conditions for the permit, the conditions were reviewed and requirements changed in 1992. The main reason for this request was that the conditions to which operations were subject were in many cases based on obsolescent technology and that they were generally out-of-date.

In its decision the National Licensing Board for Environment Protection has outlined the considerations taken into account in this review of the permit conditions and what I am going to do is to mention parts of what here is said by the Board.

Under the heading "General Premises", the following is said:

> "Emissions of sulphur dioxide and particulates from the parts of the iron and steel works in question here are very great, approximately 3,400 tonnes/year of sulphur dioxide and 1,700 tonnes/year of particulates. This means that the ironworks is one of the main individual sources of emissions to air in southern Sweden. Nonetheless, with the help of dispersal calculations and observations, the company has been able to show that the load on soil and the health of the population is relatively low. It can also be shown that the Oxelösund area is not one of the areas of Sweden suffering the most from sulphur, nitrogen and acidification, even though the "critical load limits" are exceeded."

The Board then continues:

> "One must be aware that measures at an individual emission source cannot be expected to bring about a radical change in load. If, for example, current emissions of sulphur from the ironworks (approx. 1,700 tones/year) were to cease completely, the mean load over Sweden would only decrease by one or two thousandths. However, the relative regional reduction would be one or two per cent within a range of 50 km. Thus, it cannot be expected that possible and reasonable emission limitations will be able to bring about any marked changes in the load. This will require substantial reductions in air pollution from other countries."

The above does not entail a negative approach to the need for and urgency of emission reductions. It should instead be seen as a warning of the risk of overvaluing the importance of such reductions

When considering the issue of measures to be taken to limit emissions etc., the Licensing Board is under a duty to implement the provisions of section 5 of the Environment Protection Act. Under this provision, demands for extensive abatement actions and precautionary measures are to be imposed in the light of what is reasonable from a technical and financial point of view and bearing in mind the public and private interests concerned.

Then there also are a number of rules auxiliary to the statutory rules and one such rule is that the basis for abatement measures should be "best available technology" (BAT). However, it is possible to depart from this principle for financial or other reasons.

According to the guidelines for reduction of industrial process emissions of sulphur and nitrogen oxides measures should be taken up to a cost of SEK 30 per kg of sulphur and SEK 40 per kg of nitrogen oxides. However, measures costing more than this may be justified in some cases, for example where the measure in question results in a reduction in other forms of environmental disturbance. These guidelines are referred to as “the 30-40 kronor principle”.

As may already be seen from the statements referred to above, they are in some respects contradictory and incompatible. For example, the 30-40 kronor principle represents a departure from the BAT principle. Nor is the 30-40 kronor principle binding on the Licensing Board when it considers permit applications and reviews permit conditions pursuant to the Environment Protection Act. However, the Licensing Board considers that the principle may serve as a basis for the Board's judgement of the reasonableness of the proposed conditions and measures. But there must always be scope for fairly radical departures from the principle where this is called for in view of the circumstances.

Then under the heading "Conditions for emissions to the air” the following is said regarding the sinter plant:

The sinter plant is the largest single source of emissions of sulphur dioxide, nitrogen oxides, particulates and metals from the Oxelösund ironworks. The works also consume large quantities of energy, causing large emissions of carbon dioxide. There are therefore only two courses of action open to achieve a substantial reduction in emissions of these substances from the iron works, either to install a very extensive treatment system, primarily for sulphur and particulates, or close down the works and substitute pellets for sinter as a raw material in the blast furnaces. The Board then makes a comparison between emissions from the manufacture of 1.2 Mt of pellets a year at a modern Swedish pellet plant and manufacture of the same quantity of sinter at the Oxelösund sinter plant under existing conditions.

According to this comparison, pellet manufacture gives rise to substantially lower emissions of sulphur, nitrogen oxides, heavy metal containing particulates, carbon dioxide, carbon monoxide, dioxins and other organic compounds.

The substantial reduction in carbon dioxide emissions is of particular interest from a general environmental protection point of view. This reduction corresponds to approximately 0.4 per cent of Swedish emissions from the use of fossil fuels.

It is the Licensing Board’s view that the circumstances described above ought naturally to result in a decision by the company to close down the sinter plant. No such decision has been taken however, and it is not formally open to the Board in considering this matter to prohibit operations. The circumstances described should instead result in stringent requirements for abatement measures in order to bring about a significant reduction in the difference between emissions from sinter production and those from pellet manufacture. But even at this point it should be noted that it will not be possible to meet such requirements to any great extent as far as dioxide emissions are concerned.

In the light of the above, the Licensing Board finds that a significant reduction of emissions of sulphur and particulates in particular should be required. Such a reduction is also justified in view of the local and regional pollution load. The judgement of the Board regarding the economic scope for ordering abatement measures to be taken is as follows.

On the basis of the company's presentation of the costs for removal of sulphur from process gases, the specific cost may somewhat exceed SEK 30 per kg emission reduction. However, it should be borne in mind that treatment to remove sulphur can in this case be combined with an improvement in separation of particulates, as well as a reduction in dioxin emissions, both of

which are absolutely essential. Hence, the cost will not be unreasonable in the circumstances. This treatment of process gases should reduce emissions from the sinter plant to no more than 200 tonnes a year; the particulate concentration in emissions should be limited to a maximum of 10 mg/m^3.

After the Board has also taken other emissions from the sinter plant into consideration, the Board states that a condition for emissions from the sinter plant ought to be that sulphur emissions do not exceed 0.20 kg S/t sinter and that the maximum figure for particulate emissions should also be 0.20 kg/t sinter, the figure in both cases being an annual mean value.

B. Industry's view: SSAB Oxelösund AB, presented by Kjell Lundström

SSAB's comments to case studies on the use of BAT and EQOs in the Swedish iron and steel industry

Viewpoints of Swedish environmental legislation

Decisions according to the Swedish environmental legislation are to be based on a common judgement of what is:

— technically possible

— economically reasonable

— ecologically justified

On our part, we experience that the demands imposed on the safety measures by the authorities more and more are based on what is possible from point of view of technology. The decisions from the Licensing Board for Environmental Protection have also been adapted in that direction, probably as a consequence that the government in general concerning the licenses, which are appealed against, seems to make about the same judgement as the authorities.

This implies that Swedish steel industry as a rule has considerably stricter environmental protection requirements than our competitors in other countries.

The so-called individual consideration is also a too time-consuming procedure which becomes more and more old-fashioned, particularly as the decisions, as time goes on, tend to become more uniform. A change to general requirements would therefore be desirable. It would enable the industry to predict cost and would result in shorter times of management.

Considerations in connection with decided emission limitations

Sinter plant

Our sinter plant is 35 years old with a production capacity of 1.2 million tons per year. Cyclones were used for the cleaning of process gases. Cooling air for hot sinter etc. was cleaned in dry electric filters. The cost of the emission limitations required 0.2 kg of SO_2 and dust per ton was about comparable with the cost of winding up and substitution with a new material handling system for pellets, additives and a new briquetting plant for waste briquettes. The risk that requirements for cleaning of NO_x would be imposed in future was crucial and to the disadvantage of the sinter plant. It is also simpler to control an operation without a sinter plant.

Blast furnaces

The plant consists of 2 blast furnaces.

Emissions to air

The fulfilment of a maximum emission of dust of 0.07 kg/ton of hot metal alternatively 10 mg/Nm^3 after textile filters was only an adjustment to prevailing conditions. No further investments were required.

Water pollutants

Existing process water is cleaned in thickeners and cooled in an open cooling tower before reuse. Maximally 5% of the water volume is together with separated slurry led to a slurry lagoon after which the cleaned water is discharged into the Baltic Sea. For fulfilment of the emission requirement, it is required that the wastewater containing slurry is dewatered in a dewatering equipment. The bleed-off of the process water to prevent salt formation in the system is made from the cleaned and cooled process water.

To fulfil the emission requirements of:

— zinc 0.5 mg/l

— lead 0.2 mg/l

— cyanide total 1.0 mg/l

— free cyanide 0.1 mg/l

— suspended matters 10 mg/l

— pH > 8 mg/l

The water must be sandfiltered before discharged to recipient.

The content of cyanide is normally very low due to a very low content of alkali in pellets.

Steel plants

The BOF plant contains a converter with a capacity of 220 tons per heat.

The waste gases from the converter is cleaned in venturi scrubbers. The process water is cleaned in thickeners and is recycled in the venturi scrubbers. The bleed-off of water from the system is low. The converter is built-in with an exhaust to textile filter. To cope with the tightening up of permitted dust emissions from 0.3 to 0.15 kg/ton, further exhaustion and cleaning is required from the lantern above the furnace and from the reloading station. Existing textile filter must be doubled.

The emission requirement for 3 kg of suspended matters per 24 hours with the process water is coped with without further cleaning measures. However, such an emission requirement is unfortunate, as the content of suspended matters in the sample is more dependent upon how long the sample is stored before analysis is made than upon the content of suspended matters in the process water. The suspended material mainly consists of lime, which is precipitated through the influence of the air.

Waste recovery

To take care of residual products containing iron earlier contained in the sinter mix, a briquetting plant is being built, where the material is bound with cement.

Environmental influence in the surroundings

West of the iron works area, the town of Oxelösund with about 13,000 inhabitants is situated. Between built-up area and the works area, there is a protected area of 400-800 m. The Baltic Sea is east and south of the works area. The area north of the works area mainly consists of forests.

The noise requirements are observed without further investments.

Investigations made of environmental effects to find out the company's influence as regards emissions to air leading to acidification (i.e. sulphur and nitrogen) and heavy metal deposition show that the company's emissions only have a marginal influence on the immediate surroundings (0-3 km). The main part of acid fallout in our area (80-90%) originates from Central Europe.

The contents of SO_2, NO_x and PM_{10} in the air in Oxelösund are about 20, 10 and 15 µg/m^3, respectively. These levels have not been affected by the measures taken owing to the above-described requirements, resulting that the emission of dust, SO_2 and NO_x has been reduced by about 50%.

The water in the Baltic Sea is mainly influenced by phosphorus and nitrogen supplied to the Sea through the river systems or through the air (applied to nitrogen). The company's emission to the water recipient has a very small influence. However, it is proved that recycling and cleaning of process water carried out in the middle of the 1970s have had a favourable effect on the recipient.

2.2 Metal finishing case study

The metal finishing case study was presented by **Geertjan Smits**, **Stefan Daamen**, and **Hans du Mortier**. **Mr. Smits**, from the Dutch consulting firm TEBODIN Consultants and Engineers who drafted the case study report, presented the overall conclusions from the case study, in which six OECD Member countries participated. **Mr. Daamen**, a delegate from the Dutch Water Board *Zuiveringsschap Rivierenland* presented the types of permitting processes used by the Water Board to license different industrial production processes. **Mr. du Mortier**, an industry representative from the Association for surface finishing techniques in the Netherlands, provided a complete description of the environmental and economic issues faced by the Dutch electroplating sector.

Sector overview
Geertjan Smits, TEBODIN, the Netherlands

The metal finishing case study was drafted on the basis of some country profiles presenting the industrial sector, the various processes used in the industry as well as the regulatory framework in which permitting decisions are taken. In addition, a series of permit samples provided practical illustration of the issues faced by permitting authorities in some specific cases. The following table provides a summary of the information used in each participating countries.

Participating countries	Information basis		
	sector profile	*regulatory framework*	*additional information*
Austria	✓	✓	1 water permit 2 air permits
Belgium (Flanders region)	✓	✓	2 integrated permits
Germany	✓	✓	1 water permit
Netherlands	✓	✓	1 water permit 1 air permit 1 waste permit
Switzerland	✓	✓	1 water permit 1 air permit
United Kingdom	✓	✓	2 integrated permits

The metal finishing study highlighted some key sets of issues. In particular, it sought to determine how the economic costs associated with permitting requirements for small- and medium-size enterprises (SMEs) are incorporated into permitting decisions. In addition, the survey illustrated the issue of compliance with environmental standards in an industry where permits are granted mainly by regional and local authorities. The study also focused on the substantial discrepancies between the types and levels of limit values observed between processes and between countries. The main findings are summarised below.

Environmental quality and permitting mechanisms

An interesting characteristic of this case study is that all participating countries are neighbours to each other and, except for Switzerland, they are Member states of the European Union. Thus, in the wake of the EU's IPPC directive, the policy and environmental legislation of these countries are in full motion. It may be therefore revealing to examine the commonalties and differences of these countries' approaches in setting permit conditions for the same sector. The following aspects have been identified by authors of the case study:

Similarities in permitting approaches

— Participants are neighbouring countries;

— Permits are issued by local and regional authorities;

— Environmental standards have been adopted in all countries;

— The German TA-Luft often serves as a basis for establishing air ELVs;

— ELVs may take the form of binding standards or guidelines;

— ELVs may be general standards or determined for specific processes;

— BAT limits are first applied and then compared to existing EQOs;

— Timetables are used to help alleviate the financial burden of strengthening ELVs.

Differences in permitting approaches

— Differences in water ELVs may be important (up to 10 times higher);

— Differences in water ELVs may be explained by their specificity (general or sector), their nature (binding standards or guidelines) or by differences in applying BAT in setting permit conditions;

— Differences in water ELVs may derive from external factors, such as the existence of water treatment plants and/or the location of the facility under review (e.g. near underground water);

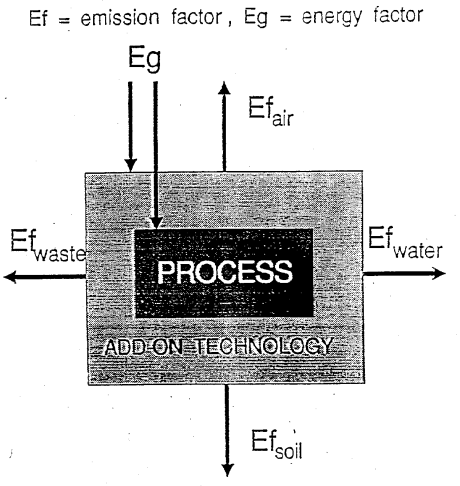
— Differences in BAT-type limits may imply that economic considerations play an influential role in setting permit limits, thus putting pressure on the competitiveness between SMEs;

— Some permits used general standards, regardless of the compounds used at the specific plants, while others concentrated on the substances used or emitted at the facility.

Metal finishing sector profile

This industry is a sector largely characterised by small and medium-sized enterprises (SMEs). In the electrolytic metal finishing industry, many different processes (metal working, welding, painting, assembling, etc.) produce several kinds of products (metal products, machines, transportation, electronics, etc.). Before electrolytic finishing, metal parts are degreased in organic solvents, by aqueous cleaning, or pickling. The most important metal coatings are zinc, nickel, copper, chromium and cadmium. The process usually takes place in a reservoir with a bath fluid through which an electrical current is led. Parts are often rinsed in water, either after a galvanising step, between galvanising steps, or after degreasing or pickling.

In addition to the electrolytic metal finishing process, the storage of chemicals and waste, the treatment of emissions (aqueous and gaseous) and the discharges of waste water are among the main environmental issues of concern. The figure below provides an abstract illustration of the various factors affecting the environmental performance of the process.



The following industrial processes can take place within the metal finishing industry, inducing the following environmental consequences:

— Degreasing:

  – emission of organic solvents to the atmosphere.

— Electrolytic metal finishing:

  – heavy metals to the atmosphere;

  – heavy metals, cyanides and acid into surface water.

— Waste water treatment:

  – sludge;

  – sludge from ion exchangers;

  – heavy metals into surface water.

— General:

  – storage of hazardous chemicals;

  – storage of dangerous waste.

Technological response

The plants under review have used a combination of in-process pollution prevention measures (to avoid the bulk of emissions), and end-of-pipe treatment techniques (to deal with remaining emissions). External treatment capacity was then used for waste generated by end-of-pipe techniques. The following measures have been reported by the facilities:

— Transport and handling of nickel carbonate in closed containers, emptied under low-pressure;

— Purchasing of nickel carbonate with a moisture degree of 33%;

— Dividing of exhaust air streams for better treatment;

— Installation of RedOx and pH control of oxidising washing media;

— Use of scrubbers;

— Internal re-use of scrubber water;

— Circulation and re-use of water streams;

— Dividing of waste water streams for better treatment;

— Low dragging from baths by spray rinsing (nozzles);

— Installation of treatment stages for sulphate, nitrite and sulphite;

— Depoisoning of cyanide-rich rinsing water;

— Transition from sodium hypochloride to peroxide for cyanide detoxification;

— Precipitation of nickel-rich rinsing water;

— Re-use of treated effluent as rinsing water;

— Combination of ion exchange and electro-deposition;

— Ultra filtration of degreasing baths to lengthen the immersion time;

— Changing over to water-based degreasing;

— Optimal use of pickling regulators.

ISSUING PERMITS FOR SMEs OF THE METAL FINISHING INDUSTRY: A DUTCH EXAMPLE

Stephan Daamen (Dutch Water Board)
Hans Du Mortier (Association for Surface Finishing Techniques)

A. Government's views: the Waterboard Zuiveringschap Rivierenland *presented by Stefan Daamen*

The Waterboard Zuiveringschap Rivierenland distinguishes two major types of permitting processes on the basis of the size and nature of the industrial facilities to be licensed:

— small enterprises characterised by simple production processes and a maximum of 25 employees are subject to a simplified procedure;

— large enterprises characterised by several complex production processes and a total number of employees in excess of 25 are handled under a more thorough permitting process.

The basic permitting process entails the following stages:

— a draft permit application is produced;

— an official consultation is conducted concerning the permit application;

— a final permit application is drafted on the basis of the information collected in previous stages;

— a draft permit incorporating standards ELVs is designed;

— the draft permit is published;

— the final permit is issued.

The permitting process for complex production processes entails the following stages:

— a draft permit application is produced; new permit applications have to be produced more than six months prior to the expiration of the current permit;

— several official consultations are conducted in which processes are examined;

— a final permit application is drafted;

— a draft permit is then issued, with:

  – limited duration; and

  – instruction to research;

— a negotiation is conducted concerning the draft permit;

— the draft permit is then published;

— the final permit is issued for a limited duration.

According to the Waterboard Zuiveringschap Rivierenland, this type of permitting system offers three major advantages:

— it avoids the application of standard solutions to different problems and allows for customisation of permitting requirements according to the types of emissions under scrutiny;

— it involves the own responsibility of the permitted company;

— it facilitates the enforcement of the permit.

B. Industry's views: the Dutch Association for surface finishing techniques
presented by Hans du Mortier

The Dutch electroplating industry is characterised by the following features:

— total number of companies: 350 shops;

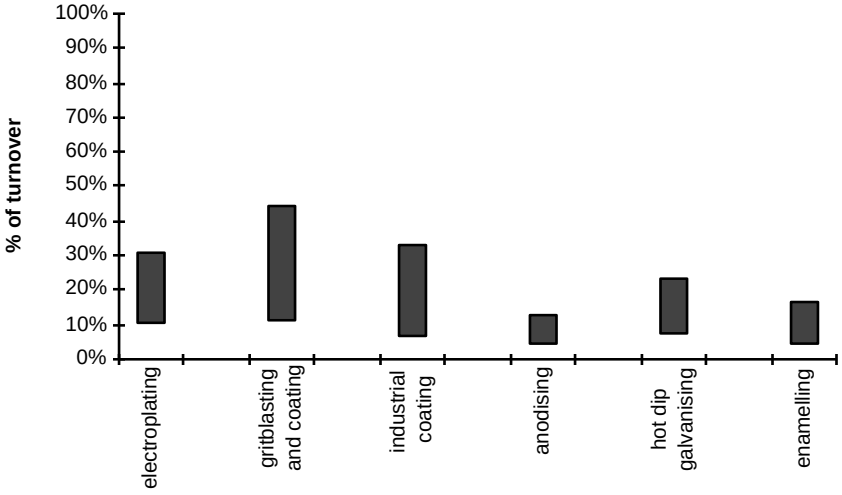
— average company size: 15 people;

— estimated turnover per worker: FF 175 000-200 000;

— net result of companies: 2-5% of turnover;

— overall environmental cost: 15-30 % of turnover.

Cost estimates of environmental protection for the Dutch surface finishing sector



The overall cost of environmental protection can be broken down according to the following processes. For each of these processes, surface finishing companies in the Netherlands estimate that their costs (in % of turnover) fall within the following ranges (see Figure 1).

The industrial processes used in the surface finishing sector have several environmental aspects. Among the problems faced by the SMEs of the surface finishing industry are the following:

— reducing water discharges increases energy consumption and waste generation;

— the link between the volume of discharges of metals (e.g. zinc or nickel) in water and emissions of carbon dioxide is far from clear;

— permittees have limited knowledge and negotiation skills.

Consequently, it is the role of the industry association to assist the SMEs of the surface finishing sector in the negotiation of permits. In so doing, it must also stress the fact that, over the long run, EQOs are an important criteria to take into consideration. For SMEs, only economic considerations are a fact of life.

2.3 Oil refining case study

The oil refining case study was presented by **Dr. Christine Hemming**, and **Philemon Berckmoes**. **Dr. Hemming**, from the British consulting firm Chrysalis Environmental Consulting who drafted the case study report, presented the overall conclusions from the case study, in which five OECD Member countries participated. **Mr. Berckmoes**, Refining Director at Esso Benelux in the Netherlands, provided a complete description of the environmental and economic advantages of the concentration bubble concept within the framework of industrial permitting strategies. Drawing on examples from the Belgian petroleum industry Mr. Berckmoes's presentation illustrated through practical examples the types of instruments that can be used to prevent and control emissions from oil refining.

Sector overview

Christine Hemming, Chrysalis Environment Consulting, United Kingdom

The oil refining case study was drafted on the basis of some country profiles presenting the industrial sector, the various processes used in the industry as well as the regulatory framework in which permitting decisions are taken. In addition, a series of permit samples provided practical illustration of the specific issues faced by permitting authorities. The table below provides a summary of the information used in each participating countries.

Participating countries	Information basis		
	sector profile	*regulatory framework*	*additional information*
Belgium (Flanders region)	✓	✓	4 integrated permits
Italy	✓	✓	3 air permits
New Zealand	✓	✓	1 water permit 1 air permit
United Kingdom	✓	✓	2 integrated permits
United States	✓	✓	2 water permits 2 air permits 2 waste permits

The oil refining study highlighted some key sets of issues. In particular, the move toward multimedia permitting, the importance of statutory requirements as a backdrop for permitting and the interaction between BAT and environment-based considerations in permitting decisions were addressed in the course of the study. The main findings are summarised below.

Environmental quality and permitting mechanisms

Three out of the five participating countries are EU Member states and EU Environmental Directives set the framework within which the permitting systems in these three countries need to operate. All of the participating countries, except for the United States, have also recently moved, or are in the process of moving, to multimedia permitting system. The United States has been intensifying its own initiatives in the field of integrated approaches, for example through environmental review mechanisms of major stationary sources such as the oil refining industry. Here are some of the main commonalties and differences in countries' permitting approaches to the sector under review:

Similarities in permitting approaches

- Relevant EU legislation:
  - Large combustion plants Directive;
  - Environmental quality standards.
- In all countries, oil refining permits are governed by recent legislation and permitting authority is generally at a higher level;
- All countries use BAT concepts in considering permit requirements;
- EQOs are overriding requirements;
- If EQOs are met, permitted limits may be based on emission limits or guidelines derived from BAT(NEEC);
- Similar substances have been controlled in the sample permits;
- Permits generally include timetable for reductions in limits.

Differences in permitting approaches

- Differences in BAT definitions (e.g. binding standards versus guidelines);
- Some countries may adopt less stringent limits than BAT, based on EQOs and economic considerations;
- BAT standards are binding in the United States;
- EQOs are set at national level (applied uniformly) in the UK, Belgium, Italy and the US, or regional guidelines in New Zealand and in the US as well;
- Permitted values may vary in form, scope and purpose.

Oil refining sector profile

Oil refining is the process by which the physical, thermal and chemical separation of crude oil generates major distillation fractions. Then, through a series of separation and conversion

steps, three major categories of petroleum products are manufactured: fuels (motor gasoline, diesel and distillate fuel oil, liquefied petroleum gas, jet fuel, residual fuel, kerosene, and coke); finished nonfuel products (solvents, lubricating oils, greases, petroleum wax, petroleum jelly, asphalt, and coke); and chemical industry feedstocks (naphtha, ethane, propane, butane, ethylene, propylene, butylenes, butadiene, benzene, toluene, and xylene). In the United States, feedstock production represents about 40% of the total energy consumed (based on BTUs consumed) related to the production of petroleum products.[22] They enter directly or indirectly in the production of many products, such as fertilisers, pesticides, paints, waxes, solvents, detergents, anti-freeze, plastics, synthetic fibres, etc. For logistical reasons, refineries are usually sited near crude oil sources (petroleum terminals, oil and gas extraction areas) and consumers (industrialised zones).

Due to the nature of its operations and to the compounds involved, the petroleum refining industry is a major source of environmental concerns. The prevalence of volatile chemicals explains the importance of emissions of toxic chemicals to the air by the refining industry. Among them are aromatic hydrocarbons (benzene, toluene, ethylbenzene, xylene, cyclohexane, 1,2,4,-trimethylbenzene and ethylbenzene). Ammonia is a also released in large quantities. The primary channel of release to the environment is through underground injection of wastewater and emissions to air. Additives and chemical feedstocks are mainly released as air emissions due to their high volatility. A significant portion of the remaining chemicals are metal compounds, which are typically transferred off-site for recovery or as a component of hazardous wastes. Sulphuric acid is also generated in large quantities and typically transferred off-site for regeneration.

Recent and future regulatory changes are expected to force the petroleum refining industry to make substantial investments in upgrading certain refinery processes to reduce emissions and alter product compositions. For example, industry estimates of the capital costs to comply with the 1990 Clean Air Act Amendments, which mandate specific product compositions are about US $35 to $40 billion.[23] Thus, pollution prevention is becoming a significant issue as environmental regulations have been strengthened and waste disposal costs have skyrocketed. The main areas of improvement are expected to be through improved operating procedures, increased recycling and waste minimisation, and process modifications. However, it appears that pollution prevention opportunities are generally expensive and that current regulations offer poor incentives for the industry to perform beyond permit requirements. It is felt that the implementation of incentives, such as emission credits and long-term voluntary agreements, could help alleviate this problem.

Technological response

It is difficult to draw general conclusions about the technology used in response to the permit requirements from the samples provided for the case study. The number of permits were too small and the processes covered are too varied. Nevertheless, there are some similarities evident in the technological solutions implemented. For example, several of the facilities use systems to monitor and manage the sulphur content of the fuels used. Sulphur recovery units have been installed at all facilities, often with improved efficiency, and there are several cases of the use of low-NO_x burners, of combined heat and power plants, of secondary seals on storage tanks, of biological treatment of aqueous effluent, and of the use of sour water strippers.

---

[22] "Profile of the Petroleum Refining Industry", EPA Office of Compliance Sector Notebook Project, United States Environmental Protection Agency, Washington DC, ISBN 0-16-048280-1, September 1995.
[23] Ibid.

Thus, the technological solutions implemented are generally a mix of internal and external controls, depending on the specific circumstances of the plants. For existing plants, the scope for internal controls is often more limited, and external controls may be the only options. Examples of internal controls include the use of fuel management systems and preventative maintenance and inspection. Examples of external controls include selective catalytic reduction units, tail gas clean up in sulphur recovery units and dust removal equipment.

ISSUING PERMITS FOR OIL REFINERIES ACCORDING TO THE "CONCENTRATION BUBBLE" CONCEPT: A BELGIAN EXAMPLE

Philemon Berckmoes, Esso Benelux

Industry's views: Esso Benelux and the Belgian Petroleum Federation *presented by Philemon Berckmoes*

Environmental control from the Belgian refining industry is based on the concentration bubble principle. The concentration bubble approach is characterised by the following features:

— emission limit values are expressed in terms of concentrations of gases (e.g. mg of SO2 or NOx per m3 of exhaust):

  – the numerator of the ELV is the sum of all the SO_2 or NO_x emissions of a refinery;

  – the denominator represents the volume sum of all flue gases;

— the relevant legislation requires all refineries to comply with emission limit values; ELVs are gradually strengthened over long periods of time in order to provide necessary predictability for plant operators;

— permits for refineries do not contain any ceilings in terms of emission tonnage:

  – emission tonnage is the result of the concentration value and the plant's economic activity;

  – total emission tonnage forecasts are provided by the permitted industry;

— on the basis of the reports submitted regularly by refiners, total emissions are computed and analysed; to ensure compliance and acceptability, spot checks are conducted by governmental authorities and systems are approved by independent experts.

The concentration bubble approach offers the following advantages over other permitting approaches:

— refiners are subject to similar emission limit values; therefore:

  – distortion of competition is avoided in Belgium;

  – however, it is difficult to establish comparisons with some other countries;

— the concentration bubble approach promotes more cost-effective reductions in emissions and flexibility:

- because of the large area over which the system applies, economies of scale apply;
- for the same environmental result, high-cost reduction measures are avoided and more resources are devoted to introduce low-cost solutions;
- the concentration bubble approach thus means a win-win situation in which lower emissions are attained at equal cost;

— for the permitted company, operational failures can be compensated by actions taken in other plants within the bubble, minimising the impact on operating costs.

For instance, the use of the concentration bubble approach in Belgium for controlling SO_2 emission has produced the following results:

— the maximum concentration of SO2 allowed in the refineries' flue gases is currently set at 2000 mg/m3; by comparison, the limit was set at 3000 mg/m3 in 1992 and will be brought down to 1300 mg/m3 in 1998;

— different refineries come up with different approaches to the same concentration requirements to satisfy current and future maxima, for instance:

- lower recovery sulphur plants are not modified until major refinery revamp occur while in the meantime concentration limits are complied with by the use of more sulphur-free gas or lower sulphur liquid fuel in the fuel pool;
- SO_2 emissions of catalytic cracker operations on non-desulphurised feed are compensated by lower sulphur concentration in the fuel pool or new, high-recovery sulphur plants;
- the operation of furnaces not equipped for low-sulphur fuel gas is compensated by the use of furnaces operating on 100% gas;
- emissions caused by sulphur recovery tail gas units temporary out of service are compensated by less sulphur in the fuel pool.

2.4 Pulp and paper case study

The pulp and paper case study was presented by **David Halliburton**, and **Ian Mackenzie.** Mr. Halliburton, from the Renewable Resources Division of Environment Canada, presented the overall conclusions from the case study, in which ten OECD Member countries participated. Mr. Mackenzie, Standards Development Specialist at the Environmental Assessment Division of Alberta Environment, provided a review of the approach to pulp mill effluent regulation followed by the Canadian province of Alberta.

Sector overview
David Halliburton, Environment Canada

The pulp and paper case study was drafted on the basis of some country profiles presenting the industrial sector, the various processes used in the industry as well as the regulatory framework in which permitting decisions are taken. In addition, a series of permit

samples provided practical illustration of the specific issues faced by permitting authorities. The table below provides a summary of the information used in each participating countries.

Participating countries	Information basis		
	sector profile	*regulatory framework*	*additional information*
Austria	✓	✓	1 water permit 1 air permit
Belgium (Walloon region)	✓	✓	1 water permit
Canada	✓	✓	7 water permits 7 air permits
Finland	✓	✓	3 water permits 3 air permits 2 waste permits
Germany	✓	✓	2 water permits 1 air permit 1 waste permit
New Zealand	✓	✓	2 water permits 1 air permit 1 waste permit
Norway	✓	✓	1 integrated permit
Sweden	✓	✓	1 integrated permit
Switzerland	✓	✓	1 water permit 1 air permit 1 waste permit
United States	✓	✓	3 water permits 2 air permits

The study highlighted some key issues such as potential cross-media effects, the balance of BAT-derived and environment-based requirements in permitting decisions for the protection of particularly sensitive receiving environments, and the practice of case-by-case as opposed to systematic permitting. Pulp and paper sector profile

Environmental quality and permitting mechanisms

The pulp and paper case study has focused on the two main chemical processes for pulp bleaching (i.e. the sulphite and kraft process). In establishing permit conditions, it appears that authorities have balanced technological and EQO considerations. The following findings focus on issues related to permitting for water quality. Broad conclusions on permitting approaches and mechanisms are as follows:

Similarities in permitting approaches

— Permits specify conditions and limits to ensure environmental protection;

— Countries use technology-driven emission standards;

- Limits developed are based on BAT concepts;
- Stricter permit limits may be set based on water quality objectives (WQOs);
- Choice of technology is left to the mills;
- Decreases to one media entail increases to others, calling for integrated media permitting approaches.

Differences in permitting approaches

- Some countries set permits on a case-by-case basis considering BAT and WQOs;
- Some countries use integrated (Sweden), or semi-integrated permitting systems (Finland);
- Remaining countries follows WQOs but one mill on a sensitive ecosystem mandates stricter control;
- Differences in parameters used to set limits:
  - BOD in 7 countries;
  - COD in 6 countries;
  - TSS in 6 countries;
  - AOX in 9 countries;
  - Toxicity in 4 countries;
  - Dioxins and furans in 2 countries;
  - Nutrients in 4 countries;
  - Colour in 3 countries.

Pulp and paper sector profile

Paper products play an important role in modern life serving in a wide range of uses such as written communication, information storage, wrapping and shipping materials, personal hygiene products, etc. Raw pulp fibres are also used to construct a variety of other materials such as building boards. Large tonnages of pulp and paper are used world-wide, mostly derived from wood, but with some being based on plant materials such as bagasse. In 1994, world paper and paper board production capacity amounted to 294 million tonnes. Recycling of used paper products is important, with the used materials being treated to recover the fibre values. The recovered fibres are then reconstituted into new paper products.

A number of different processes are used to extract the fibres from raw materials in order to manufacture paper products. These consist of mechanical and chemical processes. In the pulp and paper case study, participating countries focused on the chemical processes (sulphite and kraft processes) in order to allow the report to compare approaches for the same types of mills. The bleached chemical pulp mills also impose the greatest environmental load and therefore represent a prime choice to study how environmental requirements are addressed.

Influence of control parameters on technological change

On several occasions, workshop participants have raised the problem of the non-comparability of national systems of environmental indicators and measurements. Indeed, the lack of international standards renders difficult an accurate benchmarking of the industry's performance worldwide, a problem which has been clearly identified in the Finnish contribution for the EC document of BAT for the European P&P industry.[24] This problem may even renders difficult a comparison of environmental performance within countries.

But these different methods may also be the result of different objectives pursued by regulatory authorities, e.g. whether environmental targets to be attained in specific locations or ways of providing more flexibility to operators for complying with specified limits. As such, the pulp and paper case study has shown that Member countries use an array of control parameters when specifying ELVs in permits. For instance, biological oxygen demand (BOD) is usually used for regulating effluents discharged in inland waters since it specifically provides a measure of the oxygen consumed by bacteria while feeding on the biodegradable constituents in the effluent. However, secondary treatment to control BOD is ineffective for complying with chemical oxygen demand (COD) based-limits, which are based on a measure of all oxidisable constituents. Thus, COD will exert more pressure on operators to take internal measures, e.g. pollution prevention, to remove at source the substances of concern. Thus, it is not surprising that most permits which regulate point sources discharging in high dilution water bodies will include COD-based limits, while plants which operate nearby inland waters will have to comply with BOD-based limits.[25] This is a striking evidence of the combined use of technology-based and environmentally-based approaches for controlling point sources of pollution. As such, BOD is currently being phased out as a control parameter by Swedish authorities, while COD is not used in jurisdictions such as Canada and the United States.[26]

In addition, discharge limits may be specified by different calculation methods, e.g. set for a specific amount for a given period of time (e.g. tonnes per day or per month, or as a quantity per tonnage of production) or as a unit of concentration (e.g. milligrams per litre). The average period is another important factor when comparing discharge limits in different jurisdictions as ELVs may be measured as an annual, 3 month, or daily maximum average. Likewise, monitoring compliance may involve different methods, e.g. the "24-hour composite" method, in which a mean value is obtained from effluent samples taken at regular intervals over a given period, or the "grab sample" method, in which "snapshot" or single random sample lecture of the amount of a given contaminant in the monitored effluent is extrapolated from instantaneous samples.

Obviously, these different parameters appear to be related to the specificity of local conditions or the search for increased accurate monitoring of environmental impacts.[27] But the globalisation of environmental issues and pervasive free trade policies are emerging factors requesting the implementation of transparent and fair policy processes worldwide. This is likely to require the development of international guidelines for achieving a similar environmental performance for various countries. As such, workshop participants have identified the OECD as a most suitable forum for improving information exchange and developing consensus on the most appropriate methods for assessing environmental performance.

---

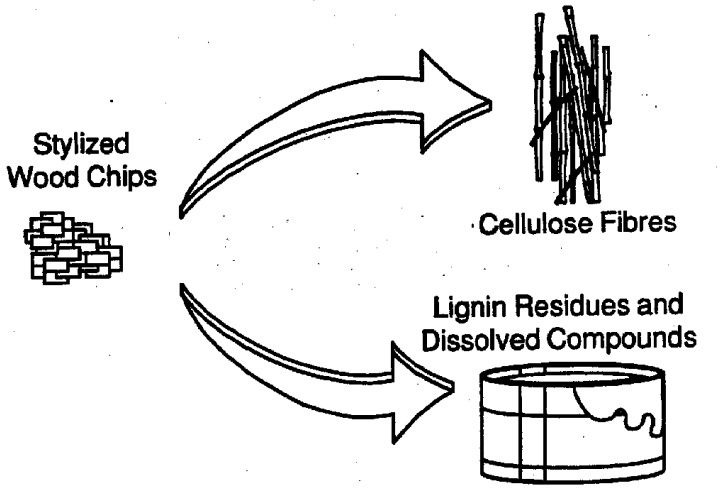
[24] "The Finnish Background Report for the EC Documentation of Best Available Techniques for Pulp and Paper Industry", *Ministry of the Environment*, Helsinki, 1997.

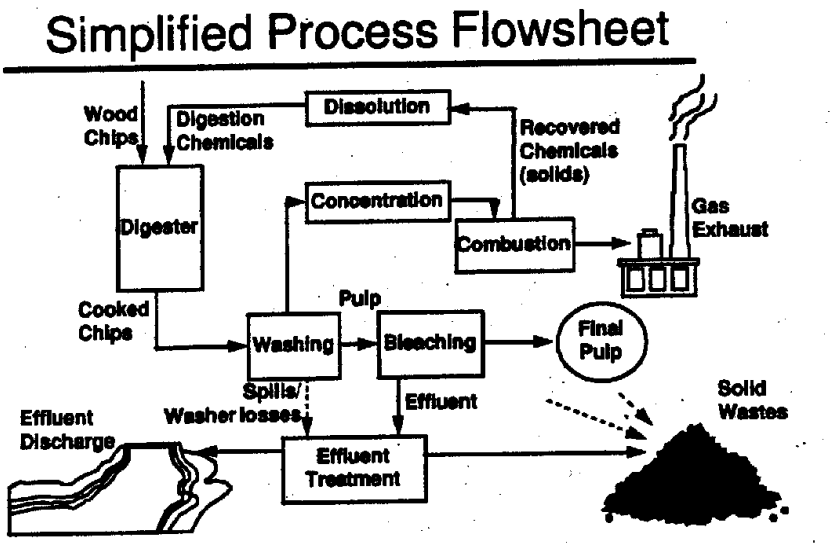
[25] "Forestry sector Benchmarking Initiative – A Case Study in Environmental Regulations", *Simons Consulting Group*, November 1994.

[26] "Case Study on the use of Best Available Technology (BAT) and Environmental Quality Objectives (EQOS) in the Environmental Permitting of Bleached Chemical Pulp and Paper Mills" (Final Draft), OECD, Paris, October 1997, p.4.

[27] For instance, COD discharge levels will vary in stringency depending if ELVs are based on either the permanganate (i.e. COD_{MN}) or dichromate (COD_{CR}) method. If set at similar numerical values, the latter will provide much tougher discharge levels to reach than the former.

Indeed, the P&P industry has long been a focus of environmental concern. Until the 1970s, the industry was weakly regulated and was then associated with some of the worst industrial environmental pollution. Owing to a combination of regulation and effective industry innovation, the most urgent and obvious environmental problems have been successfully tackled. Regulation now strictly controls the quantity and quality of emissions to different media. Air emissions standards relevant to pulping processes generally limit unit output emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), and particles (TSP). Water discharges are controlled for total suspended solids (TSS) and organic content (regulated through the implied biological and chemical oxygen demands (BOD and COD)). The kraft pulping process (the most widely-used commercial process) also leads to the formation and release of methyl mercaptan (CH_4S), a reaction product caused by partial lignin hydrolysis in the presence of sulphur. Methyl mercaptan is among the worst and most potent of the "smell" gases. The regulation of air emissions has led to the use of control technologies that have substantially reduced these problems.





Industrial processes used to separate the fibrous and non-fibrous materials from wood fibre are responsible for the large quantities of organic waste. Chemicals are used to dissolve the non-fibrous materials (lignin, gums, etc.). Both solvent and solute are then flushed out using water. On a unit product basis, pulping therefore generates large quantities of contaminated effluent, which may (or may not) be fully recovered (some mills convert some quantities of these by-products into energy). As an example, the pulp and paper facilities surveyed in the study generate between 40 and 150 m^3 of effluent for each tonne of pulp produced. If allowed to be released into the environment, the effluent has high COD and BOD which can cause eutrophication of receiving water courses. In addition, the effluents contain chemical contaminants resulting from the pulping and bleaching processes. Among others, these include sulphur (S), a substance that contributes to environmental acidification, as well as chlorine (Cl) and its compounds which can react with organic matter to produce organochlorines. While uncertainties remain on the environmental effects of organochlorines, national regulations have been established to control these compounds, generally through the regulation of Adsorbable Organic Halogens (AOX) emissions and, in some cases, by targeting dioxin and furan discharges as a preferred regulatory strategy. In both cases, stricter standards have led to high rates of use of chlorine dioxide (ClO_2) as a preferred bleaching agent, as a substitute for elemental chlorine. Nevertheless, because of remaining ecological issues linked to P&P effluents, R&D activities have been aiming toward the closed-cycle bleach kraft mill.[28] Some experts have claimed that it would be difficult to fully recycle the effluents while staying with Cl bleaching technology since to do so would involve recovering and reusing materials

[28] GLEADOWS, P. *et al.*, "Towards the Closed-Cycle Bleached Kraft Mill: Recovery Cycle Implication", *Proceedings of the 25th EUCEPA Conference*, Vienna, 4-8 October 1993.

contaminated with corrosive chloride compounds. Closed-cycle processes using Cl would also impose higher costs pertaining to equipment adapted to higher chloride levels[29].

The pulp and paper industry also generates solid waste in the form of residues from recaustising, bark solids or ashes from combustion, water treatment plant sludges, primary sludges, biological solids or drinking plant sludges.

Technological response

The analysis of permits and information provided by countries indicates that mills have implemented similar technological measures in response to the permit limits set. In some areas, such as AOX levels, some mills have even gone beyond permit requirements. With respect to bleaching, pollution prevention measures have been implemented on a combination of technological innovation and improved techniques and operating practices, such as:

— Complete cooking liquor recovery;

— Extended cooking and oxygen prebleaching used by many mills to reduce bleach plant effluent;

— Chlorine substitution or elimination to provide more environmentally benign effluents;

— Alternate bleaching agents, ClO2, H2O2, O3, etc.;

— Widespread application of biological treatment;

— Closed loop technologies are evolving;

— Good spill control.

Control of spills is an important component in mill operations and most permits require mills to have measures to facilitate this. The early detection of spills is an important control consideration and instrumentation is applied to ensure this. It is noted that the potential damages caused by spills may exceed those due to regular operations. The implementation of measures to contain such events is very important

Kraft mills have faced the added challenge of addressing odour problems related the release of total reduced sulphur gases. These gases are formed when the wood is cooked in the sulphur bearing liquor. The gases dissolve in the pressurised cooking liquors. Measures have to be taken to strip the gases from the spent pulping solutions to prevent their escape from the process units that are open to the atmosphere. The stripped gasses are incinerated to levels below the odour threshold. This requires the use of properly designed facilities.

[29] *Ibid.*

ISSUING PERMITS FOR PULP AND PAPER PLANTS IN A MORE SENSITIVE ENVIRONMENT: A CANADIAN EXAMPLE

Ian Mackenzie, Alberta's Standards Specialist, Canada

Industry's views: Alberta's approach to pulp mill effluent regulation *presented by Ian Mackenzie*

The conceptual effluent limits setting approach used by the province of Alberta provides for the adoption of more stringent ELVs on the basis of technological considerations or water quality. Technology-based limits can be sector-specific or case-specific. Water quality based limits require wasteload allocation schemes. The Athabasca River basin provides a good example of how Alberta's permitting system is implemented in practice.

Technology-based releases are set according to the following scheme:

— minimum discharge levels are set;

— different technology limits are assigned to different mill types (e.g. CTMP vs. kraft);

— release levels can be adopted from other jurisdictions or developed in Alberta;

— release limits are reviewed and updated periodically;

— release limit values are derived independently of water quality considerations;

— yet more stringent, site-specific limits may be set on the basis of water quality considerations.

Water quality based releases are set according the following scheme:

— EQO-based releases ensure that water quality is protected;

— EQO-based releases are based on worst-case conditions;

— release levels are derived independently of technology considerations (occasionally, application may be constrained by technological capability);

— requirements at some sites may be more stringent than technology-based limits;

— for instance, water quality based BOD limits are applied on the Athabasca River to address the issue of dissolved oxygen.

Alberta's approach to the problem of dissolved oxygen in the Athabasca River has highlighted several issues and has required permitting authorities and permittees to devise appropriate solutions such as:

— in order to ensure acceptability and accuracy of the environmental modelling on which release limits were based, independent reviews were carried out, government authorities shared all aspects of the modelling performed and a consensus was established that modelling was state-of-the-art;

— the issue of older mills was addressed by setting equivalent limits for existing mills and more stringent limits for newer mills;

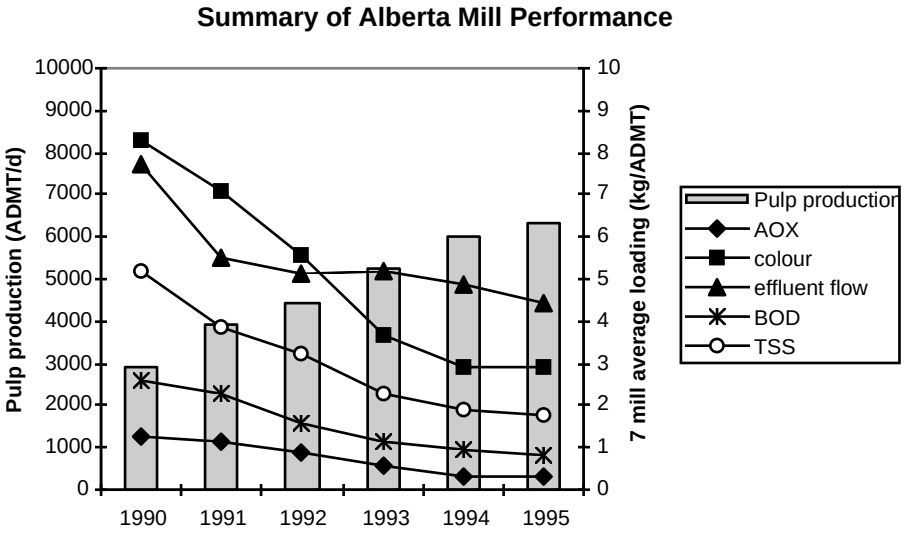
— mills were given up to three years to meet new limits so that they can bear the cost of upgrades in treatment systems;

— even though governmental authorities are not opposed to seasonal limits, worst-case conditions were imposed throughout the year;

— mills with the highest loadings (relative to limits) were required to take anticipated mitigating action in response to declining instreams of dissolved oxygen levels;

— governmental authorities are to review technology permits periodically as more stringent limits may arise.

The performance of the Alberta mill over a six-year period can be summarised in the following chart. While total pulp production doubled, all the main parameters of water effluents from the mill declined significantly during that period.



2.5 Outcome of the case study presentations

The goal of this session was to provide workshop participants with practical examples of regulatory approaches used in OECD Member countries in the issuance of environmental permits. The presentations highlighted environmental, economical, technical and regulatory issues which are at the core of the main questions that were to be discussed in the workshop sessions.

Despite some differences in approaches and requirements, the results of the four industrial case studies demonstrated a high level of convergence in permitting practices of the countries under review. The information contained in the permit samples clearly shows the preference of regulatory authorities for setting requirements on the basis of technical expertise, i.e. BAT. Obviously, the technology-based approach is considered having incorporated some level of economic considerations. Likewise, environmental quality is a major determinant of the stringency of permitting requirements, thereby influencing the type of techniques and control to be implemented. Nevertheless, this

convergence in permitting approaches highlighted the benefit of sharing experiences and information, most notably regarding the development of guidance in areas such as integrated approaches and the weighting of cross-media issues.

There were few questions from the floor as each case study presented a specific example which was discussed by the relevant national permitting authorities and permittee. However, three issues were raised either by presentators or workshop participants:

— The permit sample discussed in the iron and steel case study's presentation provided an example where BAT-driven emission limit values (ELVs) forced the closure and replacement of sintering production by pellets. The Swedish EPA decided to require ELVs based on pellet input even though BAT-based limits have been developed for sinter plants. This issue showed further the discretionary power of regulatory authorities in influencing the type of techniques and environmental control to be implemented at industrial sites. It also raised the issue of how technology-based approaches should be balanced with environmental quality criteria, economic considerations, etc.

— Much of the discussion on the metal finishing case study centred around the specific issues regarding environmental control in small and medium enterprises (SMEs). Mr. du Mortier, the representative of the surface finishing association, emphasised that SMEs need the support of permitting authorities to fully comprehend the issues and opportunities related to environmental quality. He particularly noted that access to information regarding BAT was scarce and that SMEs did not enjoy enough wealth to ensure that they could follow technological development nor fully benefit from the permit issuance process, i.e. making sure of the appropriateness of permitting requirements. He was particularly concerned with the upcoming EU Directive on integrated permitting and the delays for drafting BAT notes for SMEs. However, although recognising that the drafting of BAT notes for the many industrial sectors represents an important and lengthy effort, Mr. Rubinacci from the EU's DG XI declared that SMEs would enjoy the same level of support than other sectors. Nevertheless, many participants recognised that SMEs deserves a special attention, notably by the very fact of their economic importance and small human resources.

— Following the pulp and paper case study's presentation, a Finnish official raised the issue of the non-compatibility of national methods for expressing discharge limits. The lack of international standards for making environmental performance records public was further acknowledged as a major impediment to an effective benchmarking of the industry's record world-wide.

Each of these issues and other aspects revealed in the case study's presentations were brought up again either explicitly or indirectly in the workshop sessions. Indeed, the BAT-EQO case study session had helped participants to acknowledge the high level of consensus between countries on some of the main benefits and shortcomings of current permitting approaches, as well as the challenges ahead.

3. WORKSHOP SESSIONS

Drawing on the presentations and on the conclusions from the industrial case studies, workshop participants were invited to engage in several workshop discussion sessions, each one of which was addressing a specific issue related to the use of environmental permitting. As the core of the Workshop on Environmental Requirements for Industrial Permitting, these discussions were fuelled by a double objective.

The primary objective was one of information dissemination. Participants were encouraged to take stock of the various experiences encountered in OECD Member countries concerning the use of industrial permitting for environmental protection. Concrete information and experience were exchanged on the use of technological and ecological criteria for the establishment of permitting requirements for industrial sources of pollution and on other major aspects of current permitting practices. On the basis of this exchange of experience, workshop participants examined the benefits and shortcomings of the current approaches for achieving the most optimal balance between environmental protection and sustainable economic development.

The second objective was to develop recommendations on the use of those permitting instruments. For instance, possibilities and benefits of combining environmental permitting policies with other instruments (such as life cycle management, eco-auditing, voluntary agreements, economic and informational instruments) were explored. Participants also sought to determine an appropriate balance of environmental and technological requirements to be incorporated in permits with a view to eliciting the most efficient outcome, both in terms of environmental performance and technological innovation, and identify the types of policy and administrative improvements which should be pursued by governments.

Workshop discussion sessions were organised around four specific issues or questions which were presented:

1) *What is the best combined use of technology-based requirements and environmental media standards in setting permit conditions?*

   This issue is of great significance for permitting authorities and for industrial permittees. In particular, there is substantial difficulty in adequately defining BAT and EQO. The lack of transparency and clear direction provided by such concepts is often felt, for instance regarding the number and types of media to which BAT and EQO apply, the level of stringency which they require, as well as the relationship between short-term needs and long-term perspectives (i.e. sustainable development). The need is felt for new concepts integrating both technology- and environment-based considerations into practical options, indicating that the two approaches are complementary rather than antagonistic.

2) *How can pollution prevention be achieved more effectively through the permitting system mechanisms?*

The effectiveness of environmental permitting as a pollution prevention and control instrument is affected by the various stages and conditions related to its use. For instance, case-by-case release values can yield different environmental results than the application by permitting authorities of uniform standards. The type of parameters used for issuing permits (e.g. emission limits, waste management requirements, energy use, water intake requirements) also affects the environmental performance of licensing processes. Besides, most permit requirements are derived from a review of available technological options and therefore may encourage the diffusion of existing (often end-of-pipe) technologies rather than promote radical technological innovation (such as process substitution). Permitting authorities also need to take into considerations the conditions which they attach to the implementation of permitting requirements. In so doing, they often need to enter into a trustful, transparent relationship with permittees so as to assess what the plant or industry is likely to withstand both technologically and financially, and thus, strive for optimal permit requirements. As such, monitoring and enforcement activities are often key to push the operators towards the continuous improvement of the environmental performance of their operations. The above issues point to the importance of optimising the relationship between the main permitting stages (i.e. application, permit conditions, monitoring and enforcement), thereby emphasising the key role of the different stakeholders in improving environmental permitting.

3) *What are the results of experiences in integrated (multimedia) permitting and how can this tool be used most effectively?*

As early as 1991, the OECD encouraged Member countries to practice integrated pollution prevention and control (IPPC) in its Council Recommendation C(90)164/FINAL. In 1996, the European Union adopted its own IPPC directive, introducing multimedia permitting and ensuring that requirements are based on BAT. Available information suggests that the governments that have implemented integrated permitting programmes have found it to be an efficient and effective tool for pollution prevention and control, both in terms of environmental performance and in terms of administrative costs. The necessary overhaul of some administrative mechanisms associated with environmental permitting poses some problems. Also, the weighting of the different factors implied in the trade-off between various environmental requirements (e.g. trade-off between energy efficiency and emissions reduction) is a major issue of integrated permitting for which effective standardised methodologies have not been developed yet. Indeed, modifying conventional, media-specific permitting towards fully integrated approaches requires a careful examination of current decision-making procedures as well as the ways in which different, sometimes conflicting factors are factored in permit conditions. A transition to integrated permitting along the lines of emission sources (e.g. industrial sectors), polluting substances or geographic areas may provide some solutions.

4) *What is the best approach for taking economic considerations into account in permitting or standards-setting procedures?*

All countries do incorporate economic considerations, in one way or another, into their standards-setting and permitting processes. Even though economics may not be a direct factor in the establishment of environmental quality standards, it is a determinant of their implementation by means of emission limit values on pollution sources. Emission limit values are assessed on the basis of a gradation system whereby the more hazardous a substance discharged into the environment the less importance is granted to economic feasibility. These conditions can be set on a case-by-case basis or according to some uniform schedule, e.g. on a statutory basis, implying substantial differences in environmental and financial performance. The incorporation of economic considerations seems to be rather dependent of ad hoc mechanisms than governed by clear and transparent procedures. Balancing the environmental and technological requirements incorporated in permitting decisions with economic criteria is thus somewhat subjective in spite of the fact that some OECD Member countries seem to be developing standardised methodologies for appraising acceptable costs.

Each of these topics was introduced by a presentation addressing one or several of the issues to be discussed in the subsequent workshop sessions. Presenters chose to provide either an overview of the issues to be discussed or to focus on their national experience, and thus, introduced one particular aspect of the issues. In each session, a mediator and rapporteur summarised the substance of the discussions.

By the end of the session, workshop participants had shared significant experience and were thus able to clarify their understanding of the various environmental permitting approaches used in OECD Member countries and their effectiveness. Participants were also in a position to draw some general conclusions on the use of environmental permitting. Workshop discussions have shown that substantial agreement exists between countries on the need to revise and develop some of the main tools associated with environmental permitting. Moreover, the exchange of information and experiences revealed that there is much consensus on many of the key issues associated with environmental permitting.

The following subsections present the results, conclusions and recommendations of the four sessions.

3.1 Session 1 – Combining BAT and EQO in permitting requirements

The primary objective of this working group was to clarify the understanding of BAT and EQO and their relationship in standards-setting and permitting procedure. The main topics and questions raised in the Issues for Discussion paper drafted by the OECD Secretariat prior to the workshop were recalled and are summarised in the first subsection to this workshop session. **Lex de Jonge**, from the Dutch Ministry of Housing, Spatial Planning and the Environment, opened the workshop discussion using some concrete examples of pollution prevention and control regimes. He presented the main issues regarding technological and environmental requirements for industrial permitting, underlying the need for a pragmatic approach combining both considerations. Mr. de Jonge also pointed out the evolution of the BAT and EQO concepts towards more integrated and preventive applications. Finally, he submitted for discussion to workshop participants a summary statement in which he wrapped up his understanding of the optimal interaction between BAT and EQO for industrial permitting.

Throughout the workshop session, **Peter Wiederkehr**, Administrator from the OECD Secretariat, acted as discussion mediator. As rapporteur, **Alain Rajotte**, independent consultant to the OECD Secretariat, summarised the main findings of the session.

Overview of issues

The debate on the use of technology-based (BAT) requirements and environmental quality standards (EQS/EQO) has often been thought of as a confrontation. In that frame of analysis, these policy instruments would be mutually exclusive. An all-EQO approach was thought to be the ideal system for linking the actual quality of an environment (whether local, regional or global) with the sources emitting polluting substances into it; "unnecessary" costs could be avoided by sources releasing pollutants and wastes into the environment. An all-BAT approach was viewed as being the most appropriate system, however, for implementing the Precautionary Principle, avoiding the troubles posed by scientific uncertainty about the risks of pollutants to humans and the environment.

Certainly, the issues are not as clear-cut. National legislation may not make any explicit reference to BAT or EQO. However, the review of country laws, regulations, policies and practices shows that no country has ignored environmental or technological criteria as a basis for the establishment of permit conditions to industry. It appears from the review of Member country legislation that these two approaches are complementary, and not incompatible or alternative. Most often, permit requirements are the consequences of both technological and environmental considerations. In some countries, broader “best practicable option” principles are laid out which encompass technological, receiving media, and economic considerations. In most countries, these factors are hammered out during the permitting stage. When considered separately, however, each of the two approaches has benefits and shortcomings. There are several dimensions of this issue which might be considered:

- *Technical and economic suitability*

It could be argued that, when the assimilative capacity of the environment and the effects of the discharged substances (e.g. bioaccumulative effects) can be defined, the environmental quality approach may be the most effective system of environmental and human health protection. However, environmental quality standards are extremely science-intensive since they are based on an understanding of the paths of pollutants across media and their behaviour towards the living organisms which they are in contact with. So the EQS approach may be more suitable for conventional pollutants than for pollutants whose characteristics are still not completely understood.

The technological approach, on the other hand, may be more appropriate for regulating persistent and highly bioaccumulative substances for which the assimilative capacity of the environment may be very limited. In some instances, the means through which the actual performance has to be attained is specified in the permitting requirements. In most cases studied, requirements are expressed as performance levels (e.g. emission limits) to be met. However, some experts consider that a technology-based approach fails to incorporate the specifics of local conditions, thereby costs may often exceed environmental benefits in the aggregate.

In addition, currently-applied EQO and BAT requirements are suited to the regulation of discrete point sources of pollution. However, with polluting releases from diffuse, sometimes mobile,

non-point sources causing increasing concern for environmental protection, new tools – or new approaches to interpreting and implementing EQO and BAT have to be devised.

Technology-based standards, technological innovation and pollution prevention in the United States: the case of Solar Turbines

Solar Turbines Incorporated, a company based in the United States, manufactures mid-range industrial gas turbines used throughout the world in oil, gas, and cogeneration applications. Sensing that emissions of nitrogen oxides (NO_x) were becoming an issue and would therefore have to be curbed, Solar developed dry low-NO_x technology as early as the 1970s, ahead of regulatory requirements. Integrating its dry low-NO_x technology into its existing products, Solar came up with SoLoNO_x, a lean-premixed combustion process achieving considerable reduction in emissions of NO_x, not through end-of-pipe treatment but through pollution prevention. As an inherently cleaner technology, SoLoNO_x offers substantial cost advantages in comparison to traditional add-on NO_x abatement technologies such as selective catalytic reduction (SCR) and water injection, both of which require expensive treatment systems. The SCR technology also involves the use, transport, handling and storage of ammonia, an hazardous substance.

However, the development and application of the cleaner low-NOx process has been hindered by technology-based regulation in Solar's home market. Under the 1990 amendments of the United States' Clean Air Act, sources of criteria pollutants located in non-attainment areas (i.e. areas not in compliance with the prevailing ambient air quality standards) are required to comply with emission limit values based on the lowest achievable emission rate (LAER). As a precursor to ground-level ozone, NO_x is now regulated as a non-attainment pollutant and therefore subject to LAER. Unlike best available control technology (BACT) which is required of sources located in attainment areas, LAER does not allow for economic consideration to be taken into account in the permitting process. Whichever technology in operation achieves the lowest emission rate is automatically used as the reference for the definition of the LAER.

The best NO_x emission rate, however, is achieved by the SCR technology. The performance of the dry low-NO_x technology for mid-size turbines has improved markedly since the 1970s (dropping from 200 ppm to 25 ppm) but not sufficiently to meet the LAER standard. The standard itself is thus based on SCR-equipped conventional processes. The quickest solution is often to install the control technology that is suggested by permitting authorities. Resisting the agency frequently adds to review time. In their decision-making, permit applicants thus have to weigh the cost of delays in the permitting negotiation against the cost of the proposed add-on control. For manufacturers of small- and medium-size turbines, SCR represents a considerable expense which can cause projects to be cancelled if that technology is held by the permitting authority as an absolute requirement. In the case of large turbines, dry low-NO_x technology yields better performances (e.g. 9 ppm), allowing them to meet the LAER standard. Even then, however, an applicant can be pushed to install SCR on top of its low-NO_x process. This "belts and suspenders" situation in turn becomes the basis for the new LAER standard (e.g. 4.5 ppm). For Solar Turbines, there is no incentive to develop the combustion technology further if SCR will ultimately be required.

- *Complexity in understanding what "BAT" means*

The concept of technology-based requirements may be evolving in response to new conditions where the number and types of sources are increasing. To manage more diffuse sources, BAT may encompass requirements that have more to do with management practices than with the technological features of a process. Some countries use the broader concept of best available techniques, meaning the technologies and the way in which those technologies are applied and managed.

BAT is often insufficiently defined to provide transparency and clear direction. Does BAT mean 90% or 98% pollution reduction? Countries vary in the level at which BAT determinations are made, e.g. for an industry sector as a whole, for parts of the sector, for individual plants. It may be important to develop better norms and processes. For example, how important is it to gather a sufficient level of consensus among interested parties on which techniques, among the available ones, can be considered as being the "best" ones?

Although country practices vary, emission limit values based on BAT are – to some degree – checked against EQOs in order to assess their relevance. Also, there may be differences in performance levels demanded for different types of pollutants.

BAT has usually been defined on a medium-specific basis (e.g. water or air pollution technologies). In integrated permitting, how important is it to develop multimedia BAT guidelines, and how difficult will it be? Questions have arisen about whether multimedia BAT should be considered as fundamentally different (for example, considering more stages in the product life cycle). Does joining components automatically argue for site-specific rather than sector-wide assessment of BAT?

- *Developments in applying environmental quality objectives*

The concept of environmental quality objectives is evolving in the direction of ecosystem-based standards. Based on bioassays performed on critical animal and vegetal species, environmental quality objectives are increasingly capable of being tailored to the requirements of specific ecosystems. Such ecosystem standards could be the basis for an integrated (i.e. multimedia, multi-source) interpretation of environmental requirements. Does this potential alter the way in which industrial permitting requirements are established and viewed?

In addition, dealing with different pollutants that produce effects on different scales (local, regional or global) implies that the linkage between local environmental conditions and release requirements may not be as straightforward: for the same source of various pollutants, the relevant ecosystem may be local, regional or global.

Technology, on the other hand, is far more simple to assess and implement than ecology, e.g. chemicals that pose concern may be treated, filtered, isolated or removed (substitution). Even where carrying capacity environmental standards are not feasible or appropriate, science can be used as a screening tool to orient the technology policy, especially as the economic cost and political opposition to more stringent technology-based release standards call for justifications.

Examination of the issues and country practices leads to the conclusion that a permit cannot be optimally effective if it does not incorporate a good balance between the precautionary approach, as currently represented by technology-based performance standards, and tailored, site-specific parameters based on environmental quality. Some points where there may be a consensus are:

— Usually, countries use technological requirements as a base. In these cases, BAT is always applied and EQO is used as a reference for guiding the application of standards.

— Where local environmental conditions are insufficient for the EQO to be met, additional requirements are imposed in the permits over and beyond the BAT-based standards so that a particular source or a group of sources operating in that particular

area will not contribute to a breach of the EQO. [However, countries differ on the time period over which this is to occur.] These requirements may lead to forced closure for some existing sources or denied authorisation for process expansion or modification.

Environmental quality standards versus environmental quality objectives

In many cases, the quality levels that a country or region has set for the protection of human health and the environment cannot be readily achieved at current levels of emissions and economic activity. For example, the United States Environmental Protection Agency reckons that 40% of American rivers and lakes still do not fully meet water quality standards and that as much as twenty percent of the public in the United States live in areas where the air does not meet public health standards. Therefore, these quality levels serve as the basis for the establishment of non-binding environmental quality objectives. EQOs are a guide for the implementation of long-term emission reduction strategies. Among other things, they play an important role for the prioritisation of the issues that need to be addressed by pollution reduction strategies. Immediate, short-term reduction practices are governed by yet another ambient quality guide. Environmental quality standards (EQS) are binding quality levels that are a determinant factor in the consideration of an application for an industrial permit.

The difference in stringency between environmental quality objectives/targets and environmental quality standards lies in part in the incorporation of the economic impact on sources. While economic considerations were found to be mostly irrelevant in the definition of EQOs (targets), some countries recognised the importance of economic factors in the establishment and implementation of actual, binding EQSs. The United Kingdom and the Netherlands in particular recognised this difference between wish and reality. EQOs are the ambient quality standards that a region has set for itself in the long run. It does not have a *direct* link with current implementation mechanisms such as emission limit values (ELVs). EQOs serve as a guide for the tightening of these emission values. EQSs, however, can be directly translated into tangible emission standards and gauged against what the sources are actually able to perform. They are therefore subject to more mundane considerations such as economic and, indirectly, technological considerations. In Norway, for instance, a distinction is drawn between scientifically-based guidelines and politically-based, legally binding environmental quality standards. The former do not take into account economic considerations. When establishing the binding EQSs, however, the State Pollution Control Authority perform a comprehensive cost-benefit analysis. In the Netherlands, any financial and economic consequences which may reasonably be expected to arise from the implementation of requirements to be laid down in an EQS can be considered. The Netherlands also draws a distinction between its environmental quality standards-based on Maximum Permissible Concentration (MPC) levels – and the target quality values which are based on Negligible Concentration (NC) levels. Between those two levels, pollution must be minimised according to the ALARA principle (as low as reasonably achievable). In the Flanders region, a distinction is made between the MPC (limit values) and the target quality limit values based on ecotoxicological acceptable concentrations. The setting of these values is a task under the responsibility of the environmental administration as prescribed by law.

Different policies apply to existing and new sources, in many if not all countries. The conditions under which facilities can be forced to close or are denied an authorisation are not codified: is a shutdown required when one EQS is violated? When certain types of EQS are violated? If yes, which types?

The underlying principle behind these policies seems to be that whichever are the most stringent requirements of BAT or EQO takes precedence.

THE COMBINED USE OF TECHNOLOGY-BASED REQUIREMENTS AND ENVIRONMENTAL MEDIA REQUIREMENTS IN SETTING GOOD PERMIT CONDITIONS

Lex de Jonge
Ministry of Housing, Spatial Planning and the Environment, the Netherlands

In their respective definitions, the concepts of BAT and EQO have relatively strict objectives. The intent of BAT is to implement the best available technology. The goal of EQO and EQ standards is to impose a maximum acceptable risk for the environment.

When brought together, however, BAT and EQO are often construed as being mutually exclusive concepts. The all-EQO approach to environmental protection is based on the ideal situation where actual environmental quality (at all levels) can be linked to discharge measures and thus lead to cost-minimisation. It is the fundamental philosophy for those who consider the environment as a usable and renewable resource (the “economist’s approach”). By contrast, the all-BAT approach is based on the precautionary principle and allows no consideration for scientific uncertainties on the risks associated with pollutants. It is the fundamental philosophy for those who consider the environment as a limited and non-renewable resource (the “environmentalist’s approach”).

In practice, all countries use a combination of BAT and EQO concepts. Most often, BAT and EQO are used in a sequential fashion during permitting: some economically justified BAT level is applied and subsequently checked against prevailing EQO levels.

BAT and EQO each entail some advantages and disadvantages. EQOs are theoretically the most cost-effective and flexible way of environmental protection as standards can be monitored and emission levels fine-tuned accordingly. Among the drawbacks of EQOs, it can be utterly complex to identify the relationship between a specific source and a standard. Due to this complexity, EQOs are not so helpful for limiting pollution from substances whose effects and paths are not fully understood (e.g. bioaccumulative effects, cross-media transfers) and are more suited for conventional pollutants.

BAT provides the best insurance towards environmental sustainability and for minimising the risks posed by persistent and bioaccumulative substances. BAT can be used to require a performance level as well as the implementation of a specific technical solution. Among the disadvantages of BAT are problems of cost-efficiency and the application of the concept to diffuse non-point sources.

The concept of BAT has evolved over time to cover the following items (for instance in the definition provided in the European Union’s 1996 IPPC directive):

— a drift from the narrow “technology” towards the broader concept “technique”;

— the incorporation of economic considerations;

— increased emphasis on process integration as opposed to end-of-pipe solutions;

— increased emphasis on integrated assessment, e.g. including resources and energy efficiency;

— increased differentiation of performance and requirements on several levels (global, regional, local);

— increased importance of a level economic playing field;

— BAT levels differentiated on the basis of harm/toxicity of substances (e.g. regulations based on German TA Luft in many countries) which can be considered a first assessment of BAT against EQO considerations.

Similarly, the concept of EQO has evolved over time:

— broadening of standards from locally applicable requirements to environmental objectives (e.g. quality standards on air water, waste, soil, sound and risk), EQO for negligible risk levels, critical deposition values, reduction targets such as the Dutch NEPP, the EU's Large-Combustion Plant directive and UNECE protocols, global targets;

— increased emphasis on ecosystems-based standards (bio-assays on critical animal and vegetal species).

The following examples illustrate these changes in the definition and implementation of the BAT and EQO concepts:

— UNECE protocols (e.g. the sulphur protocol) are based on:

  – critical loads (= EQO);

  – BAT as a minimum requirement;

  – reduction targets per country;

  – internationally agreed emission standards for specific sources.

— Euro BAT (IPPC BAT) is based on:

  – article 16.2 of the IPPC directive;

  – processes only, not LCA;

  – integrated approach (multimedia);

  – cross-media balancing;

  – Euro BAT documents are sector-specific;

  – several specific options of BAT;

  – BAT options might differ for new/existing processes;

- definite BAT determination on local level (not for components contributing to transboundary pollution).

— Target group approach at the level of an industrial sector is based on:

  - (voluntary) agreement within the industrial sector;
  - (national) reduction targets for all components of the agreement;
  - individual (BAT-based) company environmental plans (CEP);
  - for each component, the sum of all CEPs compared to reduction targets.

— EU air quality (framework) directives explicitly take into account economic feasibility.

The relationship between technology – and environment-based requirements can be summarised in the following proposition:

— when EQS is breached (implying severe effects):

  - BAT must always be applied
  - if BAT is still insufficient, permits will be denied;

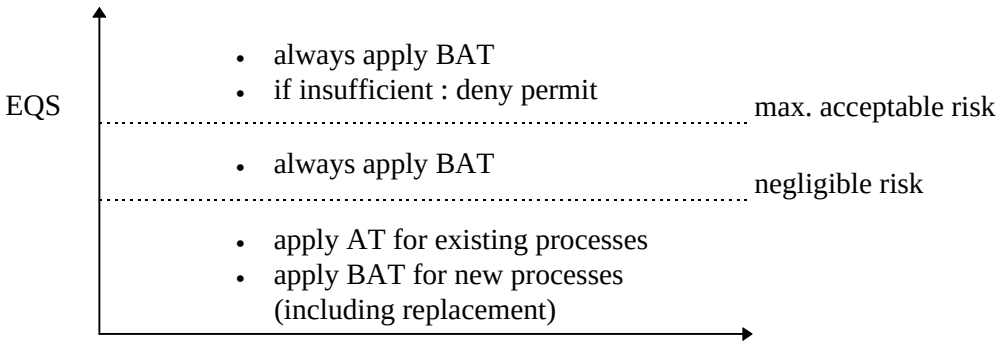
— when EQS is met (but environmental pollution is still above the no-effect level):

  - BAT must always be applied;

— when EQS is met (and environmental pollution is also under the no-effect level):

  - AT can be applied for existing processes;
  - BAT must be applied for new processes.

This relationship can be illustrated by the following graph:



The above discussion leads to the following conclusions with respect to the interaction between technology-based and environmental quality requirements:

— The precautionary principle (confirmed in the Rio Declaration), the rapidly increasing world population and the vulnerability of the environment, seem to warrant the importance of BAT as a basis for permitting strategies;

— On the other hand, if the application of BAT cannot solve environmental problems, the emphasis should be laid on EQO, thus providing flexibility in industrial permitting;

— It is to be expected that discussing the prevalence of BAT versus EQO will appear to be a non-issue, since it will often be very difficult to achieve a situation of sustainable development on the sole basis of BAT;

— In applying BAT, economic considerations should always be taken into account, mainly for priority setting.

Summary of discussions and recommendations

A general consensus emerged among workshop participants that, although this was not always the case in the past, BAT and EQO are now generally used in combination. The risk and complexity of environmental problems often lead regulatory authorities to command the application of the precautionary principle, translating into the use of a technology-based approach. Despite differences in official policies, most countries authorise the complementary use of BAT and EQO for ensuring that the best environmental options are identified as the case warrants.

However, although BAT approach appears to be the driving force for achieving improvements in pollution prevention, its use needs to be governed by comprehensive environmental protection plans with clear objectives and targets. While short-term requirements (either as ELVs or EQSs) may be driven by necessity, long-term objectives are dependent upon policy planning. It is from this careful, long-term planning that permitting may evolve from a purely administrative procedure to a comprehensive and forward-looking system for decision-making. As such, permitting must be construed less as a set of permit requirements that have to be complied with and more as a setting conducive to sustained dynamic innovation and environmental performance.

Participants in the workshop recognised the need to better define the relationship between short term requirements and long-term goals based on a sustainable environment and economy. The effectiveness of policy planning is dependent upon the ability of countries to produce and apply technological solutions for environmental purposes. A major issue in that regard involves an appropriate balance between technological change, emission limit values and environmental quality objectives or standards into the permitting process. Thus, the use of performance-based standards is generally regarded as a fundamental principle for allowing operators to choose the best compliance methods while favouring technological innovation.

Permitting programmes must strive to achieve a double goal: providing adequate flexibility for innovators while ensuring that a minimum binding standard is enforced so as to pick up laggards and protect the level playing field. In this context, permits have undeniable advantages as tools in terms of legitimacy and transparency. Therefore, permitting systems remain at the core of environmental legislation for reducing pollution effectively while ensuring the implementation of minimum environmental safeguards.

Workshop discussions also focused on the possible definitions and the role of the concepts of BAT and EQO (e.g. how to set limits and negligible risk levels). The interaction of BAT and EQO in

a sequential permitting process triggered less discussion but participants expressed the need for a common framework and common definitions that can be used in practice by permit writers. The framework proposed by the Dutch delegation in their introductory presentation raised several questions on the stringency of permitting requirements that is needed when the quality of the receiving environment is poor. In particular, some participants argued that when environmental quality standards are breached and maximum acceptable risk levels are exceeded, permitting requirements should call for performance levels beyond BAT, not simply BAT.

During their discussions, workshop participants agreed on a series of key elements concerning the interaction of technology-based and environment requirements for industrial permitting.

Workshop discussions focused first on the concept of BAT, producing the following conclusions:

— BAT has been the driving force behind the improvements that have been made in pollution prevention and control over the past three decades;

— BAT should always be used, regardless of the actual situation, just as a general principle or approach;

— BAT goes beyond the simple control or end-of-pipe technology and integrates the need to prevent, avoid or eliminate harmful releases, including process-integrated techniques (process changes, material, energy use);

— BAT takes economic considerations into account, as far as available techniques are addressed;

— BAT-based ELVs for existing sources should be as stringent as those for new sources; existing sources can however be granted some flexibility by permit writers, the specific local conditions of the plant being taken into account;

— BAT should be regarded as more stringent according to the harmfulness of substances;

— Industry prefers BAT-based ELVs or environmental performance standards over prescriptions of specific technologies to be used; industry prefers equal treatment with common ELVs and requires some flexibility for implementing requirements;

— BAT must be a dynamic concept to ensure that developments are appropriately diffused to the industrial sectors and the public;

— The BAT concept is at an early stage in addressing the issue of waste generation.

Discussions then turned to EQOs and EQSs. The following conclusions were reached by workshop participants:

— EQOs are now becoming more important as a driving force for making environmental quality improvements whereas, in the past, EQOs sometimes were too lenient and primarily health-based to induce improvements and foster technological development;

— Various concepts are used (e.g. EQO, EQS) and various release values are associated with those concepts; for instance, some countries use a combination of maximum acceptable risk limit values, target values and negligible risk (or no-effect) levels; others use single values for environmental quality standards (e.g. for air, water and soil);

— No consensus was reached on which concept would be preferable since it depends heavily on the tradition, practice and regulatory culture of the country; single limit values are clear and easy to understand for the public and industry while target values give a longer-term vision of what is to be achieved;

— While target values are based on science, EQO/EQS are an economic and political compromise;

— EQO is also an evolving concept at the national and international level;

— Industry looks at EQO with a local perspective while national/state administration look at EQOs as general goals;

— Waste requirements are not incorporated in EQOs unless waste contains hazardous substances.

Finally, workshop participants focused their discussions on the combined use of BAT and EQO requirements in permitting. They reached the following conclusions:

— The primary concern of permit writers is that their decisions must be defensible, therefore:

  – BAT requirements are used as a general approach to ensure equal treatment of cases;

  – EQOs are becoming more important in inducing improvements (e.g. the impact of environmental concentration values on water pollution);

  – guidelines and general framework are used at the national level, at least for setting BAT-based ELVs and general EQOs and the methodologies used – e.g. definition of risk, risk limits, stack heights, dispersion models, mixing zones);

— The general view is that if EQOs are exceeded even while BAT is applied, then further reduction of pollutant releases must be achieved;

— At the national level, a comprehensive plan with clear objectives and targets must be developed, and translated for individual sectors, in order to provide:

  – a predictable framework for the industry;

  – practical, usable goals (targets for permit writers and the public).

Workshop participants agreed that BAT is the preferred approach for applying the precautionary principle in the framework of the permitting process but that a clear definition of EQO targets is also needed to orient and push further the continuous improvement of the environmental

performance of industry as well as providing the political incentives for environmentally-sound technology innovation.

3.2 Session 2 – Achieving pollution prevention through permitting approaches

The primary objective of this working group was to examine the aspects of the permitting process or the types of permitting conditions which are the most likely to encourage innovation and continuous environmental improvement. The main topics and questions raised in the Issues for Discussion paper drafted by the OECD Secretariat prior to the workshop were recalled and are summarised in the first subsection to this workshop session. **Emelie Enckell-Sarkola**, from the Finnish Environment Institute, opened the workshop discussion by presenting the main features of this issue. Mrs. Enckell focused her presentation on the various stages of the permitting process where innovative solutions can be devised, leading to environmental and economic effectiveness. In particular, the negotiation stage, during which releases limit values are agreed upon, is a time when co-operation between regulatory authorities and plant operators can lead to creative solutions to environmental problems, depending on the flexibility of the standards-setting system. Innovation can also be encouraged through the setting of well-balanced permit conditions, including emission limits, self-monitoring requirements, as well as operation and maintenance requirements. Mrs. Enckell concluded her presentation by stressing the need to develop a successful synergy between industrial permitting and other types of instruments such as emission charges, regional planning, sector-wide reduction targets, requirements for in-plant environmental management systems and the use of informational instruments based on publicity.

Throughout the workshop session, **Frances Irwin**, from the World Resources Institute, acted as discussion mediator. As rapporteur, **Alain Rajotte**, independent consultant to the OECD Secretariat, summarised the main findings of the session.

Overview of issues

Environmental permitting of industry is common to all OECD countries. However, the mechanisms leading to the adoption of the operating parameters contained in the permits may vary substantially between countries. Three stages or aspects of the permitting procedure may be identified, each one being a potential impetus or, conversely, impediment to pollution prevention objectives: the negotiation process, the actual permitting requirements, and the conditions attached to the implementation of the permit. Although the operating parameters may be the main determinant for the environmental performance of the licensed facility, the conditions under which those requirements are established and enforced are important in inducing the technological response of the regulated entity (i.e. the technical means used to meet the requirements).

- *Negotiation*

The first determinant of the permitting process is the negotiation stage. Some permitting systems offer ample opportunity for site-specific negotiation between the licensing authorities and the regulated facilities, processes or industries. Depending on the size of the country, of the industries, or on the number of sources to be licensed, permitting requirements may be adopted on a case-by-case basis, absent any national legislation or regulation on sector-specific emission limit values. Countries with decentralised permitting systems and numerous competing sources in the same industry, often

apply uniform standards contained in national legislation. Such legislation typically imposes floor requirements that may be made more stringent by the permitting authorities as the case warrants. Yet, highly detailed and rigid parameters set in national regulation may be an impediment to optimal site-specific permit conditions, the actual requirements being either too permissive or too stringent. In countries characterised by highly legalistic and adversarial systems where the regulatory authorities issuing the permits have relatively little discretion, the effectiveness of permits (*inter alia*, to promote pollution prevention) may be achieved at greater costs through the upstream standards-setting procedure. On the other hand, the absence of uniform requirements may raise the concern that the economic level playing field is distorted.

- *Permit requirements*

The second aspect that will affect the performance of the licensing process in terms of pollution prevention is the nature of the parameters (e.g. emission limits, waste management requirements, energy use, water intake requirements) that the facility will be required to comply with. The determination of these parameters, and the timeframe over which they apply, poses a quandary. Ideally, permits should create a momentum, encouraging the regulated entities to seek to reduce their emissions beyond the established limits, mostly through pollution prevention (e.g. process redesign). To be sure, permitting requirements will not dictate technological choices for industry except perhaps where the presence of hazardous substances in the effluents of an industrial process confers some urgency to the measures.

However, permit requirements are not set in a vacuum but are often derived from a review of the technological options available at the time the emission standards were adopted, the technological note drafted or the permit issued. They consequently reflect past technological attainments rather than what might be expected of the real-time application of technological developments. They often leave little leeway to the regulated entities for technology shopping and force them to adopt off-the-shelf technologies, i.e. technologies that are readily available, whose actual performances have been proven. Technology-based requirements in permitting mechanisms may be suitable for technological *diffusion* and unsuitable for technological *innovation*.

Perhaps this is too negative. The case studies show that the limits are almost always based on BAT considerations, but leave the choice of technology open to the industry. The industry can thus “shop for” or develop better technology. But are there elements in the permitting process that would encourage such shopping around?

— The "right" permit limits which will stimulate innovation are difficult to establish. An understanding of what the plant or the industry is likely to withstand, both technologically and financially, and of the local conditions are crucial for reaching the optimal permit limits. Permit limits that are too lenient will not encourage substantial (especially qualitative, process redesign) modifications. Permit limits that are beyond current technological capability pose potentially high risks of non-compliance. Furthermore, they may not be cost-efficient because of the uncertainties about potential benefits.

— Finally, regulated entities argue that a period of "certainty" in the requirements is necessary for cost-efficiency. Although industry officials and representatives of the environmental advocacy groups are invited to comment, and even participate in the drafting of the requirements, setting technology-based requirements that will be valid

five, ten or more years hence may be something of a hit or miss affair. The best ways to balance certainty with encouraging technological dynamism (continuous quality improvement in diminishing environmental releases and improving other environmental characteristics of products and production) is a major challenge, especially for countries with many competing plants in the same industry.

The pollution control paradigm

Conventional regulatory strategies have been based on the principle that environmental damages resulting from the release of harmful industrial compounds and by-products can be prevented by controlling how, where and at which rate pollutants enter the environment. Indeed, the pollution control principle has often relied on a traditional view of the assimilative capacity of the environment whereby environmental impacts are reversible and may be controlled by appropriate environmental standards. Thus, the pollution control paradigm has legitimised the widespread adoption of end-of-pipe devices, biological secondary treatment plants, scrubbers, etc., for confining and controlling the level of pollutants in the environment.

However, advances in environmental science and monitoring have shown the increasing risk associated with the accumulation and globalisation of trace levels of pollutants (transboundary air pollution, persistent toxics, food chain contamination, etc.). If industrial compounds and/or by-products are allowed to be produced, and not eliminate naturally or by technical means, they will eventually reach natural ecosystems. As such, severe environmental threats, such as ozone layer depletion, increasing levels of bioaccumulative toxics, loss of biodiversity, etc., may be understood as an unintentional consequence of a regulatory approach that fails to "incorporate ways of dealing with global pollution"[30]. According to some commentators, "despite the indications of a change of intent, many policies are still based on 'pollution control' in specific media. (...) In the end, this extrinsic motivation [resulting from regulatory pressure and advice from producers and retailers of environmental technologies] leads mostly to compliance innovations with end-of-pipe techniques [EOPs]."[31]

Although EOPs are often necessary to ensure that the environmental quality is not impaired, there are many problems resulting from this approach:

- EOPs do not prevent the problem, often leading to cross-media transfer of pollutants, resulting in costly environmental problems (e.g. generation and concentration of toxic wastes, costly waste treatment technologies, etc.).
- Although EOPs may be cost-effective solutions on a short-term frame, they contribute significantly to production costs on the long run, including the proper handling and treatment of residues.
- Pollution control measures must be followed by costly regulatory and monitoring programmes to ensure that environmental requirements are complied with.
- EOPs represent a significant market associated with a business-as-usual mentality which profits from the continuous generation and treatment of industrial wastes.

While cost-benefit assessment on short term might call for EOPs, the integration of regional and international considerations in standards-setting and permitting decisions is likely to have a significant influence on the economics of environmental regulations. As was suggested by Ann Hillyer, pollution prevention should always be positively discriminated over pollution control strategies, i.e. it should represent a mandatory requirement in permitting.

[30] TRAVIS, C.C. and S.T. HESTER, "Global Chemical Pollution", *Environmental Science Technology*, Vol. 25, No. 5, 1991.
[31] Reference and examples are taken from HIRSCHHORN, J., JACKSON, T. AND L. BAAS, "Towards Prevention – the emerging environmental management paradigm", *Clean Production Strategies*, Lewis Publishers, London 1993, pp. 125-142.

- *Implementation*

The third stage of the permitting process is the implementation of the requirements inscribed in the authorisation. A set of conditions for complying with the parameters of the permits (compliance deadline, duration of permit, renewal procedure, eco-auditing, monitoring and informational requirements, mandatory or voluntary participation into an industrial or corporate agreement with the government) are usually negotiated and applied, quite separately from the parameters themselves. It is relatively common that the core requirements of a permit (based on national emission standards, for example) are not (readily) negotiable while the conditions of application of the permits can be. In many, if not all, countries, permit conditions can also be appealed.

The conditions attached to a permit can be as important, if not more so, than the performance requirements (emission limits) in influencing the technological response of the regulatees towards pollution prevention or pollution control.

— For example, tight compliance deadlines may prevent some companies or facilities, especially the smaller ones that have no in-house research capabilities and a more restricted access to technology, to identify more innovative processes and force them to opt for readily available end-of-pipe solutions.

— Conversely, excessively long compliance deadlines may waste some of the company's potential for technological change by giving it a right to pollute beyond what it can actually accomplish.

— A difficulty lies in gauging what a company or facility can reasonably achieve. Hence the necessity for the permit-issuing authority to entertain as intimate and trustful a relationship with the regulatees as possible. For instance, regulators have to be aware of the investment cycles of each industry, company or facility. Process modifications designed to promote pollution prevention can hardly be imposed successfully when a firm's investment cycle has just begun and the related costs have not been amortised yet.

Long-term planning tools may be helpful in providing a more secure environment for companies afraid of frequent or unannounced changes in regulation. Long-term goals may be based on environmental quality objectives (e.g. pollutant or greenhouse gas reduction targets) or technology objectives (e.g. "eco-efficiency", waste minimisation or zero emissions goals). The permitting process is most often regarded as a step-like process: new requirements are imposed after the government has incorporated some recent technological developments into its BAT regulation; permits are granted to a facility on condition that it complies with the standards for the next period of years until the permit comes up for renewal.

Could this system be altered such that long-term targets, conditions of permit duration and renewal could be merged into a more constant review process that would make it more explicit that improved environmental performance is a continuous requirement? Linking permits with voluntary agreements which incorporate energy efficiency and product improvement measures may offer one approach.

Permitting policies and technology innovation

In a 1991 report on the influence of permitting and compliance policies on technology innovation, the Technology Innovation and Economics (TIE) Committee, a standing committee of EPA's National Advisory Council for Environmental Policy and Technology (NACEPT), concluded that: "Permitting and compliance systems, as they function today, discourage all stakeholder groups from taking the risks necessary to develop innovative technologies (...) and to bring them into routine use to solve environmental problems".[32] Considering that "the environmental statutes and regulations, and their enforcement, "make the market" for these very same technology", the authors identified five major areas needing improvements:

- modifying permitting systems to promote the testing of innovative technologies;
- implementing incentives to facilitate the introduction of innovative technologies;
- promoting the use of innovative technologies in compliance programmes;
- enhancing the effectiveness of compliance programmes by supporting stakeholders; and
- revising regulatory barriers which inhibit environmentally-sound technology innovation.

In OECD countries, permits to industry are usually delivered for a fixed duration in time, rarely exceeding ten years and often longer than four years. However, the permitting process can be quite lengthy and complex, sometimes antagonistic. For instance, it took a total of three-and-a-half years for the German company Thyssen to obtain a permit for a particular industrial facility. According to the Thyssen company representative at the workshop, fear of making mistakes during permitting and subsequently losing a court battle prompts environmental authorities to be exceedingly cautious in their processing and negotiating of authorisation requirements. This lengthy period, during which the future operating setting of a firm is unclear, may cast doubt on the optimal policy to be followed. In the meantime, market conditions may have changed significantly or some technological development may be occurring. Applicants are usually free to select and develop the techniques and technologies for complying with prevailing performance standards. Yet where the regulatory agencies have strong powers to suggest or influence the adoption of a technology which they deem more effective, resisting the permit writers can substantially add to the review time. Therefore, because they are often time-consuming to negotiate and yield requirements that are frozen in time, environmental permitting and standard-setting can be a reflection of the state of what was technologically achievable at one point in time rather than a medium conducive to continuously improving environmentally-sound performance and technology innovation.

The OECD Workshop has shown that there is a growing international consensus on the need to revise regulatory systems in order to reconcile environmental and economic objectives. The harmonisation of environmental statutes through the implementation of integrated approaches is a right step toward this objective. Promoting and updating BAT and EQOs are other major elements for defining an environmentally-sound market for technology innovation. But, most importantly, shifting environmental systems toward regulatory approaches which incorporate the cycle of technology innovation is likely to require the implementation of a trustful regulatory process involving all major stakeholders toward this goal.

Determining the effectiveness of various factors in an overall environmental policy is important. The case studies show that pollution prevention has been promoted to some degree through permit mechanisms. But as pollution prevention is also promoted through other means such as product policy by life cycle management and levies on emissions and wastes, how can the partial effects be evaluated?

[32] "Permitting and Compliance Policy: Barriers to U.S. Environmental Technology Innovation", *National Advisory Council for Environmental Policy and Technology (NACEPT)*, EPA 101/N-91/001, January 1991.

Two approaches seem especially promising to link permitting authorities and policy-makers engaged in other pollution prevention efforts:

— Accelerated development of integrated sector-by-sector strategies should shed light on the relative relationships of regulatory, economic and other instruments. Involving the full spectrum of stakeholders in developing and implementing such strategies should enable the technological options, issues and prospects for innovation to be seen more clearly. Integrated strategies for special geographic areas (such as the Rhine River or the Great Lakes) also offer significant insights for improving systems approaches.

— Continued attention to and development of measurements and indicators for (a) overall environmental health; and (b) pollutant/waste reduction over the entire life cycle of production and consumption. Implementing Pollutant Release and Transfer Registers (such as the U.S. Toxic Release Inventory) through which sources must report their releases publicly are one important mechanism.

HOW CAN POLLUTION PREVENTION BE ACHIEVED MORE EFFECTIVELY THROUGH PERMITTING SYSTEM MECHANISMS?

Emelie Enckell-Sarkola
Finnish Environment Institute, Finland

The concepts of BAT and EQS have relevance only as part of the polluter regulating and permitting system, introducing an attempt to guide and harmonise requirements set on the polluters. The concept of BAT should be used to set the level of emission limits to be included in the permits. Today we have a boom for BAT descriptions. Their informative value is indisputable. Partly based on this information, emission norms are established that will be valid for the next 5...7 (?) years. Will the industry hold on to "safe" and "accepted" technologies rather than develop or apply new ones? Can we reach at an ideal methodology to evaluate multimedia environmental impact priorities and technical feasibility, a methodology that could guarantee an optimal and continuous progress with regard to local as well as global environmental aims?

The substance and level of requirements are influenced by all constitutional levels in the environmental field: national legislation, international agreements, regulations and norms, licensing and supervision practice, other policy instruments interfering, monitoring and research. How can the permitting system in itself, regardless of constitutional regulations and agreements, promote continuous improvement of pollution prevention? Let us consider three aspects: negotiations, permit conditions and interaction with other policy instruments.

Negotiations

The national framework of regulations, norms and licensing practice is for the most parts a result of negotiations. Items to be discussed between the authority and a specific enterprise mostly concern environmental policy questions of the plant, the need for a new permit, a new application, or non-compliance with the permit, but it may also concern international recommendations, legislation under development, regional plans or research. Many of these steps interact thus guiding one another but also reducing the discretion of the actors.

The enterprise is in response for informing the authority of a new production unit or a change in production in due time in order to find out which permits are needed and what plans and reports and other information are to be included in the application documents. Special studies and research programmes to be carried out by the enterprise should also be looked into. A formalised list of application documents do not offer sufficient guidance for the enterprise, who will gain time and certainty in its aims by arranging negotiations already at this stage. The next stage of negotiations may be to assess the results of the required studies and to make sure that the application documents are sufficient. It should, however, be underlined that the enterprise prepares the application documents independently and that no agreements on permit conditions can be made at this stage. The best contribution the authorities may give is creativity in asking the right questions and a consistent guidance to ensure good application documents that meet the point without being overdone.

When a permit is issued there ought to be an understanding between the enterprise and the supervising authorities on the interpretation of the permit conditions. They should be unambiguous and easily understood also by the affected parties. Still they often leave many details to be agreed upon. One of the conditions, the details of which as a rule are negotiated, at least in Finland, concerns the monitoring and reporting programme. Since monitoring is quite expensive it is important to make it cost-effective. Thus the programme should produce information and not just a maximum of data.

Whenever a plant deviates from the permit conditions, the authority should be informed. The situation might also call for a written report and negotiations. If the partners can not agree on the interpretation of the compliance or on the possibilities the enterprise has or should have to abate the pollution or monitor the emissions or their effects, the negotiations might turn into a battle. Such situations demand for much use of time and they should be avoided at least as resulting from personal antipathy and impertinent means. Such situations should in time be brought up to a sufficiently high level, ultimately the court. A formalisation of compliance interpretation certainly helps, but again very strict formalisation leads to lost opportunities to exchange information and views between the enterprise and the authority.

The main aim of negotiations in the environmental field is not to find compromises. The main issue is to exchange information to help both parties to find optimal and far-sighted solutions to aim at, each on his side. This exchange of information is most valuable in defining BAT and in particular in evaluating what emission levels can be achieved by optimal operation and maintenance. There ought to be a mutual understanding of each others' role, and neither should try to question or take the role of the other. Yet for instance knowledge of the investment cycle of each industry is very valuable for the authority and helps to find an optimal timetable for the requirements. The rules for secrecy are important for the psychology of negotiations. Documents under preparation are not public. Neither is it allowed to disclose business secrets or economic facts given with confidence to the authority.

Permit conditions

The main permit conditions in all countries can probably be grouped into emission limits, monitoring and reporting, operation and maintenance, investigations and renewal of permit conditions. The use of raw materials, energy and chemicals are, so it seems, not yet commonly, if at all, regulated by environmental permits.

We are supposed to set emission limits corresponding to BAT, but we have numerous choices to formulate the requirement. Concentration limit, mass flow (kg/d or kg/month?), kg/tonnes (of capacity or real production?). Over what time interval, e.g. to be reached any time or as an average over a given time period – 24 hours or a month or maybe twelve? Measured at certain streams, covering a certain unit or as a bubble over all facilities, diffuse sources included or not included? Any special allowance for exceptional situations like yearly maintenance, start up or bad weather? Suitable enforcement time-table? More stringent limits to be implemented within 3 years or target values? Besides these and similar questions the stringency of the requirement will in practice be influenced by the national and regional compliance criteria and the consequences of non-compliance.

Monitoring compliance for the continuous improvement of environmental performance

Some commentators have argued that an adversarial, inflexible "regulatory style" for the enforcement of environmental regulations "is not only inefficient in treating minor and significant violations equally, but counterproductive in fostering antagonistic relationships between regulators and the regulated".[33] According to these critics, a more conciliatory and co-operative enforcement style would be more productive in getting the polluter to comply with legal requirements. However, this difference in enforcement approaches should be minimised as even a conciliatory strategy is based on the implied threat of coercive actions.

Beyond the legalistic aspects of enforcement, non-compliance issues may provide much opportunity to regulatory authorities and permittees for discussing the main reasons for the violations, as well as identifying the need for more appropriate conditions. In her workshop presentation on pollution prevention through permitting mechanisms, Emelie Enckell, from the Finnish Environmental Ministry, has emphasised the importance of environmental monitoring in the continuous improvement of plant operations. Even minor violations of numerical values, if repetitive, may be a sign of a real problem faced by the operator to comply with the prescribed conditions, of inefficient requirements and/or environmental measures at the plant which, in turn, may call for the strengthening and refocus of emission limit values. Permitting authorities should strive to investigate the reasons why the operator seems incapable of performing beyond the ELV. Beyond the purpose of checking compliance and backing enforcement actions, monitoring programmes may provide significant regulatory power to push the industry toward the improved environmental performance of its industrial operations.

Every country has made its choice on the emission limit "system" and improves that continuously with a broad variety also within the country as a result. Maybe we ought not to seek harmonisation but we could ask for more specific descriptions of the systems used. Most important is to recognise the different possibilities and their influence on the stringency of the emission limit and on the emission levels achieved in practice. In this context, it is also crucial to relate them to the picture we have of the emission profile of the site and to ensure that we have a good enough picture. A good knowledge of the emission profile of the plant is an important part of finding the "right" BAT level to be required.

Self-monitoring is not only a tool for supervising permit condition compliance. The aim is to get a full picture of emission profiles, wastes included, and effects. Unaccountable emission fluctuations may indicate good opportunities do reduce the pollution without excessive costs. The authority should be as interested in those as the responsible operator. A complementary record on break downs and failures improves the opportunity to discuss environmental management efficiency.

In the national information given to the OECD BAT/EQO Reference Guide Finland, Korea, the Netherlands and Norway indicate a direct feedback of information from the monitoring results and recorded site-specific environmental performance to the permitting system while most other countries indicate a similar feedback to the level of regulations and standard setting. Are or should the use of raw materials, energy and chemicals be included in that feed back?

The permit may include requirements referring to the operation and maintenance, with the aim to keep emissions "as low as possible", regardless of emission limits. Some of these conditions may be rather indefinite with weak juridical status, but still they may provide opportunities to discuss technical problems, monitoring and reporting.

---

[33] HARRISON, K., "Is Cooperation the Answer? Canadian Environmental Enforcement in Comparative Context", *Journal of Policy Analysis and Management,* 1995, Vol. 14, No. 2, pp. 221-244.

The permit may also include obligations to investigate certain issues such as the technical development or pollution load impacts. An environmental risk analysis offers a good tool for improving the current situation during the permit period. This systematic approach has not only improved risk management at the site but, in some cases, resulted in decreased continuous emissions as well. Risk analyses also help to define BAT. Investigations to develop technology and processes, including cost estimates, may be fruitful but since they become obsolete quite fast and we do not want them to be made pro forma they need careful timing, taking both the investment cycle and other interests of the enterprise as well as the permit period into account.

Interaction

Some countries have developed a successful interaction between the permitting system and economic instruments, in particular emission charges. Depending on the type, these approaches may provide incentives for continuous improvement below emission limits, for commitment to an exceptionally low emission limit or just for strict compliance.

Regional planning and branch-wide targets have also improved industry's commitment to environmental aims and thus influenced for instance the substance of new applications. The value of these instruments are not self-evident and the real environmental benefit is due to the quality of the programme adopted.

The use of environmental management systems is expected to improve the plant's environmental policy, improve efficiency in the use of raw materials and energy, reduce emissions as well as improve the information system and reporting to authorities and the public. There are many opinions on how this may interfere with the permitting systems and related supervision. Ideally, the supervising authority could stop worrying about checking permit compliance and focus on the ecological quality of investigations, applications, monitoring and a maximum use of its results, environmental impact assessment and the development of a multimedia (integrated) permitting process and the identification of BAT. The permitting system can benefit at least from improved information and awareness at the site.

Publicity could be an effective tool which however does not seem to attract authorities very much. Hesitations seem to arise mainly from the authorities' ambitions to reflect more holistic and scientific approaches, the need for a trustful negotiation climate and a mere lack of time. If, as an example, there was a decision to publish all the violations of emission limits, which we certainly have recorded, what would the consequence be? Some plants have more stringent limits than others. How would it affect the permitting procedure? On the other hand both permits and emissions should be available to the public.

Summary of discussions and recommendations

Beyond existing environmental regulations and agreements, permitting systems must promote the continuous improvement of pollution prevention and control while ensuring that an acceptable level of environmental quality is achieved. There are three key aspects of the permitting procedures which bear significant influence on the outcomes: negotiations, permit conditions and interaction with other policy instruments.

Good permit conditions are a function of the information provided by the applicants, the quality of monitoring results and the appropriate enforcement of the requirements. Supporting the ongoing development of technological innovation for environmental purposes requires a careful assessment of the different factors involved. The main objective of negotiations between the applicant and the permitting authority is to exchange the necessary information to help both parties find the most optimal and far-sighted solutions in relation to the problems identified.

An assessment of BAT should be used to measure the appropriateness of the measures proposed by the applicant to comply with the proposed requirements and to set ELVs. But the final permit conditions must also include some measures of environmental results, either ambient-based and/or benefits-based. A good knowledge of the emission profile of the plant is an important part of finding the "right" BAT level to be required.

Permitting must ensure good environmental performances, not compliance for its own sake. One issue is to develop effective monitoring programmes that will provide an assessment of the appropriateness of environmental requirements and measures of compliance. The quality of the environment cannot be based solely on statistical measurement or computerised simulation of pollution plume, but on real assessments of the structure and functional integrity of ecosystems. The aim is to get a full picture of emission profiles – including wastes – and effects. Unaccountable fluctuations in emissions may indicate good opportunities to reduce pollution without excessive costs. Moreover, a complementary record on breakdowns and failures improves the opportunity to discuss the efficiency of environmental management.

Moreover, the ongoing development of BAT notes necessitates good monitoring of environmental results. This is crucial to steer the exercise toward the most important and urgent problems while avoiding costly surveillance programmes and sterile requirements. This is particularly critical in relation to cross-media issues. In addition, effective monitoring programmes may offer the possibility to reward good performing plants by reducing end-of-pipe monitoring and allowing cost savings to be allocated instead to R&D for cleaner processes and techniques. The same type of incentives could be offered in enforcement programmes with operators that show good faith. In that respect, regulatory approaches must develop new policy initiatives which have the potential to remove barriers in permit programmes which stifle technological innovation.

One important consideration in permitting negotiation is to call for the continuous improvement of environmental performance in order to push the implementation of techniques and management in pollution prevention, regardless of existing technology or current state of receiving environments. However, participants in the workshop rightly pointed out that the notion of continuous environmental improvement must be used with caution. Indeed, without a full understanding of cross-media transfers of pollutants resulting from different options, there is a risk that what looks like a pollution reduction measure induces an increase of environmental releases to another medium. In Finland, permitting strategies promoting the closing of industrial wastewater cycles have prompted an industry's representative from the pulp and paper industry to call for the implementation of integrated

permitting in order to take into account trade-offs associated with such measures. The permit may also include requirements for investigating the environmental impacts of pollutant releases in search for more cost-effective ways of abating emissions and/or assessing technological performance.

Public participation and information supporting pollution prevention

Public involvement can take several forms. The public may be consulted during the permitting process through a formal hearing or through a procedure of inquiry for instance. A number of OECD countries have established Pollutant Release and Transfer Registers (PRTR) as a means of informing the public and as a tool of their pollution prevention and control policies. PRTRs provide publicly available information on the type, quantity and location of polluting releases to various environmental media as well as information on the sources of those releases. As a result, PRTRs have been shown to elicit radical improvements in environmental performance from the sources mentioned.[34]

Establishing a link between permitting and PRTR-type information reporting mechanisms fulfils only a portion of the public demand for information, more precisely that arising downstream of the permitting process. The public also needs to be involved in decision-making upstream of the permitting, regulatory or standard-setting process. This participation of the public usually takes the form of consultations, hearings and inquiries. It allows the regulatory authorities to direct their efforts to what is felt to be the most pressing issues and deflect criticisms that might otherwise arise later in the application of a standard or permit. More importantly, opening the regulatory process to the public may ensure that important issues, such as permit renewals, major expansions of industrial activities, standards-setting and the likes, will not fall prey to the sole views of more wealthy organised social forces.

As a commonly underpriced resource, the use of the natural environment, particularly as a recipient of industrial residues, allows polluters to shift environmental costs to society. Public policies are critical to ensure that polluters will reduce their harmful activities to socially-acceptable levels. In this regard, regulatory approaches do have a bearing on technological change, mostly through permitting requirements, but also through incentive-based instruments such as “green” taxes, pollution fees, tradable pollution quotas, etc. The ongoing development of new policy instruments (i.e. LCA, EMAS, BPEO, discharges fees, green taxes, etc.) indicates a trend whereby environmental strategies tend to transcend the contradictory objectives of environmental protection and economic development toward a comprehensive, exercise of social planning for sustainable production and consumption patterns.

During their discussions, workshop participants agreed on a series of key elements concerning the use of industrial permitting mechanisms as an instrument to encourage effective pollution prevention:

— permitting authorities should aim for the continuous improvement of environmental performance, regardless of existing technology; this goal stresses the importance of techniques and management as instruments to enhance performance;

[34] See OECD, *Pollution Prevention and Control: Pollutant Release and Transfer Registers (PRTRs): A Tool for Environmental Policy and Sustainable Development: Guidance Manual for Governments*, OECD, Paris, 1996.

— permitting authorities should – insofar as possible – use a sequential approach to permitting, examining first the type and extent of the inquiry as well as the information provided by the industry on environmental impacts and associated activities;

— because of permitting requirements (such as the closing of some pollutant cycles), cross-media issues are increasingly addressed, either by permitting authorities or directly by industry; however, most pollutant registers still do not take account of cross-media issues;

— Some tools and techniques can contribute to moving permitting strategies toward more preventive and integrated approaches:

  – permitting authorities should underscore the importance of asking for the right information from the industrial applicant; in Finland, for instance, a list of applications on ways to reduce pollution is used;

  – pollution prevention can be effectively promoted through targeting policies whereby reduction and performance goals are established for certain sectors and substances; in the Netherlands, for instance, integrated environmental goals are applied through covenants and company plans; in Canada, targets are set for specific chemicals and pilot projects are conducted on materials and energy use; in the U.S. state of New Jersey, companies set individual goals to reduce target chemicals);

  – pollution prevention can also be effectively promoted through the development of EMAS and ISO 14001 schemes;

  – finally, the importance of public information and participation cannot be underestimated (e.g. Toxic Releases Inventory in the U.S., EMAS in Europe); many countries publish environmental reports as well as lists of companies not in compliance with standards or permitting requirements.

— The OECD should devote some of its future work on pollution prevention to:

  – a review of methods used by Member countries to measure emissions, and the development of comparable methodologies and data;

  – help develop comparable new tools (second generation LCA tools from the inventory stage to the impact stage).

3.3 Session 3 – Integrated permitting systems and approaches

The primary objective of this working group was to examine the experience accumulated by Member countries in setting and using integrated (i.e. multimedia) permitting systems and identify the possibilities provided by this instrument to promote pollution and waste reduction at source. The main topics and questions raised in the Issues for Discussion paper drafted by the OECD Secretariat prior to the workshop were recalled and are summarised in the first subsection to this workshop session. presenting the main features of this issue. **Ulf Bjällås**, from the Swedish National Licensing Board for Environment Protection, opened the workshop discussion by presenting the various aspects of the Swedish licensing process. The Swedish permitting system was examined because it provides

significant experience and insight on the types of issues posed by the establishment and use of an integrated permitting system. In particular, Mr. Bjällås depicted the statutory requirements and the principles on which the licensing system is based. He also painted a detailed picture of the administrative and regulatory mechanisms at work which contribute to the effectiveness of the pollution prevention and control approach in Sweden. Drawing on his own record, Mr. Bjällås concluded his presentation by relating the experience of the Swedish integrated permitting system, with a particular emphasis on the features that, in his opinion, contribute to its effectiveness. He stressed the importance of individual review in facilitating flexibility.

Throughout the workshop session, **Henrik Harjula**, Administrator with the OECD Secretariat, acted as discussion mediator. As rapporteur, **Laurent Renevier**, independent consultant to the OECD Secretariat, summarised the main findings of the session.

Overview of issues

In 1991, based on a proposal of the Environment Ministers' meeting, the OECD Council issued a Recommendation (C(90)164/FINAL) encouraging OECD governments to practice "integrated pollution prevention and control" (IPPC), taking into account "the effects of activities and substances on the environment as a whole." A priority area of concern was to promote multimedia regulation of polluting sources so that all environmental pollution and waste requirements for a particular source were assessed at the same time and the best overall environmental option selected.

Concurrently, the European Union's Fifth Action Programme ("Towards Sustainability") designated integrated pollution control as a priority field of action. In 1996, the Council of Ministers of the European Union adopted Council Directive 96/61/EC on Integrated Pollution Prevention and Control (IPPC) which became binding for 15 OECD Member countries. The IPPC directive introduces a multimedia permitting system and ensures that requirements are based on best available technology (BAT).

Available information suggests that the governments that have implemented integrated permitting programmes have found it to be an efficient and effective tool for pollution prevention and control. Administrative costs should have been reduced as media-specific inspectors have been cross-trained and sources of efficiencies have been identified. IPPC should also have been promoted through the incorporation of environmental auditing requirements in permit application procedures. These audits should have been appropriate tools for looking at all relevant environmental protection issues, determining the implications of each option for reducing pollutants, wastes and other environmental damages, and choosing the least environmentally-damaging options which could be implemented at acceptable cost. Integrated permitting should also have been more effective than media-specific approaches in linking to longer-term environmental strategies for reducing pollution loads and promoting "sustainable development". (In other words, long-term environmental plans integrate the notion of time into the integrated permitting approach.)

Owing to their comprehensive nature, integrated permitting systems require large amounts of data as inputs for policy decision. Instruments that facilitate the collection, dissemination and exchange of information, such as BAT reference or guidance notes, and publicly-accessible pollutant release and transfer registers, are likely to make the integrated systems more effective. (But is "integrated BAT" so difficult to define in the way that governments have used BAT in single-medium programmes?) By the same token, the amount of applicable research could be increased so as to better understand the cross-media effects of pollutant releases and to perform adequate cross-media

analyses leading to policy decisions concerning the trade-offs between available environmental options.

Current experience with integrated permitting systems appears to show that few systems are actually "integrated", and most countries are still in transition. For example:

— Beyond acceptance of the philosophy of IPPC, difficulties may lie in the establishment of actual administrative mechanisms for implementing a transitional phase during which legislative, regulatory and permitting processes are brought closer together. Shifting from a media-specific system to a totally integrated system may be excessively ambitious in the short run.

— Perhaps as a transition, environmental decision-making may be integrated along several lines: sources (e.g. industrial sectors), substances or geographic areas.

— Possibly, ecosystem-based environmental quality standards may become increasingly relevant as instruments for integrating pollution prevention and control measures .

Another difficulty is to develop substantial criteria for integrated environmental protection at the site-specific level. The weighing of different factors perhaps is more explicit in integrated permitting systems, with trade-offs in emissions to different media (e.g. air pollution abatement by scrubbers versus waste disposal for additional scrubber wastes). Trade-off issues have been raised between input and output (e.g. between energy efficiency and emissions reduction or recycling). Some countries seem to be developing standardised methodologies. What is the confidence in these methodologies?

So far, a number of sources, particularly small and medium-size processes and diffuse sources, are not covered by integrated permitting. Should extending the coverage of such systems be given priority?

— Perhaps rather than extending integrated permitting systems to small systems or diffuse sources, integration may take the form of life cycle product policies with permitting of special problems left to single-medium systems.

— Alternatively, or additionally, diffuse sources may be regulated within the framework of an integrated geographic area policy.

THE SWEDISH INTEGRATED PERMITTING SYSTEM

Ulf Bjällås
National Licensing Board for Environment Protection, Sweden

Through its licensing system, Sweden has accumulated one of the longest experiences among OECD Member countries in setting multimedia permitting requirements for some types of industrial plants. The system has been in force since 1969. The features and pollution prevention record of this system are presented below.

Legislation

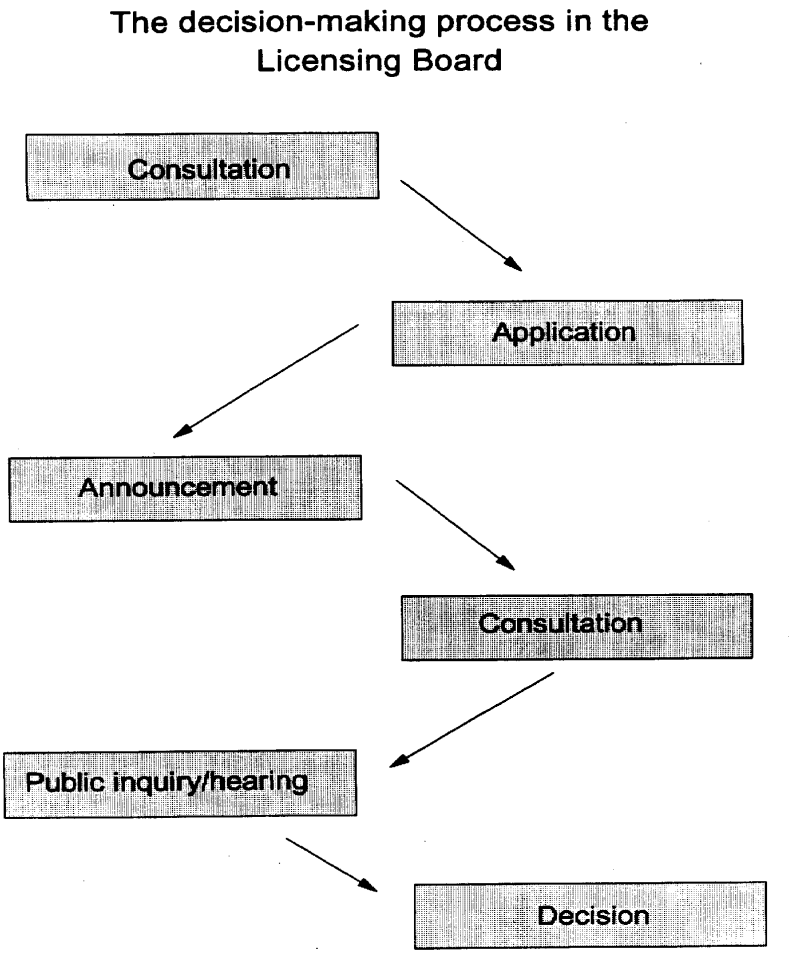
The Environment Protection Act and the Environment Protection Ordinance

The intention of this regulation is both to prevent negative impact on the environment and to restore/clean up sites that have already been damaged. It applies to emissions and disturbances associated with the use of real estate or stationary plants (point sources). Water and air pollutants, noise, light, vibrations and the like are examples of disturbances, that fall under the regulatory umbrella of this law.

To ensure compliance with the terms of the Act and the Ordinance, permitting and reporting requirements have been established for many types of activities and operations. In the Ordinance there is a list of environmentally hazardous activities for which permits or reports are compulsory. Such activities may not be commenced, nor may work on facility begin before the relevant authority has issued a permit (license) and set the terms (conditions) for the permit (see figure 1 on the decision-making process).

Manufacture of pulp and paper, chemical and petroleum products, installation for gasification or combustion for a power input of more than 200 MW, iron and steel works, airports, discharge of waste water from more than 100 000 inhabitants are examples of activities which need a permit from the National Licensing Board for Environment Protection. Activities with a lower environmental impact require a permit from a regional authority (County Administrative Board).

Typical for the Swedish regulation is that the terms (conditions) in the permit are set after an individual review of the plant. Thousands of plants have been required to reduce their environmental impact in this manner.



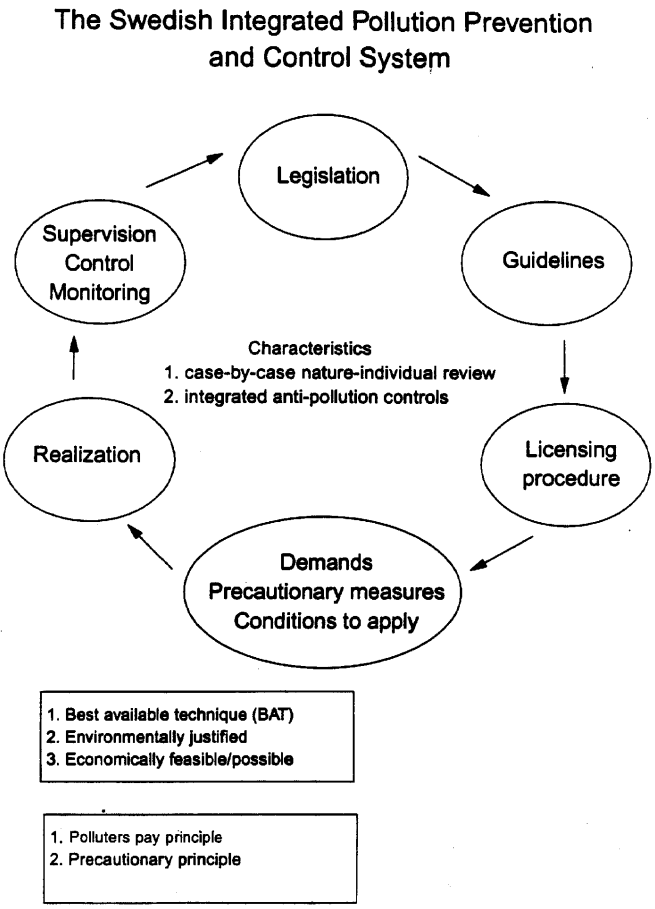
When deciding what kind of protective and other precautionary measures are required to prevent and reduce negative environmental effects, the Licensing Board takes into consideration the following three factors:

— best available techniques (BAT)

— economically feasible

— environmentally justified

The integrated pollution prevention approach is also typical for the Swedish regulation. It means that the Licensing Board takes into consideration all kinds of emissions/disturbances, at the same time, before granting a permit (see figure 2).



Environmental authorities

Permit authorities

In the Environment Protection Ordinance there is a list of environmentally hazardous activities which require permits or reports (see table). Activities with the gravest disturbances require a permit from the National Licensing Board for Environment Protection and activities with lower environmental impact require a permit from a regional authority (County Administrative Board). There are 24 counties in Sweden.

For activities causing only limited and local disturbances, no permit is required. Instead, the local environment authority (municipal authority) must be notified. There are 284 municipal authorities in Sweden.

authority	Type of Activity		
	A	B	C
Licensing Board	permit		
Regional authorities/ county		permit	
Local authorities/ municipalities			report

Supervisory authorities

The National Environment Protection Agency (EPA), the County Administrative Boards and the municipal boards exercise supervision of environmentally hazardous activities.

The National EPA co-ordinates the work of supervision and provides assistance if it is required.

The County Administrative Board exercises supervision of such activities that require a permit from the National Licensing Board and the local environmental authorities of other activities.

The inspectors are cross-media trained and the authorities are organised along a multimedia model. EPA is organised in different divisions, dealing with all kinds of environmental problems in a specific line of business.

Supervisory authorities have the right to:

— access factories

— request and take part of information

— carry out investigations (taking samples)

— issue injunctions (precautionary measure, prohibition, inspection programme)

An inspection programme contains routines and procedures for:

— inspection of emissions to air, water, land (includes methods for measuring and analyses)

— inspection of chemicals and waste

— inspection of noise and other nuisances

— documentation and reporting

Experience

Licensing System

Emissions from industrial and other plants have been greatly reduced since the 60s. It has been possible to make these reductions because the authorities have gone through the individual plants, one by one, and made specific demands for emission-reducing measures. Thousands of plants have been required to reduce their environmental impact in this manner. The administrative regulation has so far been a success. It has led to a significant reduction of emissions.

The case-by-case nature of the regulation has been important in that it has allowed individual circumstances to be considered and simplified the introduction and implementation of technological advances. General regulation of an entire branch of industry makes for less adaptability and strikes more blindly at problems.

The integrated approach in permitting has been very important – and successful. It has made it possible to assess all kinds of emissions and other disturbances from a specific plant at the same time and select the best overall environmental option. For instance, it has made it possible to accept – in a specific case – a minor increase in emissions to air in favour of a major reduction in discharges of waste water, if that has been the best overall environmental option.

The individual approach has encouraged the performers to suggest their own solutions to environmental problems. This means that different plants – even in the same line of business – can have different solutions to the same problem. Consequently, technical innovation has been encouraged and emphasis has been put on developing the industrial processes – i.e. to reduce emissions at source – rather than on more conventional end-of-pipe solutions.

When issuing a permit, the authority may postpone the decision on a specific condition until experience of the activity has been gained. The permitting authority is always entitled to postpone a matter in order to get information or to start an investigation. The permit holder has to pay the cost for the investigation. In that way, it has been possible for the authorities to get necessary information, for instance about technological advances and about the BAT-level. By using this tool, the permitting authority has been successful in stimulating innovation and the use of new techniques. The possibility for the authorities to postpone the decision of a special condition in a permit is a very important part of the Swedish permitting system.

An other important part of the Swedish permitting system is the open – and trustful – dialogue between the authorities and the enterprises. It has made it possible for the authorities to get relevant information. The whole procedure to issue a permit and to set the conditions is very open and transparent. It has made it possible for different authorities, members of the public and NGOs to give comments on permit applications.

The National Licensing Board is an independent authority, which functions rather like a court of justice. The chairman of the board is well-versed in legal matters and has experience as a judge; the other members of the board (3) have experience of technical, environmental and industrial matters. They always listen to the case in a public hearing (similar to a trial), where the applicant presents his application and the environmental authorities and the members of the public give their opinions. A special licensing board, independent from the environmental authorities and with members versed in different matters, has given credit to the licensing system. The public hearings have also given credit to the system.

Regarding the heavy industry – not small and medium sized companies – the very general environmental legislation in Sweden, which gives a lot of freedom and power to the Licensing Board, has been successful. It is up to the Board to find the balance-point between the interest of the company on one hand, and the interest of the environment on the other hand and then to make a fair decision. There are very few legally binding standards, but instead general principles issued by the Swedish Parliament, the Swedish Government and the Swedish EPA, giving guidelines on how to assess environmental matters.

The environmental policy instrument represented by administrative regulation is now in the process of being complemented by economic controls and in the future we will have a lot of legally binding standards.

Fees will be charged to limit or control emissions and use of certain substances and chemicals. Fees will be structured so that it will make economic sense to clean effluent streams or take other environmental measures. Thus they will effect behaviour and yield environmental benefits.

It is probable that emission sources that are common and similar in nature will gradually come under the control of general regulations. Individual circumstances would then be of little or no consequence. Such regulations might apply to filling stations, small sewage treatment plants, etc. But for large companies with a significant impact on the environment, the integrated permitting system with an individual review of a plant will remain.

Summary of characteristics

The Swedish integrated permitting system is characterised by a few key features. One of these characteristics is the use of case-by-case permitting reviews.

Individual review

From the point of view of permitting effectiveness, economic efficiency and pollution prevention, an individual review process entails some significant benefits. Individual review:

— allows individual circumstances to be taken into consideration and facilitates the introduction and implementation of technological advances; it is difficult to find the right level in a national standard; it is blind for individual circumstances and there are problems to adapt new technique;

— the performers can suggest their own solutions to environmental problems (recycling, cleaner production., instead of end-of-pipe solutions;

— technical development can be encouraged and emphasis can be put on developing the industrial process rather than on more conventional end-of-pipe solutions;

— the permitting authority sets the emission levels, then it is up to the performer to choose his own solution;

— the possibility for the permitting authority to postpone the decision of a particular condition until experience of the polluting activity has been gained;

— the possibility for the permitting authority to commission an expert to perform a special investigation (the polluter pays the cost of the investigation).

Over its thirty-year history of operation, the Swedish integrated permitting system has enabled Swedish permitting authorities to gain significant experience. The main benefits and shortcomings of the Swedish approach can be clearly identified.

Benefits of integrated permitting

In Sweden, the integrated permitting system has produced the following benefits:

— the permitting authority can control the transfer of pollution from one medium to another and then choose the best overall environmental option (ex. pulp industry and emissions of VOC to air);

— more cost-effective from a supervisory point of view, the inspectors can be cross-media trained;

— the performer needs just one environmental permit;

— it is easier for NGOs and individuals to express their opinions on a multimedia application concerning all emissions/disturbances from a plant, than on a single media application;

— the permitting authority is independent; it is not a division of the Environmental Protection Agency;

— the permitting system is open and transparent.

Shortcomings of integrated permitting

Despite its undeniable success, the Swedish integrated permitting system has left some issues unanswered, for example:

— small point-sources and mobile sources are not covered under the permitting system;

— emissions and other disturbances from the use of a product cannot be controlled; emissions to air from a point source can be controlled – for instance emissions from paint production – but emissions from the use of paint products are not addressed under the current system;

— in a specific area, the most cost-effective solution to a problem is difficult to find when conducting case by case examinations; an option to examine several sources at the same time is sometimes necessary;

— the best overall environmental option is often difficult to identify when examining only one point source: a trade-off is possible between the reduction of NOx from the combustion process and emissions from the transportation of ammonia to the combustion plant.

Summary of discussions and recommendations

The emergence of integrated approaches in many OECD Member countries is causing institutional changes toward multimedia permitting, a regulatory move which is expected to stimulate pollution prevention initiatives over a longer timeframe. Integrated systems can claim a considerable advantage because single-media authorities are expected to be reorganised along the lines of reengineered, joint-media permitting procedures and negotiation. Concurrently, many industries have already started moving toward integrated strategies, reassessing current technologies and practices, and potential technological paths for substituting them with cleaner processes.

Workshop participants identified the benefits and the limitations of the current regulatory drive towards more integrated permitting systems. Criticisms and comments focused on the integrated permitting procedure itself. The incomplete coverage of issues (e.g. waste) and the *ad hoc* nature of integrated decision-making processes (e.g. the management of possible multimedia trade-offs) were a source of debate. The prioritisation of substances and environmental impacts was also identified as a means of establishing a more transparent and cost-effective policy context. Participants also emphasised the role of sector- or substance-specific reduction plans and targets in setting a predictable and transparent context for industry, governments and the public. A recurrent theme was the significant role of public participation and consultation for effective permits.

Yet the issues pertaining to this aspiration for a broader integration of permits into a transparent policy setting were mostly left unresolved. For instance, workshop participants underlined the technical difficulties of area-wide pollution sharing between multiple sources (especially when diffuse sources of pollution are involved). Similarly, they stressed the difficulty of evaluating risk in a priority-ranking strategy, determining appropriate levels for EQSs, and coming to expert judgement in integrated permitting decisions. The other difficulties were those linked to the management of information: identification of costs, monitoring, results from environmental impact assessments, life cycle assessments, etc. As a prerequisite, participants recognised that the effectiveness of integrated permitting is dependent upon a much closer collaboration between industry and environmental authorities.

During their discussions, workshop participants agreed on a series of key elements concerning the use of integrated permitting mechanisms. Workshop participants opened the discussion by stressing three fundamental propositions that would govern the whole session:

— the central goal of integrated permitting approaches should be to promote pollution and waste reduction at source;

— integrated permitting entails trade-offs between various emissions and environmental disturbances;

— no definite methodology exists for arriving at an optional multimedia permit; no uniform basis for decision-making should be anticipated.

During the discussion, three main areas of concern were addressed:

— what the concept of integrated permitting systems is supposed to mean;

— how the concept of “integrated permitting system being beneficial for the environment as a whole” should be understood (i.e. the holistic view);

— what do we mean by integrated BAT: is there a need for integrated EQO?

Workshop participants reached some conclusions to these questions but also raised some issues for further debate.

- *The meaning of integrated permitting*

  — participants seemed to exhibit a rough understanding of the integrated permitting system;

  — participants emphasised the central aspect of training – i.e. skills of decision-making staff (inspectors, permit writers) – in an integrated permitting system because a major benefit of such as a system depends on case-by-case determination and expert judgement, as was described in the presentation of Sweden's permitting system;

  — participants also underscored the need to integrate the permitting system into a range of tools; they were uncertain of how fees and charges could be fitted into permitting mechanisms, or how differing ELVs could be adjusted to permits;

  — the role of public participation and consultation as a central element of an effective integrated system was also underlined; in particular, it was indicated that all the relevant information should be made available to the public prior to launching a permitting procedure.

- *A holistic vision of the environment*

  — from the participants' discussions, it became evident that no definite methodology exists for assisting at an optimal multimedia permit; some countries use expert judgement, some have general guidelines (such as the UK's best practical environmental option, BPEO, a system for structuring expert judgement);

  — another issue centred around the efforts and ideas to share the pollution load between different kinds of sources; with reference to programmes implemented in Norway, the United States and Canada a few options for integration were proposed:

    – "horizontal" integration along a geographic area ("hot spots" programmes); beyond the hot spots programmes, however, the current integrated systems seem to lack the capacity to fully take into account the impacts from all the sources that contribute to a pollution problem (e.g. automobile traffic, agriculture, product uses); it was recognised that integrating does not limit itself to lumping together the releases to the various media but that an even more holistic approach was required for incorporating all sources into planning;

    – "vertical" integration (e.g. inclusion of reduction at source of waste in the permit): the permitting experience of the United Kingdom, Denmark, United States, Canada and Austria served as an illustration;

— workshop discussions also revealed that participants were concerned by the fact that "vertical integration" was often incomplete insofar as integrated permitting does not always cover the final state of waste;

— on the basis of the Swedish experience, workshop participants expressed fears that the need to work only with individual applications seemed to run counter to the objective of "horizontal" integration.

- *The meaning of integrated BAT*

— participants noted that experience with integrated BAT is still in its infancy, except for countries like Sweden, which, for almost thirty years, has had an integrated system that has proven successful in reducing and preventing pollution; Sweden emphasised the independent nature of its national licensing board as an asset in the permitting process.

— it was understood that the development of integrated BAT was an information-intensive endeavour; on the key problem area of information availability, workshop participants recognised that the study which the European Union was conducting on integrated permitting would be a valuable source of information;

— participants came to the conclusion that there seemed to be no need for the development of integrated EQOs.

Workshop participants came to the conclusion that integrated permitting was still in its infancy in most OECD Member countries and that the amount of related experience was therefore limited. However, in spite of the growing importance of other relevant pollution reduction tools, participants stressed that industrial permitting was still an important tool for an effective pollution prevention and control policy.

3.4 Session 4 – Incorporating economic considerations into permitting decisions

The primary objective of this working group was to examine the experience accumulated by Member countries in incorporating economic considerations into permitting decisions. Relying on this experience workshop participants were also invited to derive some conclusions and recommendations on the best practices for integrating economics into permitting with a twofold objective of environmental effectiveness and cost-efficiency. The main topics and questions raised in the Issues for Discussion paper drafted by the OECD Secretariat prior to the workshop were recalled and are summarised in the first subsection to this workshop session. **David Mottershead**, from the United Kingdom's Department of the Environment, opened the workshop discussion by presenting the main features of this issue. Mr. Mottershead outlined the different approaches for incorporating economics into permitting (i.e. in the framework of nationally-set standards versus case-by-case examinations) as well as the benefits and disadvantages associated with each approach. He also drew the attention of workshop participants on the crucial issue of the availability and transparency of information. In addition, as an illustration of the types of synergy that can be created through a joint and optimal incorporation of environmental and economic considerations, **Dr. Horst Mierheim**, from the German Federal Environment Agency, presented a summary of the results from a research project on cost reduction through environmental protection measures. The project – undertaken jointly by the German Federal Ministry of Environment and the Federal Environment Agency – consisted in a

series of case studies showing the relationship between the adoption of environmental protection measures and the cost-benefits that companies can derive from those initiatives. According to Mr. Mierheim, the results of the case studies confirm that current cost accounting systems should be modified to incorporate environmental protection requirements.

Throughout the workshop session, Mr. Mierheim also acted as discussion mediator. As rapporteur, **Laurent Renevier**, independent consultant to the OECD Secretariat, summarised the main findings of the session.

Overview of issues

Economic considerations are a central concern when sectoral standards or specific permit conditions are established. Consultations with the regulated sources enable the regulatory authorities to incorporate the economic impact of measures on the concerned sources. Thus, to some extent, no standard or permit ignores economic considerations.

However, there are differences in how and at what level of the legislative, regulatory or permitting process economic factors are applied, which may create unintended differences in competitive advantage both within and among countries. For example:

— Economic issues concerning a given class of installation (e.g. steel mills of a certain type) may be factored in during the emission standards-setting phase and not considered at the permitting stage at all.

— Conversely, no reference (or only very general reference) to economic conditions may be made at the standards-setting level, either in the consultation debates or in the official text, yet the economic situation of a specific facility or company may be taken into account during the negotiation leading up to the delivery of a permit.

A number of countries mandate the use of pollution control techniques that do not entail excessive costs (e.g. BATNEEC). Others include a reference to the commercial viability of a technique in their legal definitions of BAT. Some countries apply general criteria for determining the economic impact of the measures they impose. These criteria usually refer to an average plant operated by an average, financially sound firm of the particular sector of concern. Thus, the economic situation of an industrial sector will be taken into account against such a yardstick but the cashflow situation of a particular firm may be disregarded. The concept of economic viability remains vaguely defined, however, as it is primarily left to the permitting authority to decide on each situation.

Ambient quality standards are mostly science-driven, based on environmental needs, and are therefore regarded as quite immune from the more pecuniary considerations of management policies. However, costs may vary considerably for meeting standards from area to area. The local environmental conditions affect the permit requirements that are set for individual facilities. For example, if plants are in “non-attainment areas”, limits will be strict and economic costs high. If not, the available “assimilative capacity” can be used and can be a reason to argue that BAT is not necessary. Thus, even though economic considerations may not be a direct factor in the establishment of environmental quality standards, they are a major determinant of their implementation by means of emission limit values on pollution sources. The policies of OECD Member countries vary with respect to the judgements used to determine when environmental quality standards should be relaxed

or their attainment postponed, on the ground of economic hardship (to the individual firm's profit margin? to overall economic conditions and employment effects in the locality?).

Economic considerations may also be incorporated into the emission standards-setting or permitting process on the basis of the nature of different polluting substances. According to this principle, a gradation system is set up according to which releases of hazardous substances (e.g. persistent, highly bioaccumulative, toxic, mutagenic or carcinogenic pollutants) are ineligible for review or waiver on economic grounds. The same may hold for minimum standards on the release of conventional pollutants. Additional increments in pollution removal may be subject to more systematic economic impact assessment. A moving scale may be used as new requirements are progressively incorporated into the floor requirements for which no economic review is performed. For hazardous substances, all requirements are considered as floor requirements.

Ideally, one could argue that economic parameters should be dealt with at the sectoral level, national, even international level in order to avoid creating economic distortions and unduly burden or spur competitiveness. Yet setting parameters at a higher level than the site-specific level can introduce inefficiencies in resource allocations, which itself runs counter to the proclaimed objective of taking economics into consideration.

The manner in which countries resolve the tension between the need for a level playing field for uniform emission standards, on the one hand, and local environmental conditions for maintenance of a safe environment, on the other, is quite revealing. One seems to be at the expense of the other. Either specific conditions of the receiving environment are paramount, in which case they induce distortions between similar processes operating in vastly different environments. Or local conditions are not taken into account so as not to distort the economic level playing field, in which case the requirements must either be patterned after a set level of across-the-line environmental protection which may be either too low or too high. This debate took place within the European Union during the proposition of the Integrated Pollution Prevention and Control (IPPC) directive. In Article 9 of the IPPC directive, a median path has been sought: Member States are free to impose specific, more stringent, obligations for particular classes of facilities but not in the permitting requirements. In any case, a high level of environmental protection is required. Downward levelling is precluded.

Two additional instruments may be relevant in guiding the competent authorities in their determination of the right balance of environmental requirements and economic considerations. At the standards-setting or permitting level, environmental audits and economic impact assessments may help provide the regulators with a more holistic view of the implications of their measures. Among other things, these tools may help identify trade-offs between pollution removal/prevention possibilities, forecast the benefits of reduced pollution, provide figures to the overall cost of the measures and arbitrage between options. Integrated (i.e. multimedia) permitting processes are more amenable to such policies than are media-specific systems.

Voluntary or negotiated agreements between government and industrial sectors or specific firms/plants may also be helpful in identifying which economic considerations are to be taken into account in which cases. For instance, minimum requirements for conventional pollutants and all requirements for hazardous substances would not be subject to any procedure for review or negotiation on economic grounds. Additional requirements would be imposed in negotiated agreements at the sectoral or firm/plant level.

The difficulty of incorporating economic considerations into permitting or standards-setting procedure lies in the antagonism between the official nature of requirements and the ad-hoc nature of

economic considerations. Perhaps an unequivocal separation between the requirements/standards that are negotiable on the basis of economic conditions and those that are not would provide a clear signal to industry on where they can expect flexibility and where they cannot.

THE ROLE OF ECONOMIC CONSIDERATIONS IN ENVIRONMENTAL PERMITTING

David Mottershead
Department of the Environment, UK

Dr. Horst Mierheim
Federal Environment Agency, Germany

A. Incorporating economic considerations in permitting

presented by David Mottershead

The OECD's issues paper invites us to reach conclusions about the best circumstances for incorporating economic considerations into permit decisions. These could be, for instance. when setting national standards, or in the context of a decision on a particular plant, and/or in the development and/or implementation of environmental quality standards. We are invited to reach a consensus on the most appropriate way or ways of doing it. That seems to me rather ambitious. I think we could usefully aim to come up with a list of the pros and cons of the various different approaches which we all agree on, whilst some of us will attach more importance than others to some of the individual pros and cons.

We are also invited to comment on how to ensure sufficient transparency in such decisions. In the case of technology-based standards – BAT for short – many if not all countries have policies which allow standards which are weaker than state of the art to be applied provided there is sufficient economic justification. The transparency problem is about ensuring that the business of getting from an assessment of state of the art to the conditions in a permit is done in a publicly accountable way.

The transparency issue raises difficult problems, notably the frequent impossibility of obtaining adequately verifiable information about costs from regulatees but also difficulties associated with the valuation of increments in environmental performance. There is a lot to be said for avoiding the pitfall of feeding totally spurious numbers into a highly formalised cost-benefit analysis, just for the sake of transparency.

As far as EQOs are concerned, whilst economics may play little part in defining ultimate target levels of environmental quality, it has a large part to play in the development of strategies to hit those targets. This is true both as to the timescale over which any given EQO is to be met and the individual measures by which it is met.

Economics and BAT

The literal meaning of “best available techniques” would be that these were the best techniques at preventing environmental harm, irrespective of cost. If environmental policy were to be based on such a concept, then we could expect to see electrostatic precipitators fitted to every window and door in a domestic house, to abate the household dust, and something as polluting as the local fish and chip shop would require a battery of pollution abatement equipment similar to that seen in a nuclear power station.

In practice, of course such an interpretation of “best available techniques” does not prevail anywhere, and the concept of proportionality is built into all countries’ systems. But how it is built in can differ significantly from one country’s pollution control system to another's.

On the one hand, there are some countries where standards are generally set nationally. and there is little or no scope for them to be relaxed to take account, for instance, of particularly difficult local circumstances which might make the nationally set standard much more expensive than usual to meet. Sometimes, such countries allow the nationally set standards to be made tighter if local conditions demand it – for example if standards for odour control for a process were set on the assumption that the planners would have done their job well and ensured that odorous processes were not located next to residential areas, you would want to tighten these standards if you came across an animal rendering plant right in the middle of a town (as we have in England). Sometimes the importance attached to harmonisation – all companies of the same type facing similar or identical environmental requirements – is such that local tightening of standards in this way would not be allowed.

At the opposite end of the spectrum, you have countries like the UK where permit conditions are usually negotiated separately for each site. They can vary up or down from a national norm for any particular process type according both to the difficulty of achieving a given standard at any particular plant and the needs of the local environment. If your site is on a windswept moor, for instance, you might not worry too much about building, a tall stack to ensure adequate dispersion of any emissions to air because the geography of your site will do that for you anyway. Equally, if you have a process with a particular configuration which means that it cannot meet the normal level of environmental performance expected of that type of process without spending twice as much money as the average operator, you have the flexibility in this sort of site-specific system to loosen the standard. On the other hand, where you have a sensitive site – for example one with poor dispersion conditions – you have to tighten the normal standards, as may happen with the other type of system based on rigid national emission limits.

I think it could be useful for us to discuss what the pros and cons might be of these two basic types of approach. My own list would be as follows:

Nationally set standards

Pros	Cons
✓ transparent ✓ administratively efficient ✓ difficult for firms to “cheat”	✓ economically inefficient

Site specific standards

Pros	Cons
✓ economically efficient	✓ administratively expensive ✓ prone to regulatory capture ✓ transparency may be difficult

B. Cost Reduction through Environmental Protection Measures
presented by Dr. Horst Mierheim

Background

- Environmental protection measures are often carried out or planned by companies, if the cost benefits of these measures are evident.

- Environmental protection measures are often not carried out by companies, because the beneficial effects of the related costs are not obvious.

- There are several reasons for this behaviour:

  - Due to inappropriate accounting, the costs of environmental protection cannot often be attributed directly to the production costs of the product. Generally, these costs are transferred to entire production facilities or sites of companies.

  - Compared to large enterprises, small- and medium-size enterprises often do not have or have only inappropriate cost accounting systems.

- Conclusion: There is a need to modify current cost accounting systems, in order to evaluate and relate directly the effects of costs from environmental protection measures to the production costs of the product.

Goals of the research project

- Development of practical guidelines for a modified cost accounting system for companies taking into account environmental aspects.

- Emphasis is given to the user friendliness of the system that will allow primarily small- and medium-size enterprises to apply a cost accounting system not entailing a great administrative burden.

- Delivering of a tool for companies that enables the systematic identification and evaluation of cost saving potentials from environmental protection measures taking into account entire production processes and operations of a company.

- The project presents 22 case studies of profitable environmental protection management with a view to encouraging the broader use of environmentally oriented cost accounting (see the following box).

Main advantages of an environmentally oriented cost accounting system

- Increasing awareness and knowledge, in particular, in determining material and energy flows, such as

  - the amount of CO_2 emissions which may lead to considerable future emission reduction costs, are being addressed and reduced cost effectively;

  - knowledge of the material and energy contents of different waste streams that will allow the operator to avoid the continuously increasing costs for treatment and disposal of wastes;

- knowledge of the amount and type of generated waste water, enabling the operator to identify the sources and prevention possibilities as well as their cost effectiveness, and consequently limiting or even balancing the increasing costs for waste water treatment.

— The use of environmental criteria as steering tools in cost calculations and budgeting can be verified to create an environment-oriented steering system.

— Such a system may be supplemented by environmentally oriented cost indices, e.g.

  - the proportion of environmental protection costs relative to total costs or production costs;

  - the ratio of environmental investment to current environmental protection costs;

  - the proportion and shares of various environmental protection costs (for waste, water, air emissions etc.)

— Determination of material and energy-related indicators and indices:

  - costs per production unit of avoided environmental pollution;

  - amount of material and energy used per unit of output;

  - amount of waste, waste water and air emissions generated per unit of output.

— An environmentally oriented cost accounting system can be an important pillar of an effective environmental management system as defined by EMAS or ISO 14000.

— Environmentally oriented cost accounting is an important contribution to sustainable development.

Areas of cost saving potentials

Results from the 22 case studies i.e. number of cases where the following types of savings were identified:

— Treatment of wastes	8
— Waste water treatment	10
— Energy	7
— Material substitution	3
— Site Clean-up	2

Further project findings

— There is a very large, unexploited potential for realising cost savings through environmental protection measures in the German industry. What are the reasons that this potential is realised only marginally?

— There are *two main reasons* for not realising profitable environmental protection measures:

The economic problem:

Many profitable environmental protection measures are considered only second priority due to their economic indicators:

— capital gains are below 20% to 30%;

— pay-back time period of more than 3 to 5 years;

— cost saving potential of less than 20,000 to 30,000 DM per year.

The strategy of many companies focuses on measures that deliver more promising results.

The know-how problem:

— Identifying profitable environmental protection measures requires interdisciplinary know-how including technologies, environmental management, cost accounting/controlling;

— Such know-how is usually available at different levels within a company: management, operations, advisers, and financial control;

— Organisational procedures and structures are quite rarely put in place to enable co-operation between different units concerned (exemption: internal licensing).

Ideas for realising profitable environmental protection measures

- Waste management:
  - separated collection of waste and systematic selling of recyclable material;
  - avoidance of unnecessary packaging and packaging material;
  - reuse of packaging material within a company.
- Energy management:
  - evaluation of possibilities for energy recovery through heat exchangers in each energy supply process;
  - use of ”free cooling” instead of using cooling units;
  - replacement of old and high electricity consumption units, optimising heating installations;
  - daytime and demand-oriented use of air conditioning systems.
- Waste water management (areas for action: water supply, water use , and waste water treatment):
  - recycling of cooling water;
  - systematic evaluation of water use and possibilities for water re-circulation;
  - demand-oriented (not permanent) water supply in rinsing systems;
  - silver recovery from galvanic surface treatment;
  - use of lime-milk suspension for neutralising of waste water;
  - recycling of surface coating sludges by optimising waste water treatment.
- Substitution of hazardous substances (e.g. degreasing substances)
- Identification of contaminated sites and determination of the most cost-effective time period for their clean-up
- Identification of area and origin of costs generation by using cost accounting system, e.g.:
  - what type of wastes are generated, and where, and how much does their treatment cost?
  - are there any electricity counters, and which are the high consumption units?
  - which are the generators of waste water and how much does its treatment cost?

— Development of a catalogue of technical and organisational measures including their cost estimates.

Benefits of project results for cost accounting and eco-audit

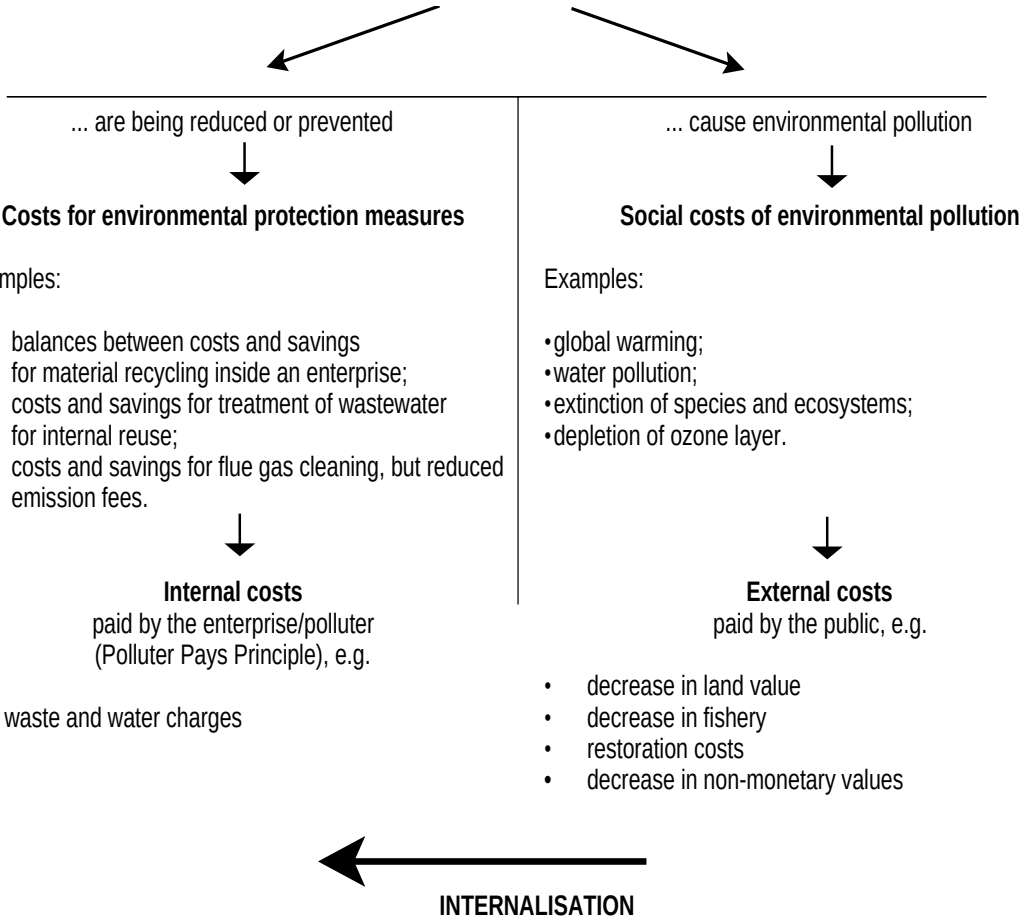
Findings from the case studies and information collection:

— Profitable environmental protection measures can be found in practically all enterprises

— Environmental protection measures are – often after their realisation – considered relatively easy to realise

— Companies that realise their opportunities are more innovative, leading in technology, organisationally flexible, and have motivated employees

Do you calculate your environmental protection costs correctly?



Environmental cost accounting systems: a German experience

During the last two decades, government, industry and public awareness of environmental issues has increased significantly. While public authorities and environmental groups asserted their social benefits, opponents of strict environmental regulations have argued that costly requirements decrease productivity, slowing down economic growth. However, the assumption has been based on conventional accounting approaches which incorporate environmental expenditures solely as costs, without considering any offsetting benefits.

Because of the uncertainty surrounding the economic implications of environmental regulations, some governments have supported several projects aiming at better approaches to fully comprehend the potential for coupling environmental quality and economic profitability. For instance, Germany has launched a project to help develop practical guidelines for a modified cost accounting system that would take into account environmental aspects. The project, which was presented by Dr. Horst Mierheim at the workshop session on economic considerations, consisted of 22 case studies of profitable environmental protection measures in seven firms. The practical experiences from the case studies suggest that environmental protection can be profitable, highlighting the significant advantages of implementing environmentally-oriented cost accounting systems, for example:

- ABB ColorEmag Schaltanlagen AG has saved up to 14,000 DM per year by substituting environmentally-friendly decoating agents to methylchloride, an ozone depleting substance and suspected carcinogen. The measure has allowed to avoid emissions of 35 tonnes of methylchloride per year. Current emissions of new decoating agent are estimated at 16 tonnes per year, but they are collected and returned to the primary producer where they are recycled after distillation;

- the above firm was also targeted by public authorities for discharges of wastewater containing silver ions. More stringent emission limit values prompted ABB ColorEmag Schaltanlagen AG to redesign their production units in order to comply with the stricter ELVs. The new design allows to channel wastewater flowing into rinsing baths in separate basins where an electric current runs, allowing the separation and collection of silver ions. The new measure allowed not only to comply with the new discharge limit, but revenues from the sale of recycled silver are estimated at 33,000 DM per year;

- Mitsubishi Semiconductor Europe, which used PVC-coated packaging tubes for the transport of semiconductors, had to face significant costs for the treatment and disposal of PVC waste. By introducing a less environmentally harmful coating (i.e. utilisation of an antistatic conditioning technique), the company was able to recover and reuse its packaging, while avoiding PVC waste. Savings were up to 17,000 DM in the first year, and increased to 124,000 DM the following years with increasing production corresponding to higher savings;

- Muelhaus GmbH Co. had to deal with enormous amount of wastewater as a consequence of its need for cooling water in the production of cosmetics filling machines. By installing a closed-loop water system, water intake and discharge were almost reduced to zero, ensuring compliance with permitting requirements. Yearly savings amounted approximately to 83,000 DM.

The results show that “pollution prevention pays” and confirmed that potential for applying the “3Rs” (reuse, recover, recycle) as a conceptual approach to environmental issues. Moreover, the results have proven that there is much benefit to modify cost accounting systems which take into account environmental aspects of industrial processes and products. As the above results demonstrate, there are many opportunities for firms to comply with regulations while achieving substantial cost savings if proper economic signals are provided. In that regard, environmentally-oriented cost accounting systems appear to bear an additional advantage: bringing together top executives, designers, production engineers, even workers in search for more environmentally-compatible and cost-efficient production methods by shedding light on the most pressing and/or profitable issues at hand.

3.5 Summary of discussions and recommendations

Workshop participants were invited to seek to reach conclusions about the best circumstances (e.g. level, criteria, information required) for incorporating economic considerations – both in the context of technology-based BAT requirements, and in the development and/or implementation of environmental quality standards; and to identify the appropriate level of, and means for assuring, transparency in such determinations.

As a fundamental conclusion, workshop participants determined that all countries incorporate economic considerations, in one way or another, into their standards-setting and permitting processes. They agreed that this was an area where better mutual understanding, transparency and clear guidelines might substantially improve the credibility of environmental permitting programmes.

In examining the various approaches for taking economic considerations into account during the permitting process, workshop participants established a difference between new and existing plants:

— for new plants, economic considerations for setting emissions standards like BAT or state-of-the-art are implicitly taken into account and the proportionality principle is used;

— for existing plants, different approaches are possible:

  – using the same stringent standards as used for new plants but, in keeping with the principle of proportionality, time is given for the application of the standards. The reason behind is that existing plants are emitting the same or a larger amount of substances than new plants.

  – to decide on the time-span for complying with emission standards, the following criteria should be taken into account:

    - nature, volume and hazardousness of the emission originating from each installation;
    - the emission released therefrom;
    - the useful life of the plant or the process unit within plant (some countries stressed that they have a culture of continuous reconstruction of different units on each site); and
    - characteristic technical features.

Workshop participants then addressed the issue of setting emission release values:

— Some countries are using uniform emission standards for the whole country and binding regulations. Other countries are using individual site-specific approaches. The site-related standards differ from site to site, and consider general economic impact.

— Another concept takes the economic situation of a special facility or company into account. Additional criteria could be environmental impact, the cash flow and others.

Some techniques for assessing the costs induced by permitting requirements were presented and critically examined by workshop participants:

— The "best practical environmental option" (BPEO) is an approach for writing licenses which incorporates the impact on the environment, the individual economic situation of the facility, an integrated media approach, and using a cost-benefit analysis (CBA). The BPEO is based on a marginal cost approach that takes into account the configuration of a permittee, not its financial situation.

— The discussion of BPEO made clear however that this approach is very complicated to implement into the licensing procedure. The questions raised on the implementation of the BPEO concept centred on how the environmental impact could be assessed, how the data for the CBA could be elaborated and brought together with the individual economic situation of the facility, and how the integrated assessment could be done. It was agreed that some more experience was needed to assess the practical feasibility of the concept for the permit writer.

— Workshop participants also examined the cost-effectiveness approach. This approach is still being developed in one country with a view to come up with standard cost-reduction figures for individual substances (e.g. SO_2, NO_x, VOC, HC). This approach should enable permit writers to set priorities for emission reduction in individual industrial sectors. Future experiences in this field should receive attention. Since the methodology is focusing on the sources themselves (discharges and emissions), it cannot be applied for items which are only of importance in the receiving environment (e.g. odour and noise).

Workshop participants also devoted some of their time to the issue of effective promotion of environmental investment on the part of the permitted plants. One country introduced a demonstration project which provides one-time investment funding to improve one facility in each industry branch. The purpose of the project is for government authorities to garner at least some information on the total cost (investment and operating) of a new emission reduction technology, the stability of the process over time and technical problems of optimising the process. This programme relates to stipulating in a branch-wide approach more stringent state-or-the-art emission standards compared to the existing ones. This programme also stipulates the environmental technology sector to offer better environmental technologies to demanding companies. This is also a source to claim information on environmental reduction costs.

Another research project was presented whose purpose was to inform participants that advanced and intelligent environmental reduction measures should not necessarily increase production costs. In many cases, such measures could decrease the production cost of a product. The main reason (besides others) that companies do not invest as much as they should into cost-saving environmental protection measures is the lack of adequate environment-related cost accounting systems which can provide management teams with a clear indication of where the saving potentials are. Such a practicable cost-accounting system is developed. Over 20 case studies are presented in the research project giving examples on cost-saving measures in both bigger firms and SMEs. Also, as the experience has shown that in many instances, projected compliance costs are blown up by the regulated industries, participants stressed the valuable contribution that cost databases could make for permitting authorities seeking to identifying the real economic impact of a measure.

Integrating economic considerations into the EQO development process is very difficult. EQOs are mainly stipulated on scientific bases, but there are a lot of big uncertainties as discussed in other

sessions. A major difficulty was found to lie in the adoption of environmental quality standards that do not differ markedly from the scientifically-endorsed environmental objectives, the latter remaining as targets for pollution reduction policy. At this stage, the debate polarised around two opinions, one arguing that economics had indeed a role to play in determining the standards, even if implicitly, and the other arguing that it had not. For achieving the EQO/S, however, there seemed to be agreement that some marginal cost prioritisation scheme was needed to manage multiple sources. For doing so, it was noted that the nature of the costs should first be clearly established (costs to society, economy, particular companies).

Finally, workshop discussions focused on the issue of the competitive distortion that may be introduced by permitting requirements on industrial plants.

— The OECD Environment Ministers meeting of February 1996 emphasised the role of the globalisation of the economy as a major factor affecting environmental policies in Member countries. Workshop participants addressed the issue of whether more international harmonisation was needed to come to grip with this globalisation phenomenon and to avoid competition problems. Harmonisation was deemed a good issue but it was reminded that it should not be pursued for its own sake but rather be addressed where appropriate, i.e. in those sectors in which the trade effects are significant. The OECD could draw upon its own resources to tackle this issue.

— There was a strong agreement however that national and international competition problems should not be a justification for setting substandard requirements. One reason could be that stringent emission standards could give incentives to industry to develop cheaper and better integrated solutions.

4. CLOSING SESSION: CONCLUSIONS ON WORKSHOP DISCUSSIONS

On the last day of the workshop, participants discussed the results of the meeting. The objective of this session was to draw the main practical conclusions from the workshop and to develop some policy recommendations on the various topics addressed. Consensus was reached on a number of key issues presented and some recommendations emerged from this consensus.

Participants recognised that permitting programmes still represent a central policy strategy for preventing and controlling releases from stationary sources of industrial pollution. The assessment of current permitting systems and practices in OECD countries indicates a definite trend toward new policies and practices.

Despite differences in official policies, national permitting practices use a combination of BAT and EQO. The complexity of environmental problems often leads to the application of the precautionary principle, using a technology-based approach. Regardless of existing technology, continuous improvement of environmental performance has also been a requirement, thereby stressing the importance of management techniques to achieve pollution prevention. While BAT appears to be the driving force for achieving improvements in pollution prevention, its use needs to be governed by comprehensive environmental protection plans with clear objectives and targets.

However, participants recognised that the principle of continuous improvement based on BAT may lead to undefined cross-media effects that need to be addressed. As a consequence, the trend towards integrated (multimedia) approaches for controlling environmental releases from industrial facilities has been observed in most countries. Some questions remain however on the adequacy of the current policy framework for addressing the problem of cross-media transfers, notably the lack of a methodology for weighing the various environmental factors into a permitting decision. However, to fill the gaps in current understanding of the mechanisms and effectiveness of integrated systems, it is crucial to increase the exchange of information and share experiences. The transition towards integrated pollution prevention and control will require the adjustment of legislative, regulatory and administrative processes as well as the development of new approaches and instruments.

It was recognised that good decisions on permits are a function of the information provided by applicants, the quality of monitoring results and appropriate enforcement of requirements. Harmonised measurement methods are needed in order to understand fully the transboundary and cross-media impacts of environmental releases. Beyond the effectiveness of the regulatory framework, the right of the public to be informed about the issues and criteria associated with the decision-making process has been emphasised as a major factor for ensuring good environmental performance of the industry.

Likewise, participants recognised the need to examine current practices regarding the incorporation of economic considerations into permitting and standards-setting procedures. An optimal permitting decision takes into account economic considerations to a certain extent. While

EQOs are primarily based on scientific and technical understanding, policy decisions include economic considerations, implicitly or explicitly. Various approaches and models for integrating economics into the permitting and standards-setting process were discussed. As a general principle, economic considerations should not lead to the relaxation of an environmental requirement, but they are needed to take full account of the specific factors in a decision, including its feasibility and desirability, and to distinguish cost-effectiveness from affordability. Some countries have reported new activities in the field of environmentally-oriented cost accounting systems.

4.1 The limits of permitting systems

Workshop participants noted that many questions remained on the adequacy and scope of current regulatory approaches. They identified some limits to industrial permitting as it is now defined and used in OECD Member countries. Those limits are related essentially to the search for environmentally and economically efficient solutions.

— Permitting programmes address large-scale point sources yet do not cover smaller but numerous point sources nor releases from diffuse sources. They are also criticised for the redundancy of some of their requirements (e.g. the controversial nature of the burden of proof caused by setting release parameters, monitoring requirements deemed unnecessary in light of new equipment, excessive add-on control technologies impeding the development of new processes), as well as their time-consuming and often adversarial procedures.

— Although a growing number of policy experts and officials support the implementation of the precautionary principle in the regulation of industrial pollution, more information on the environmental results achieved through such measures is needed to provide additional and more effective guidance for ensuring that the environment is fully protected. In this regard, the assurance that local considerations are well integrated into permit requirements remains an issue even though most countries apply a case-by-case approach. Thus, the excessive reliance upon release monitoring for compliance purposes may be insufficient to ensure that local considerations are fully assessed and is sometimes felt as a short-term remedy against the absence of/ignorance about the state of the environment.

— These issues have prompted many stakeholders to avoid the search for optimal policies and opt for more pragmatic approaches (such as the implementation of best practicable environmental options [BPEO], the assessment of local environmental results from permit requirements through the use of investigative programmes on the relationship between material inputs and release outputs, etc.). These developments have prompted the use of combined instruments for setting national standards and/or permit requirements.

— Traditional views on risk analysis – identifying the risks, integrating economic considerations (cost-benefit analysis), and negotiating the outcome of permit requirements – appear inadequate to deal with the increasing complexity and sources of pollution. Indeed, new initiatives in regulatory systems try to surpass the linear and static identification and cost-benefit evaluation of requirements in favour of a more dynamic concept of negotiation where risks can be integrated as a function of the decision-making process (e.g. evaluating the cross-media trade-offs that may result from specific

requirements, incorporating issues such as liability for site preservation and/or restoration, and accidental releases into short-term requirements). In this regard, the development of a more pragmatic approach as well as an adequate relationship between short-term and long-term conditions depends on how different circumstances are analysed and lead to prioritise differently which instruments should prevail, how they should interact, and influence the decision-making process.

4.2 Remaining issues

At the end of the workshop, participants recognised that a number of issues scheduled for debate had not been addressed or remained unanswered in spite of their discussions. Some other issues were reckoned to require additional consideration, possibly in the framework of the OECD. By and large, these remaining issues reflect some key concerns felt by permit writers and fall into three broad categories:

— definitions and approaches for setting acceptable release levels

— integrating the various aspects of permitting into an optimal decision

— supporting the core requirements of permitting through appropriate supporting mechanisms.

Workshop participants recognised that although the harmonisation of standards was not pertinent unless warranted by serious trade effects, some further work and clarification was needed on the approaches used in OECD Member countries for setting actual release limit values. In particular, they noted that:

— some differences existed on the definitions of the BAT and EQO concepts on which a significant part of permitting requirements are actually based;

— in spite of the prevailing understanding that EQO refers to science-based environmental quality and that EQS suggests a politically acceptable quality level, the difference between EQO and EQS was not always explicit;

— approaches for setting EQO, EQS and no-effect levels were not completely understood;

— the link between EQO as an indicator of environmental quality and the actual permit requirements was not clear;

— the prioritisation of measures on the basis of the hazard posed by substances and disturbances did not have a clear bearing on the way BAT is determined;

— some guidance was needed for assessing trade-offs in the case where several BAT options may be eligible for an integrated permitting decision.

Workshop participants stressed that although the trend towards more integrated permitting decisions was desirable, integrating the various aspects of a permitting decision posed some serious challenges to permit writers in particular and to policy-makers in general. They emphasised that:

— limited knowledge could be shared on the incorporation of economic considerations into permitting;

— although it was recognised that the cost-effectiveness method for assessing the economic costs of permitting allowed for the prioritisation and sequential use of measures, there was still some debate as to whether it should be preferred to other assessment methods such as cost-benefit analysis;

— there remained some serious questions on the best methods for determining the relevant nature of costs induced by permitting decisions (costs to society, costs to firms);

— integrating various levels of EQO into a permitting decision (problems of local concern as opposed to regional or even global environmental problems) was often difficult;

— permitting may be rendered more difficult by the lack of cross-media integration of some other instruments such as pollution registers;

— integrating permitting decisions had to be achieved along five distinct dimensions:

1. policy integration: integrating permitting and other instruments (fees, charges);

2. horizontal integration: integrating permitting into multi-source pollution plans, which raises the question of how to address pollution from small, diffuse, non-stationary sources into a pollution sharing scheme and how to handle individual applications in a general plan;

3. vertical integration: e.g. integrating waste generation requirements into permitting requirements;

4. time integration: integrating permit requirements in long-term, dynamic reduction schemes, e.g. plans and targets; and

5. procedural integration: incorporating consultation and public participation into permitting decisions.

Finally, workshop discussions shed light on the importance of the supporting mechanisms in the effective implementation of the core requirements of permitting decisions. Workshop participants stressed that some key questions remained to be answered, in particular:

— the importance of appropriate and timely training for permit writers and decision makers; and

— approaches for ensuring that access to information enhances the effectiveness of permit decisions.

ANNEX:
WORKSHOP PROGRAMME AND PARTICIPANT LIST

WORKSHOP PROGRAMME

Thursday, 9 May 1996

9:00 – **Registration**

9:30 – **Opening Session: Welcome Address**

9:45 **– Keynote speech**

– **Dr. David Slater**, Director of the Environment Agency of the United Kingdom

10:15

– **Dr. Jürgen A. Philipp**, Thyssen AG (Bundesverband der Deutschen Industrie e.V.)

– **Ms. Ann Hillyer**, Representative of the West Coast Environmental Law Association (WCELA)

10:45

Introduction of the overall project: Presented by **Rebecca Hanmer** (Chairman)

11:00 – **Presentation of the four industrial case studies and discussion of specific issues**

Pulp and Paper Case Study (Lead Country: Canada*)*

• Overview of Approaches – Presented by **David Halliburton**, Environment Canada

• Discussion of Considerations given to Environmental Quality Objective Requirements in the Permit Conditions that are set and the Technological Responses by mills – Presented by a **Canadian** permit writer and permittee.

Metal Plating Case Study (Lead Country: The Netherlands)

• Overview of Approaches – Presented by **Geertjan Smits**, TEBODIN, The Netherlands

• Economic Considerations and permit requirements in SMEs – Presented by a **Dutch** permit writer and permittee

Oil Refining Case Study (Lead Country: the United Kingdom)

• Overview of Approaches – Presented by **Christine Hemming**, Chrysalis Environment Consulting, UK

• Mechanisms in the permitting process for dealing with many separate permitted sources in the same locality – Presented by a **Belgian** permit writer and permittee

Iron and Steel Case Study (Lead: The Secretariat)

• Overview of Approaches – Presented by **Alain Rajotte**, OECD Environment Directorate

• Interaction between the precautionary principle and BAT in permit requirements – Presented by a **Swedish** permit writer and permittee

13:00 – 14:30 **Lunch**

14:30

DISCUSSION ON THE CASE STUDY ISSUES
(Panel**:** Case study presentators, permittees and permit writers)

• interaction between the precautionary principle and BAT in permit requirements

• use of the bubble concept in setting BAT requirements

15:50 – 16:10 – **Coffee Break and Refreshment**

16:00

• interaction between EQO requirements and technological response

• economic considerations and permit requirements in SMEs

Panel Comments of the issues will be followed by a floor Discussion.

17:30

Chairman and keynote speakers **– Wrap-up on case study results**

17:50 – 18:00

– Conclusion: Closing remarks and presentation of the Agenda for May 10

Adjournment

Cocktail at 18:30 Room A (Château)

****

Friday, 10 May 1996

9:15 – **Keynote Address**

– **Directorate-General XI (European Commission)** – The Integrated Pollution Prevention and Control Directive (IPPC): Implementation and Issues

9:30

– Introduction of the Workshop Issues • **Rebecca Hanmer** • Representative from the BAT-EQO Panel

10:00 – 10:20 **Coffee Break and Refreshment**

10:20 – **WORKSHOP SESSIONS**

Group A (Presentation and Mediation, **Lex de Jonge**, the Netherlands) (Rapporteur: Alain Rajotte) **Question:** What is the best complementary use of technology-based requirements and environmental media requirements in setting good permit conditions? – **WRAP-UP**: 12:15 – 12:45

10:20

Group B (Presentation and Mediation, **Ulf Bjällås** – Sweden) (Rapporteur: Laurent Renevier)

Question: What are the results of experiences in integrated (multi-media) permitting and how can this tool be used more effectively? For example: how to use integrated permitting so that BAT considers the environment as a whole?

– **WRAP-UP**: 12:15 – 12:45

12:50 – 14:30 – **Lunch**

14:30 – **WORKSHOP SESSIONS**

Group A (Presentation and Mediation – **Emelie Enckell-Sarkola** – Finland) (Rapporteur: Alain Rajotte)

Question: How can pollution prevention be achieved more effectively through the permitting system mechanisms; what is the relationship of integrated permitting to life cycle management and EMS tools?

– **WRAP-UP**: 16:30 – 17:00

14:30

Group B (Presentation and Mediation – **David Mottershead** – UK) (Rapporteur: Laurent Renevier)

Question: What is the approach for taking economic considerations into account in permitting (or associated standards-setting)?

– **WRAP-UP**: 16:30 – 17:00

17:00

– Summary of the results of the four workshop group discussions and recommendations

Presented by the discussion group moderators
(assisted by Laurent Renevier and Alain Rajotte)

DISCUSSION

17:45 – 18:00

– Closing Remarks and Agenda for the Saturday morning session

Presented by the chairman: **Rebecca Hanmer**

Adjournment

Saturday, 11 May 1995

9:15 – **PLENARY SESSION**

– Conclusions/findings for the workshop

• introduced by **Rebecca Hanmer** and **Keynote Speakers** Panel – *30 minutes*

Building on workshop reports what can we conclude as a group on:

– the benefits and shortcomings of the current approaches for achieving the double objectives of environmental protection and sustainable economic development;

– the benefits of combining permitting policies with other instruments (e.g. life cycle management, eco-auditing, voluntary agreements, economic and informational instruments);

– determining an appropriate balance of environmental and technological requirements in setting permit requirements, and fostering pollution prevention measures.

DISCUSSION – 2 hours

11: 45

– Implications for the OECD/PPC work programme

12: 45 – 13:00

Closing remarks and End of Session

LIST OF PARTICIPANTS

ALLEMAGNE
GERMANY

Dr. Horst MIERHEIM
Senior Policy Advisor
Federal Environmental Agency (Umweltbundesamt)
Mauerstrasse 52
D-10117 Berlin
Tel: (49.30) 23.14.57.36
Fax: (49.30) 231.56.38

Mr. Karl-Heinz ZIEROCK
Senior Technical Advisor
Federal Environmental Agency (Umweltbundesamt)
Bismarckplatz 1
D-14193 Berlin
Tel: (49.30) 89.03.28.12
Fax: (49.30) 89.03.22.85

Dr. Elisabeth SCHMID
Federal Environmental Agency (Umweltbundesamt)
Postfach 330022
D-14191 Berlin
Tel: (49.30) 89.03.26.15
Fax: (49.30) 89.03.22.85

Dr. Evelyn HAGERAH
Regionenpratin
Federal Environmental Agency (Umweltbundesamt)
Postfach 3300 22
D-14191 Berlin
Tel: (49.30) 23.14.57.89
Fax: (49.30) 23.15.56.38

Mr. Michael SUHR
Engineer, Pulp & Paper, Plastics and Packaging Industries
Federal Environmental Agency (Umweltbundesamt)
Bismarckplatz 1
D-14193 Berlin
Tel: (49.30) 89.03.23.93
Fax: (49.30) 89.03.22.85

Mr. Georg SCHMID-DRECKSLER
Regional Director
Bavarian State Ministry for Environment
Rosenkavalierplatz 2
D-81927 München
Tel: (49.89) 92.12.24.72
Fax: (49.89) 92.14.36.11

AUTRICHE
AUSTRIA

Mrs. Dipl. Ing. Susanne CHLAN
Federal Ministry for the Environment
Stubenbastei 5
A-1030 Wien
Tel: (43.1) 515.22.16.48
Fax: (43.1) 515.22.76.05

Dr. Margund BELKE
Federal Ministry of Economic Affairs
Landstrasser Hauptstrasse 55-57
A-1030 Wien
Tel: (43.1) 71.10.23.16
Fax: (43.1) 714.35.82

Dr. HEFLER
Federal Ministry for Agriculture and Forestry
Stubenring 12
A-1010 Wien
Tel: (43.1) 711.00.27.43

BELGIQUE
BELGIUM

Mr. Bruno DE KERCKHOVE
Ministère Région Wallonne
Direction Générale Ressources Naturelles et Environnement
Av. Prince de Liege, 15
B-5100 Namur
Tel: (32.81) 32.58.13
Fax: (32.81) 32.59.84

Mr. Jean PAUWELS
Co-ordinator, BAT-EQO Project Flanders
Flemish Environmental Agency
A. Van de Maelestraat, 96
B-9320 Erembodegem
Tel: (32.53) 72.66.24
Fax: (32.53) 77.32.90

Mr. Roger DIJKMANS
Project leader, BAT-centre
VITO
Boeretang 200
B-2400 Mol
Tel: (32.14) 33.55.51
Fax: (31.14) 33.55.99

CANADA
CANADA

Environment Canada
13th Floor, Place Vincent Massey
351 Blvd St Joseph
Hull, Quebec K1A 0H3

Mr. Vic SHANTORA
Director General
Toxics Pollution Prevention Directorate
Environment Canada
Tel: (1.819) 994.56.62
Fax: (1.819) 953.53.71

Mr. David HALLIBURTON
Head, Pulp and Paper
Renewable Resources Division
Environment Canada
Tel: (1.819) 953.11.28
Fax: (1.819) 994.77.62

Mr. Ian MACKENZIE
Standards Development Specialist
Standards Development Branch
Environmental Assessment Division
6th Floor, Oxbridge Place
9820-106th St
Edmonton, Alberta TSK 276
Tel: (1.403) 422.25.40
Fax: (1.403) 422.97.14

Mr. Harry VOGT
Manager, Technical Services and Special Wastes
British Columbia Ministry of Environment,
Lands and Parks
Suite 1106, 1175 Douglas St
Victoria, British Columbia V8V 1X4
Tel: (1.604) 387.99.53
Fax: (1.604) 953.38.56

Ms. Helle TOSINE
Director, Programme Development
Ministry of Environment and Energy
40 St Clair Ave West, 14th floor
Toronto M4V 1M2
Tel: (1.416) 314.39.20
Fax: (1.416) 314.41.28

DANEMARK
DENMARK

Danish Environmental Protection Agency
29 Strandgade
DK-1401 Copenhagen K

Poul K. G. EMMERSEN
Advisor, Danish Environmental Protection Agency
Tel: (45.32) 66.01.00
Fax: (45.32) 66.04.79

ETATS-UNIS
UNITED STATES

U.S. Environmental Protection Agency
401 M. Street, S.W.
20460 Washington D.C.

Mr. Rick PICARDI
Policy Advisor
Office of Solid Waste, Code 5304
U.S. Environmental Protection Agency
Tel: (1.202) 260.57.56
Fax: (1.202) 260.06.37

Ms. Susan HAZEN
Director, Environment Assistance Division
Office of Pollution Prevention & Toxics, Code 7408
U.S. Environmental Protection Agency
Tel: (1.202) 260.10.24
Fax: (1.202) 260.17.64

Ms. Breck MILROY
Science Advisor for Environmental Affairs
US Mission to the OECD

FINLANDE
FINLAND

Ms. Emilie ENCKELL-SARKOLA
Finnish Environment Agency
P.O. Box 140
FIN-00251 Helsinki
Tel: (358.0) 40.30.00
Fax: (358.0) 40.30.01.90

Erja MONTO
Inspector, South-east Finland Regional Environment Centre
Laserkatu 6
53850 Lappeenranta
Tel: (358.53) 624.32.90
Fax: (358.53) 412.10.59

Airi KARVONEN
Senior Advisor
Ministry of the Environment
Ratakatu 3
Helsinki
Tel: (358.0) 19.91.96.88
Fax: (358.0) 19.91.97.16

FRANCE
FRANCE

Direction de la Prévention des Pollutions et des Risques
Ministère de l'Environnement
20 avenue de Ségur
75302 Paris CEDEX 07

M. Jean-François LAIGRE
Direction de la Prévention des Pollutions et des Risques

ITALIE
ITALY

Mr. Domenico GAUDIOSO
E.N.E.A.
C.R. Casaccia
via Anguillarese 301
S. Maria de Galeria
00060 Rome
Tel: (39.6) 30.48.65.64
Fax: (39.6) 30.48.49.25

JAPON
JAPAN

Environment Agency
1-2-2 Kasumigaseki, Chiyodu-ku
Tokyo

Mr. Tsutomu SAKAGAWA
Assistant Director, Air Quality Bureau
Environment Agency
Tel: (81-3) 35.80.21.65
Fax: (81-3) 35.80.71.73

Mr. Makoto OKAZAKI
Special Advisor to the Director-General
Air Quality Bureau
Environment Agency
Tel: (81.3) 35.80.21.65
Fax: (81.3) 35.80.71.73

MEXIQUE
MEXICO

Mr. German GONZALEZ
Permanent Delegation of Mexico to the OECD
4 rue Galliéra
75116 Paris
FRANCE
Tel: (33.1) 53.67.86.18
Fax: (33.1) 47.20.07.91

NORVEGE
NORWAY

Ms. Ingrid BJOTVEIT
Head of Department
Norwegian Pollution Control Authority
PO Box 8100 Dep.
0032 Oslo
Tel: (47) 22.57.34.00
Fax: (47) 22.67.67.06

Ms. Anne Marie MO RAVIK
Senior Executive Officer
Norwegian Pollution Control Authority
PO Box 8100 Dep.
0032 Oslo
Tel: (47) 22.57.34.00
Fax: (47) 22.67.67.06

NOUVELLE ZELANDE
NEW ZEALAND

Mr. Lindsay GOW
Deputy Secretary, Policy Implementation
Ministry for the Environment
84 Boulcott St
P.O. Box 10362
Wellington

PAYS-BAS
NETHERLANDS

Ministry of Housing, Spatial Planning and the Environment
P.O. Box 30945
2500 GX The Hague

Mr. J. A. SUURLAND
Director of Industry, Building, Products & Consumer Policy,
Code 650
Ministry of Housing, Spatial Planning and the Environment
Tel: (31.70) 339.46.69
Fax: (31.70) 339.12.93

Mr. Robert DROOP
International Environmental Affairs Directorate
Ministry of Housing, Spatial Planning and the Environment
Tel: (31.70) 339.47.08
Fax: (31.70) 339.13.06

L. DE JONGE
Ministry of Housing, Spatial Planning and the Environment

M.E. TIMMER
Ministry of Housing, Spatial Planning & the Environment

J. BUNTEMA
Ministry of Transport, Public Works & Water Management
Postbus 20906
2500EX The Hague

Mrs. J. BIJSTERBOSCH
RIZA

ROYAUME-UNI
UNITED KINGDOM

Dr. David SLATER
Director
Environment Agency
Head Office, River House
Waterside Drive
Aztec West
Almonds Bury
Bristol BS12 4UD
Tel: (44.1454) 62.40.57

Department of the Environment
Romney House
43 Marsham Street
SW1P 3PY London

Mr. David MOTTERSHEAD
Head of Branch
Integrated Pollution Control Policy Unit, Room B236a
Department of the Environment
Tel: (44.171) 276.89.16
Fax: (44.171) 276.82.99

Ms. Jessica MATTHEW
Integrated Pollution Control Policy Unit, Room A241
Department of the Environment
Tel: (44.171) 276.87.47
Fax: (44.171) 276.82.99

Mr. Richard MILLS
Air Quality
Department of the Environment
Tel: (44.171) 276.
Fax: (44.171) 276.82.99

Mr. Ian MacDONALD
Integrated Pollution Control Policy Unit
Department of the Environment

Mr. Martin BIGG
Department of the Environment, Room A-519

SUEDE
SWEDEN

Ms. Siv NASLUND
Ministry of the Environment
Tegelbacken 2
S-103 33 Stockholm
Tel: (46.8) 405.20.13
Fax: (46.8) 20.46.66

Mr. Hans LANNERBLOM
Senior Technical Officer
Swedish Environmental Protection Agency
106 48 Stockholm
Tel: (46.8) 698.11.38 Fax: (46.8) 698.13.45

Mr. Ulf BJÄLLÅS
National Licensing Board for Environmental Protection
Box 8163
S-104 20 Stockholm
Tel: (46.8) 692.21.20
Fax: (46.8) 692.21.00

SUISSE
SWITZERLAND

Mr. Bruno MILANI
Vice Director
Office fédérale de l'environnement, des forêts et du paysage (OFEFP)
CH-3003 Berne
Tel: (41.31) 322.93.02
Fax: (41.31) 352.12.10

Mr. Marcel SCHMID
Deputy Chief
Environmental Protection Agency of the Kanton of Aargau
Buchenhof
CH-5001 Aarau
Tel: (41.62) 835.34.31
Fax: (41.62) 835.34.39

Mr. Martin WÜRSTEN
Head, Department of Water Protection and Water Management
Canton of Solothurn
Office of Environment, Canton of Solothurn
Baselstr. 77
4509 Solothurn
Tel: (41) 65.21.28.06
Fax: (41) 65.21.76.96

Dr. Benjamin SOLBERGER
Adjoint Scientifique
Office fédéral de l'environnement, des forêts et du paysage
BUWAL
CH-3003 Bern
Tel: (41.31) 322.69.68
Fax: (41.31) 371.25.83

REPUBLIQUE TCHEQUE **CZECH REPUBLIC**	Mrs. Libuse ROMANOVSKA Director of Department of International Relations Ministry of the Environment Vrsovicka 65 100 10 10 Prague
TURQUIE **TURKEY**	Ms. Ipar ONEL Permanent Delegation of Turkey to the OECD 9 rue Alfred-Dehodencq 75116 Paris FRANCE Tel: (33.1) 42.88.50.02 Fax: (33.1) 45.27.28.24
UNION EUROPÉENNE **EUROPEAN UNION**	*European Commission* *Rue de la Loi 200* *B-1049 Bruxelles BU-5 00/174* *BELGIQUE* Mr. Leopoldo RUBINACCI Administrator, DG-XI (Environment) European Commission (TRMF 5/77) Tel: (32.2) 299.03.03 Fax: (32.2) 299.10.67 Mr. Dominique KLEIN Directorate General Industry (DGIII B-4) European Commission (RP3 5/5) Tel: (32.2) 296.17.14 Fax: (32.2) 295.38.77

OBSERVERS

Dr. Pàl VARGA
Head, Expert Department
National Environmental Authority
Fö u. 44
1011 Budapest
HONGRIE
Tel: (36.1) 457.35.30
Fax: (36.1) 201.42.82

Jana JAGNESÁKOVÁ
Goverment Policy Maker, Air Protection Department
Ministry of the Environment
Hlboká 2
812 35 Bratislava
SLOVAK RÉPUBLIQUE
Tel: (42.7) 39.18.42
Fax: (42.7) 39.12.01

Mrs. Grazyna SZTANDERA
Senior Specialist
Ministry of Environmental Protection,
Natural Resources & Forestry
00-922 Warszawa ul. Wawelska 52/54
Warsaw
POLOGNE
Tel: (48.22) 25.45.60
Fax: (48.22) 25.20.03

Mr. Jae-Young KO
Director, Environmental Technology Promotion Division
Ministry of Environment
1 Choongang-Dong
Kwachon City Kyungi-Do
REPUBLIQUE DE COREE
Tel: (82.2) 504.92.42
Fax: (82.2) 504.92.05 / 92.80

Mrs. Catherine CHALANDON-MASSON
Economic Commission for Europe
Palais des Nations
8-14 avenue de la Paix
CH-1211 Genève 10
SUISSE
Tel: (41.22) 917.12.34
Fax: (41.22) 904.01.07

Ms. Clare COCAULT
UNEP Industry and Environment
32, Bd du Roi René
49100 Angers
FRANCE
Tel: (33.16) 41.81.08.12
Fax: (33.16) 41.81.08.12

Dr. Stefan HAIN
Deputy Secretary, Oslo and Paris Commissions
New Court, 48 Carey St
WG2A 2JQ London
ROYAUME-UNI
Tel: (44.171) 242.99.27
Fax: (44.171) 831.74.27

INDUSTRY & NGOs

Prof. Dr. Jürgen A. PHILIPP
Thyssen AG
D-47166 Duisberg
ALLEMAGNE
Tel: (49.203) 52.28.231
Fax: (49.203) 52.26.332

Dr. Ralph AHRENS
European Environmental Bureau, Brussels
Hans-Sachs-Str. 19
D-50931 Köln
ALLEMAGNE
Tel: (49.221) 40.60.334
Fax: (49.221) 40.60.334

Dr. MARKOW
Representative, Pulp and paper industry
Fa. Lenzing AG
A-4860 Vöcklabruck
AUTRICHE
Tel: (43) 767.27.01
Fax: (43) 76.72.29.07

Dr. Ursula KÖNIG
Representative, Wiener Umweltanwaltschaft
Meiereistrasse 2
A-1020 Wien
AUTRICHE
Tel: (43.1) 727.040
Fax: (43.1) 727.048.8989

Mr. Jean MULKINS
Directeur Adjoint, Fédération Petrolière Belge
4, rue de la Science
1000 Bruxelles
BELGIQUE
Tel: (32.2) 512.60.53
Fax: (32.2) 511.05.91

Mr. Walter MEERSSEMAN
Environment Co-ordinator, Bekaert Group
VOM asbi
Interleuvenlaan 62/3
3001 Leuven
BELGIQUE
Tel: (32-16) 40.14.20
Fax: (32.16) 40.01.35

Ms. Anne-Marie DE NOOSE
Information Analyst
Intergraf
International Confederation for Printing and Allied Industries
Sq. Marie-Louise 18 (Bte 27)
B-1040 Bruxelles
BELGIQUE
Tel: (32.2) 230.86.46/26.72/26.78
Fax: (32.2) 231.14.64

Mr. Bob NIEUWEJAERS
Division Amina Bel
Aminal
Belliardstraat 14-18
1040 Bruxelles
BELGIQUE
Tel: (32.2) 507.30.03
Fax: (32.2) 507.67.53

Ms. Ann HILLYER
Staff Councillor
West Coast Environmental Law Association
Suite 1001, 207 West Hasting
Vancouver, British Columbia V6B 1H7
CANADA
Tel: (1.604) 684.73.78
Fax: (1.604) 684.13.12

Mr. Guy BOUCHER
Vice President, Environment
Domtar
395, Boul. Maisoneuve Ouest
Montreal, Quebec H3A 1LG
CANADA

Mrs. Frances IRWIN
World Resources Institute
1709 New York Avenue, N.W.
Washington D.C. 20006
ETATS-UNIS
Tel: (1.202) 662.25.28
Fax: (1.202) 628.08.78
Email: fran@wri.org / franirwin@aol.com
Pirkko MOLKETIN-MATILAINEN, M. Sc.
Finnish Forest Industries Federation
Etela Esplanadi 2
00130 Helsinki
FINLANDE
Tel: (358.0) 13.261 Fax: (358.0) 17.44.79

Mr. Lars LØCHEN
Production Manager
A/S Union (Union Co.)
PO Box 66
3701 Skien
NORVEGE
Tel: (47) 35.58.50.00
Fax: (47) 35.58.51.00

Philemon BERCKMOES
Refining Director, Esso Benelux
PO Box 1
4803 AA Breda
PAYS-BAS
Tel: (31.76) 529.18.93
Fax: (31.76) 522.11.77

A. DE LANGE
Association of the Province of the Netherlands
Postbus 165
4330 AD Middelburg
PAYS-BAS

J.W. BIEKART
The Netherlands Society for Nature and Environment
Donkerstraat 17
3511 KB Utrecht
PAYS-BAS

Mr. J. VAN DEN BROEK
Netherlands Confederation of Industry and Employers
Postbus 93093
2509 AB The Hague
PAYS-BAS

J.W. DU MORTIER
Association for Surface Finishing Techniques
Postbus 120
3720AC Bilthoven
PAYS-BAS

Geertjan J. SMITS
Tebodin
Postbus 7613
5601 JP Eindhoven
PAYS-BAS

S. DAAMEN
Zuiveringsschap Rivierenland (water board)
Postbus 599
4000 AN Tiel
PAYS-BAS

Mr. Stanislav HLAWICZKA
Institute for Ecology of Industrial Areas
6 Kossutha Str.
40-833 Katowice
POLOGNE

Mr. Ki-Woong SUNG
Environment Planning Team
Pohang Iron and Steel Co.
Pohang City Kyungbook-Do
REPUBLIQUE DE COREE
Tel: (82.562) 220.02.95
Fax: (82.562) 220.52.96

Ms. Christine HEMMING
Chrysalis Consulting
8 South View
Startford Rd
Great Dunmoor, Essex CM6 1UQ
ROYAUME-UNI
Tel: (44.371) 87.25.47
Fax: (44.371) 87.25.47

Richard TAPPER
16 Glenville Rd
Kingston-upon-Thames, Surrey KT2 6DD
ROYAUME-UNI
Tel: (44.181) 549.19.88
Fax: (44.181) 974.94.83

Mr. Kjell LUNDSTRÖM
Manager, Environment Control
SSAB Oxelösund AB
613 80 Oxelösund
SUEDE
Tel: (46.1) 555.40.88
Fax: (46.1) 555.40.82

Nils JIRVALL
Vice President, Environmental Policy
Swedish Forest Industries Association
Box 5518
S-11485 Stockholm
SUEDE
Tel: (46-8) 783.84.00
Fax: (46-8) 661.73.06

Dr. Heinz LEUENBERGER
Consultant (Buwal)
c/- Carbotech A6
Gurzetngasse 25
4500 Solothurn
SUISSE
Tel: (41.65) 23.77.70 Fax: (41.65) 23.77.71

Mr. Kazutaka YASUMI
General Manager, European Office
Japan Iron and Steel Federation
Avenue des Arts 50, Bte 6
B-1000 Bruxelles
BELGIQUE
Tel: (32.2) 512.20.91
Fax: (32.2) 512.60.37

Mr. Nick COOK
BIAC Representative
Elf Antar France
Tour Elf, 2 Place de la Coupole
92078 Paris La Défense
FRANCE
Tel: (33.1) 47.44.42.59 Fax: (33.1) 47.44.62.70

OECD SECRETARIAT

Ms. Rebecca Hanmer
Director of Pollution Prevention and Control Division
OECD
2, rue André-Pascal
75775 Paris Cedex 16
France
Tel.: (33.1) 45.24.98.70
Fax.: (33.1.) 45.24.78.76

Mr. Henrik Harjula
Administrator, Pollution Prevention and Control Division
OECD
Tel.: (33.1) 45.24.98.18

Mr. Peter Wiederkehr
Administrator, Pollution Prevention and Control Division
OECD
Tel.: (33.1) 45.24.78.92

Mr. Alain Rajotte
Consultant, Pollution Prevention and Control Division
OECD

Mr. Laurent Renevier
Consultant, Pollution Prevention and Control Division
OECD

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 1999 03 1 P) ISBN 92-64-16193-7 – No. 50527 1999

OECD documents

Environmental Requirements for Industrial Permitting

Vol. 3 – Regulatory Approaches in OECD Countries

ENVIRONMENTAL REQUIREMENTS FOR INDUSTRIAL PERMITTING

Vol. 3

Regulatory Approaches in OECD Countries

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original Member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became Members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996) and Korea (12th December 1996). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

© OECD 1999
Permission to reproduce a portion of this work for non-commercial purposes or classroom use should be obtained through the Centre français d'exploitation du droit de copie (CFC), 20, rue des Grands-Augustins, 75006 Paris, France, Tel. (33-1) 44 07 47 70, Fax (33-1) 46 34 67 19, for every country except the United States. In the United States permission should be obtained through the Copyright Clearance Center, Customer Service, (508)750-8400, 222 Rosewood Drive, Danvers, MA 01923 USA, or CCC Online: http://www.copyright.com/. All other applications for permission to reproduce or translate all or part of this book should be made to OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France.

FOREWORD

The provision of environmental permits to industrial facilities is an integral and most significant component of the regulatory process in most OECD countries for controlling sources of pollution. Environmental permitting is used to achieve two main objectives: (a) reducing the generation of pollutants related to various environmental media (e.g. air, water, soil); and (b) protecting and improving the quality of the environment surrounding the discharging facilities. This policy survey presents the main features of the regulatory framework and approaches governing the negotiation and delivery of environmental permits in some twenty OECD Member countries.

This survey shows that many countries apply a combination of "Best Available Technology" (BAT) and environmental quality objectives and/or standards (EQOs and/or EQSs) for setting permit requirements. It also reveals that permitting policies are increasingly moving toward the integration of all environmental aspects in order to achieve optimal environmental conditions. In addition, this survey provides information on various practices for incorporating economic considerations into permitting decisions.

This report is Volume 3 of the three-volume publication which came out of the OECD project on Environmental Requirements for Industrial Permitting. It attempts to shed light on the use and implications of environmental and technological requirements in permits and was carried out under the purview of the OECD's Pollution Prevention and Control Group.

The two other project publications are: Volume 1, the policy study of the entire project; and Volume 2, the proceedings of the international workshop and the summaries of the sectoral case studies. The industry case studies from the iron and steel and pulp and paper sectors, include detailed country profiles, and therefore, are released as separate OECD documents.

The report is published on the responsibility of the Secretary-General of the OECD.

ACKNOWLEDGEMENTS

The OECD would like to acknowledge the important assistance and support provided by government officials and experts from OECD Member countries during the preparation of this reference guide. The project was also supervised by the "BAT-EQO" Advisory Panel, which included Delegates to the Pollution Prevention and Control Group from the following participating countries: Karel de Brabander and Bruno de Kerckhove (Belgium), James Riordan (Canada), Robert Droop and Jan Suurland (Netherlands), Antero Honkasalo (Finland), Horst Mierheim (Germany), David Mottershead (United Kingdom), Rick Picardi (United States), and Leopoldo Rubinacci (European Commission). Valuable input was also obtained from experts participating in the OECD Workshop on Environmental Requirements for Industrial Permitting held in Paris in May 1996. The amount of information gathering, fact checking and updating necessary to produce the survey and analysis of permitting approaches for these countries was substantial, and a great number of specialists in Member country administrations were instrumental in helping ensure that this was done in a thorough and accurate manner. Financial support for the project was provided by the governments of Austria, the Netherlands, Switzerland which is greatly acknowledged.

This survey was compiled and written in the Pollution Prevention and Control Division of the Environment Directorate. The main responsibility for this work rested with Laurent Renevier and Alain Rajotte under the direction and editorial oversight of Ms. Rebecca Hanmer, former Head of Division, and Peter Wiederkehr. Environment Canada, the Dutch Ministry of Environment, and the UK Department of the Environment, respectively, were responsible for carrying out the case studies on the pulp and paper, metal finishing, and oil refining sectors. Input, assistance and advice by past and present colleagues in the Environment Directorate are also acknowledged. Ms. Freda O'Rourke and Lyndia Levasseur ably provided editing and logistical assistance.

The report was revised and approved by OECD's Pollution Prevention and Control Group.

TABLE OF CONTENTS

INTRODUCTION **11**

AUSTRIA **17**

Regulatory framework *17*
BAT *17*
EQS *18*
Permitting *19*
Economic considerations *24*
Financial assistance *26*
Monitoring and Inspection *26*

BELGIUM **29**

Regulatory framework *29*

FLANDERS 29
Regulatory framework *29*
BAT *30*
EQS *31*
Emission limit values (ELVs) *32*
Permitting *32*
Economic considerations *34*
Financial Assistance *34*

WALLONIA 35
Regulatory framework *35*
BAT *35*
EQS *36*
Emission Limit Values (ELVs) *36*
Permitting *36*
Monitoring and inspection *37*

CANADA **41**

Regulatory framework *41*
BAT *42*
EQS *44*
Emission limit values (ELVs) *46*
Permitting *46*
Economic considerations *48*
Monitoring and Inspection *48*

DENMARK **51**

BAT *51*
EQS *52*
Emission limit values (ELVs) *52*
Permitting *53*
Economic considerations *55*
Monitoring and Inspection *55*

FINLAND **59**

Regulatory framework *59*
General Environmental Law *59*
BAT *60*
EQS *61*
Emission Limit Values (ELVs) *61*
Permitting *63*
Economic considerations *65*
Financial assistance *66*
Monitoring and Inspection *66*

FRANCE **69**

BAT *69*
EQS *70*
Permitting *71*
Economic considerations *73*
Monitoring and Inspection *73*

GERMANY **77**

Regulatory framework *77*
BAT *77*
EQS *79*
Emission limit values (ELVs) *80*
Permitting *80*
Economic considerations *81*
Monitoring and Inspection *82*

HUNGARY **85**

Regulatory framework *85*
BAT *85*
EQS *86*
Emission Limit Values (ELVs) *87*
Permitting *87*

ITALY **91**

Regulatory framework *91*
BAT *91*
EQS *93*
Emission Limit Values (ELVs) *93*
Permitting *94*
Economic Considerations *94*
Monitoring and Inspection *95*

JAPAN **99**

Regulatory framework *99*
BAT *100*
EQS *100*
Emission limit values (ELVs) *101*
Regional pollution prevention and control efforts *102*
Permitting *103*
Economic considerations *104*
Monitoring and Inspection *104*

KOREA **107**

Regulatory framework *107*
BAT *107*
EQS *110*
Emission Limit Values (ELVs) *111*
Permitting *112*
Economic considerations *115*
Financial and Technical Assistance *115*
Monitoring and Inspection *116*

NETHERLANDS **121**

Regulatory framework *121*
BAT *121*
EQS *124*
Emission Limit Values (ELVs) *126*
Permitting *126*
Economic considerations *127*
Financial and Technical Assistance *128*
Monitoring and Inspection *128*

NEW ZEALAND **131**

Regulatory framework *131*
BAT *131*
EQS *132*
Emission limit values (ELVs) *133*
Permitting *133*
Economic considerations *135*
Financial & Technical Assistance *135*
Monitoring and Inspection *135*

NORWAY **139**

Regulatory framework *139*
BAT *139*
EQS *140*
Emission Limit Values (ELVs) *142*
Permitting *142*
Economic considerations *145*
Financial and Technical Assistance *146*
Monitoring and Inspection *146*

SWEDEN **149**

Regulatory framework *149*
BAT *149*
EQS *150*
Emission limit values (ELVs) *151*
Regional pollution prevention and control efforts *151*
Permitting *152*
Economic considerations *153*
Monitoring and Inspection *154*

SWITZERLAND **157**

Regulatory framework *157*
BAT *157*
EQS *159*
Emission Limit Values (ELVs) *161*
Permitting *162*
Economic Considerations *163*
Financial and Technical Assistance *164*
Monitoring and Inspection *164*

UNITED KINGDOM **169**

Regulatory framework *169*
BAT *169*
EQS *171*
Emission limit values (ELVs) *172*
Permitting *173*
Economic considerations *175*
Monitoring and Inspection *177*

UNITED STATES **179**

Regulatory framework *179*
EQS *181*
BAT *183*
Emission Limit Values (ELVs) *189*
Permitting *190*
Economic considerations *193*
Financial and technical assistance *195*
Monitoring and Inspection *195*

EUROPEAN UNION **201**

BAT *201*
EQS *202*
Emission Limit Values (ELVs) *203*
Permitting *203*

INTERNATIONAL AGREEMENTS **205**

CONVENTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT OF THE NORTH-EAST ATLANTIC (OSPAR) 205
BAT *205*

CONVENTION ON THE PROTECTION AND USE OF TRANSBOUNDARY WATERCOURSES AND INTERNATIONAL LAKES 207
BAT *207*
EQS *208*

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE : LONG-RANGE TRANSBOUNDARY AIR POLLUTION 209
BAT *209*

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE: RECOMMENDATIONS TO ECE GOVERNMENTS ON WATER-QUALITY CRITERIA AND OBJECTIVES 211
EQS *211*

REFERENCES **215**

LIST OF FIGURES

Figure 1 : Austria 28
Figure 2 : Belgium (Flanders) 38
Figure 3 : Belgium (Wallonia) 39
Figure 4 : Canada 50
Figure 5 : Denmark 57
Figure 6 : Finland 68
Figure 7 : France 75
Figure 8 : Germany (air) 83
Figure 9 : Germany (water) 84
Figure 10 : Hungary 89
Figure 11 : Italy (air) 96
Figure 12 : Italy (water) 97
Figure 13 : Japan 106
Figure 14 : Korea 119
Figure 15 : Netherlands 129
Figure 16 : New Zealand 137
Figure 17 : Norway 148
Figure 18 : Sweden 155
Figure 19 : Switzerland (air) 166
Figure 20 : Switzerland (water) 167
Figure 21 : United Kingdom 178
Figure 22 : United States 197
Figure 23 : United States (air requirements) 198
Figure 24 : United States (water requirements) 199

INTRODUCTION

The Industrial Permitting Project

In 1993, OECD's Pollution Prevention and Control Group (PPCG) initiated a project on the relationship between environmental requirements for industrial permitting and the types of technological responses induced. The study focused on permitting policies and practices encouraging the use of "best available technologies/techniques" (BAT) for preventing and controlling pollution, and the application of environmental quality objectives (EQO) and standards (EQS). The main objectives of the project were to:

- increase mutual understanding among countries of how environmental requirements for industrial point sources, based on technology evaluation and environmental quality objectives, were established and applied progressively;

- examine the combined use of BAT and EQO requirements for developing permits to industrial facilities; and

- develop policy recommendations for integrated and preventive approaches in environmental regulation based on BAT and EQO, including expanded use of cleaner technologies.

During the first part of the industrial permitting project, the laws, regulations, policies and practices of some OECD Member and Observer countries were examined. The purpose of this survey was to analyse the regulatory framework in which permitting decisions are taken in a number of countries and to show the possible relationship between various requirements (e.g. technological) and environmental performance. On the basis of information, material or and responses to OECD questionnaires, the main features of national and international regulations and policies have been summarised into the present Reference Guide.

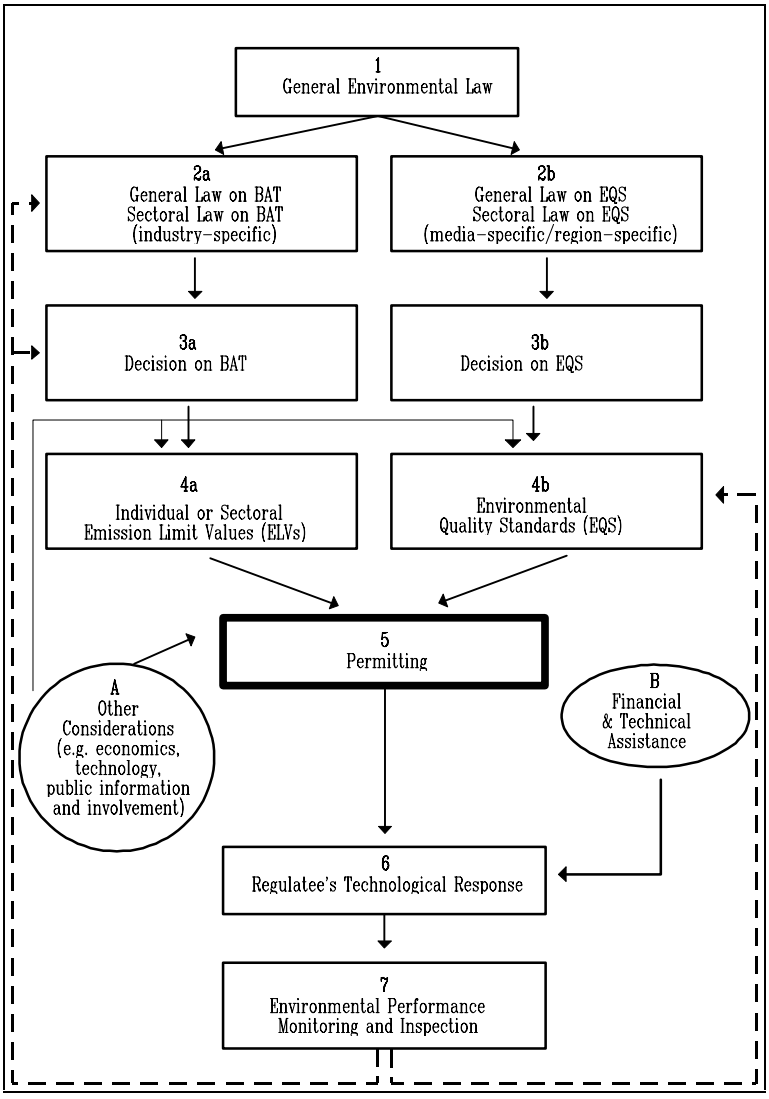
This Reference Guide also served as a background for further work on the project. It set the basis for conducting and analysing a series of case studies performed in four environmentally relevant industrial sectors (pulp and paper, iron and steel, metal finishing and oil refining). All this information was presented and discussed at an international workshop on environmental requirements for industrial permitting held by the OECD on 9-11 May 1996. The workshop brought together regulators, permit writers, industry permit holders and other private sector representatives from OECD Member and Observer countries. Workshop participants exchanged information and discussed experience on the use of technological and ecological criteria for setting permit requirements, and examined the benefits and shortcomings of current permitting approaches.

The Reference Guide

In order to understand how OECD Member governments actually set and use technological and environmental requirements for industrial permitting, it is necessary to understand the rationale behind the use of ecological, technological and economic criteria in permitting decisions. Another key issue addressed in this survey was to analyse the implications of these permitting decisions on

technological innovation and environmental performance. The present guide is designed to facilitate the extraction, use and comparison of information on the regulatory approaches used. Each country-specific section is divided into sub-sections devoted to recurring themes. As a general rule, a first sub-section covers the regulatory framework (distribution of authority and general environmental law) in which decisions are taken. Following sub-sections present the various requirements which permit writers must take into considerations (BAT-type requirements, environmental quality standards and objectives, emission limit values). Another sub-section deals with the permitting stage, which occupies a central, almost strategic position in the environmental policy implementation process. The remaining sub-sections present other factors that come into play in the permitting process (e.g. economic considerations, financial and technical assistance) as well as monitoring and inspection requirements.

Each country section is supplemented by one or several flow-diagrams that provide a schematic overview of the legislative, regulatory and administrative processes leading to the adoption of technology-based and/or environmental quality standards in permitting decisions. Each diagram is structured after the following model:



The numbers at the top of each box refer to the various stages in the decision-making process leading to the adoption and implementation of industrial permits. In many of the surveyed countries, **Stage 1** corresponds to the general legislation establishing the principles and objectives of environmental protection. In the following stages, medium-specific or industry-specific laws and regulations (**Stage 2**) are adopted, and technological and environmental criteria are used to determine emission limit values (**Stages 3 & 4**). In keeping with the focus of the project, **Stage 5** is represented as the central stage in the policy implementation process as it refers to the setting of permitting conditions. The last two stages (**Stages 6** & **7**) are those of performance evaluation and monitoring. Two factors have been identified as having an impact on permitting and on the technological response induced by permitting. Economic and technological considerations (**Factor A**) comes primarily into play at the permitting stage (**Stage 5**), but also has an impact on the standards-setting stage (**Stage 4**). Financial and technological assistance (Factor B) influences the type of investment that will be made by the permit holder (**Stage 6**). In turn, the actual environmental performance of the permitted facilities has an impact on the fine-tuning of existing standards, laws and regulations and the adoption of new ones.

In the country sections, each stage number is indicated in bold at the top of each thematic part (for instance **BAT**.....**Stage 2**) so as to emphasise the link with the diagrams. The actual situation in each of the countries covered in this guide does not necessarily fit neatly into this simplified structural diagram. However, the uniform structure of the thematic sections and the schematic diagrams should facilitate reference and comparison.

Some Highlights and Major Findings

The survey of country policies performed in this Reference Guide provides some basis for analysis. Thus, two main approaches to industrial permitting can be identified :

- The **technological approach**, which focuses on the attainment of some prescribed performance level through the use of state-of-the-art abatement techniques.

- The **environmental quality approach**, which is more closely linked to the reality of local conditions since the actual state of the receiving environment is the primary limiting factor. The “critical load” concept is of increasing interest in a number of countries.

The survey also reveals that a number of OECD Member countries apply both technology-based requirements (“BAT” either as limitations derived from technology assessment or application of specific technologies) for pollution sources and environmental quality objectives (EQO) and standards (EQS) in regulating pollutants. Beyond this underlying finding, the following conclusions can be drawn from the information presented in the Reference Guide :

- While BAT approaches and EQS approaches coexist in most Member countries, the concepts of technology-based standards and environmental quality standards may be interpreted and applied in different manners in the various surveyed countries.

However, in spite of the different approaches used, environmental performances are roughly similar throughout the studied group of countries.

- In some of these countries (most notably Korea and Japan, to a lesser extent the Scandinavian countries), regulatory requirements are often considered as a baseline that is expected to be exceeded through various mechanisms involving industry and the government. Voluntary agreements to go beyond the government-imposed emission limit values are very important in Japan and Korea. Formal regulation is perceived differently in various contexts.

As regards the adoption of technical standards, two main approaches can be identified in member countries:

- On the one hand are the countries where technology requirements are embodied at the most upstream stage of the decision-making process and in very explicit and precise terms. In this context, the regulatory, permitting and enforcement authorities have a more limited discretion and their actions are scrutinised by other branches of governments and/or any concerned party. Deviations from the defined mandate are often settled in courts. The United States is the prime example of such a regulatory system.

- On the other hand are countries (most of the OECD) where discretion on the part of the regulatory authorities is the norm. In these countries, technology requirements are either absent from legislation (Japan, Korea) or broadly defined (Europe), which leaves much latitude to the downstream authorities but also to the permit applicants, principally in the permitting negotiations. In some of those countries, technical instructions impose technical requirements that are absolutely binding for permitting authorities. Technical instructions therefore have the same impact on licensing procedures as legislative requirements.

- Best available technology criteria almost never mandate the use of a particular technology. Instead, they are expressed in terms of performance requirements (on emissions and effluents, waste generation, energy or materials used, recycling contents, for instance). However, the performance requirements are typically based on a review of the technologies commercially available throughout the world at the time of the review.

The incorporation of economic considerations into permitting decisions follows the following general rules:

- When EQS are used as legal standards, economic aspects are central. However, economic considerations are not taken into account in the development and setting of health- and ecosystem-based environmental quality objectives and limit values. Norway, for instance, draws a distinction between “scientifically-based EQOs” and “politically-based EQOs”.

- Economic considerations play a more important role in the determination of technology-based emission limit values. Yet the methodologies for determining the economic viability of a requirement are either not developed or so general that decisions are in fact taken on a case-by-case basis. Some general principles for factoring in economics may apply: for instance, regulatory/permitting authorities may be willing to consider broad economic efficiency criteria (cost-benefit analysis, principles of reasonableness and proportionality) in relation to a particular facility or company. It is more problematic to apply BAT to small and medium-size enterprises. For this however, most countries have threshold sizes for the sources to which technological requirements are mandated to be applied. Nevertheless, it appears that more work is needed to develop tools for economic assessment of measures in the framework of environmental permitting.

AUSTRIA

Regulatory framework **Stage 1**

The Austrian Constitution, as amended since 1984, designates environmental protection as a prime policy task. The Austrian legal system does not provide for a general environmental protection act but relies instead on the constitutional provisions in that domain. The constitutional amendments have given commanding powers to the federal government for the protection of the environment in the field of air in particular. The Republic of Austria's general declaration on environmental protection is established in the Constitutional Law on Extensive Environmental Protection (*BVGuU*) of November 27, 1984:

> *Extensive environmental protection means preserving the natural environment as a foundation of life for humans against damaging effects. In particular, extensive environmental protection encompasses measures for keeping air, water and soil clean as well as for avoiding disturbances caused by noise.*

BAT **Stages 2a-4a**

In Austria, Best Available Technology requirements are a central issue in several laws such as the Trade and Industry Act (*Gewerbeordnung*), the Water Act, the Steam Boiler Emission Act and the Waste Management Act. The Trade and Industry Act regulates the licensing of all operational plants from small workshops to large industrial complexes.

The Trade and Industry Act and the Water Act define BAT in the following way:

> *BAT ("Stand der Technik") in the sense of this law is the level of development based on the relevant scientific knowledge of advanced technological processes, facilities and operational modes, whose proper function has been tested and proved. In the regulation of what BAT is, especially comparable processes, facilities or operational modes have to be considered.*

Availability is given in principle if one successful example of a working new technology exists. Usually it is a question of negotiation and discussion, whether any given example of BAT is really comparable with the specific proposal to be licensed. The discussions are based on a survey of technologies that have been in successful use throughout the world.

Technologies are also indirectly defined : improvements in management are included in the legal definition of BAT. Energy and raw material efficiency are not directly included in BAT

requirements for air pollution. The principle of efficient use of water, however, is directly connected with the BAT requirement in the Water Act. As the Waste Management Act requires in any case a priority for waste prevention, waste minimisation is not necessarily required also in the context of BAT.

According to the 1990 Waste Management Act, the federal administration has to establish and to publish the Federal Waste Management Plan. This plan determines overall goals for waste prevention and reduction. The Waste Management Plan also defines specific targets for waste prevention and reduction in specific industry branches. In order to implement these targets the Federal Ministry of Environment has developed waste prevention concepts for a number of industrial branches. These concepts include detailed description of BAT and also the latest technological developments for pollution prevention.

In cases where no BAT is defined by law, experts have to state what should be considered as BAT in the course of the licensing process which usually includes extensive discussions between the company applying for a permit and government experts. The final decision has to be taken by the competent authority.

BAT as defined in the Trade and Industry Act is "state-of-the-art technology" whose functioning has been proven and demonstrated. BAT requirements are not just guidelines. BAT standards are binding, sectoral emission limit values which become part of a permit for an installation.

BAT requirements are partly defined as specific air or water emission limits. Air emission limits are explicitly regulated for boilers of a certain capacity range, dry cleaning plants, plants handling chlorinated hydrocarbons, the cement industry, glassworks, the gypsum industry, foundries and others. For 60 industrial branches emission standards are planned to be set. So far 14 industrial branches are covered by ordinances to the Water Act.

EQS **Stages 2b-3b**

Environmental Quality Objectives are defined for the environmental media air, water and soil, but they are only partly legally binding. Most of the quality standards are still defined as target values. The first guidelines providing immission limits for air and water were passed in 1987. Regulations including binding requirements for air and water are currently under negotiation.

In general, the provinces (*Bundesländer*) are responsible both for legislation and for implementation of EQOs. For air and water, agreements between federal administration and state governments have been reached on uniform immission limits. For soil, no uniform regulation exists.

For soil EQOs, agreements have been signed on target values between federal administration and federal provincial government. Soil quality standards (e.g. for heavy metals) and target values for a maximum concentration of pollutants in sewage sludge to be used as fertiliser are set for agricultural land use. EQOs for air and water have been elaborated by scientific experts. In the case of ambient air quality standards the Austrian Academy of Sciences has defined standards for a large number of pollutants.

In the Treaty on Ambient Air Quality Standards between federal and federal province governments, air quality standards are defined for the pollutants SO_2, CO, NOx and the summary of SO_2 and particles. These limits are in force by federal law. Legally binding EQOs for woodland areas concerning the pollutants SO_2, NO_2 HCl, HF, NH_3 and particles respectively have been set up in the Ordinance of the Forestry Act.

Legally binding EQOs have also been set in the Ozone Act and the Smog Alarm Act. These EQOs are thresholds and relate to warning or alert values. If alert pollutant concentrations are exceeded the Ozone Act and the Smog Alarm Act entitle federal provincial governments to take mandatory measures such as traffic limitations or the temporary reduction of industrial emissions, even by reducing or closing down operation of individual plants. Federal legislation for ambient air quality standards is under negotiation.

Regional EQOs for surface water are defined for most of the Austrian rivers and lakes. Water quality standards for surface and underground water have been based on ecological considerations. EQOs apply to the whole territory of Austria or to certain types of environments (mountain rivers as opposed to flatland rivers).

Permitting — Stage 5

The county administrative authorities serve as the first instance, in practice with the expert co-operation of the respective state authorities. Each province maintains a staff of official experts whom the authorities (commercial authorities, water authority) can employ as consultants in the permitting process.

BAT requirements as set in the permitting process are generally binding. For the time being, most EQO requirements have not been introduced in the permit process on a binding basis.

The precautionary principle that is laid down in several of the relevant legal provisions such as the Trade and Industry Act is strictly applied in the licensing process.

Trade and Industry Act

Permitting under the Trade and Industry Act encompasses permission for construction and modification of an industrial plant. Separate permitting is not required under the Steam Boiler Emission Act or the Waste Management Act. This permitting is carried out together with the permitting process under the Trade and Industry Act, and a single permit is issued. For permitting under the Trade and Industry Act, protection of neighbours and general environmental protection take priority. The following basic principles apply:

- An industrial plant permit may only be issued if the combination of BAT and the state of the art in medicine and other applicable sciences:
  - preclude the endangerment of human life and health,
  - annoyance of neighbours by a door, noise, dust, smoke and vibration is restricted to an acceptable level, and

- detrimental effects on waters are restricted to an acceptable level.

- In any case, emissions of air pollutants must be limited in accordance with BAT.

- In accordance with BAT, wastes must be avoided, recycled or otherwise disposed of.

Waste management must be implemented such that:

- damaging or detrimental effects, or consequences that otherwise negatively impact on general human well-being, on humans as well as animals and plants and their living space and natural environment are kept to an absolute minimum;

- raw materials and energy reserves are conserved;

- the consumption of landfill volume is minimised as far as possible;

- residual wastes include only such materials whose landfill deposition poses no potential danger for future generations (prevention principle);

- the operator must submit a waste management concept to the authorities.

Industrial plants with a particular danger potential:

- Dangerous industrial plants require safety measures reflecting the state of the art in order to protect humans, the environment, and the rights of others from the effects of breakdowns.

- The operator must prepare a safety analysis and a schedule of safety measures.

The Trade and Industry Act requires a permit for the construction, modification and operation of an industrial plant if the endangerment of humans and annoyance of neighbours cannot be precluded. Since the permitting process generally requires significant effort, the Trade and Industry Act provides a simplified procedure for what are termed "bagatelle facilities" (e.g., mechanic workshops). The installation of standardised machines and facility components in industrial plants does not require permitting, but does require reporting. Numerous standards exist for such machines and facility components.

Water Act

Permit under the Water Act is required whenever public waters are used. In practice a water use permit encompasses permission to draw water and to discharge waste water in some defined quantity and a specified quality. Normally the application for a water use permit is submitted to the authorities simultaneously with the application for a permit under the Trade and Industry Act.

Within the limits prescribed by law, everyone is allowed to use public waters. However, such water users must fulfil general caretaking duties to keep water clean and to conserve water. In permitting of water use the protection of the public interest and of the rights of others takes priority in the considerations. The public interests are enumerated in the law.

Thus an industrial plant can be permitted in the public interest only if:

- the quality of the water is not affected adversely; and

- there is no anticipation of significant impairment of the ecological functionality (self-cleansing capability) of the waterway;

- likewise, a sparing use of water is in the public interest.

Some principles for water-use permitting for waste water discharge include the following:

- A permit may be issued only if there is no infraction of the public interest and the rights of others and the water use corresponds to BAT requirements. Permitting the discharge of waste waters into flowing waterways and public sewage systems requires considering the state of the art in waste water treatment technology and the possibility of reducing the volume of waste water discharge.

- Hazardous contaminants in waste water additionally require considering the possibility to avoid the discharge with BAT.

- Waste water contaminants and waste energy (heated water) may be discharged only to the extent that is absolutely necessary.

- The reduction, avoidance and recycling of waste water contaminants and waste energy takes priority in waste water treatment.

- Protective measures for one body of flowing water must not lead to diverting the pollution to other waterways to an unjustifiable extent.

- Through the use of water-conserving technologies and methods, the quantities of waste water discharged into the flowing waterway must be kept as low as possible.

- Waste water pollutants are to be retained directly at their place of origin or use (treatment of substreams) whenever possible.

- Dilution of waste water is forbidden.

According to the Water Act, any use of water that exceeds common domestic use requires permitting. An industrial plant requires permitting if there is any expectation of detrimental impact on the quality of the water. The construction or modification of facilities for the use of water requires permitting.

Environmental Impact Assessment Act

Since the Environmental Impact Assessment Act came into force on July 1, 1994, planned plants that can be expected to have a significant impact on the environment must be subjected to an environmental impact report. Such types of plants are specified in the law. The Environmental Impact Assessment Act provides for the limitation of emissions of pollutants according to BAT and requires that exposure levels and the environmental burden shall be kept at minimum, and that waste shall be avoided or recycled in accordance with BAT. The Environmental Impact Assessment Act provides for a concentrated permitting process. This concentrated permitting process co-ordinates all responsible authorities as well as the permitting restrictions. All permits applied for, such as commercial permit and water use permit, are handled collectively in the procedure. A single permit is issued.

In an environmental impact report a company must present and evaluate the effects of a planned facility on the environment. The report also encompasses measures for prevention or reduction of the impact, the advantages and drawbacks of alternatives to a project, and the advantages and drawbacks of the proposed site of the industrial plant.

Some principles for permitting under the Environmental Impact Assessment Act are the following:

- The permitting prerequisites of other administrative regulations such as the Trade and Industry Act and Water Act must always be fulfilled.

- Emissions of pollutants must be restricted in accordance with BAT.

- The ambient quality that affects the objects to be protected (people, animals, soil, plants) must be optimised.

- Permitting must consider the results of the environmental impact report, including the position statements of affected parties.

- In any case, suitable requirements, conditions, time limits, project modifications, etc. shall be prescribed in the permitting decision.

- The operation of a plant must not cause serious environmental pollution as a result of cyclical effects, accumulation or diversion.

Procedure

A permitting procedure is normally initiated with an application submitted by a company for the construction or modification of a plant. The applicant must provide the authorities with all technical documents (products, capacities, raw and auxiliary materials, plans) as well as any

additional information about the emissions expected from the plant (by type and quantity), as might be required for their evaluation.

The applicant need not provide an assessment of the environment or an evaluation of the anticipated ambient quality situation. The Environmental Impact Assessment Act deviates from this practice. The permit application must be accompanied by an environmental impact report, which also encompasses an evaluation of the anticipated impact on the environment.

A industrial plant permit under the Trade and Industry Act additionally requires a waste management concept and, for dangerous facilities, a safety analysis and a schedule of measures for the event of a breakdown. The water use permitting procedure also requires application for the requested water use in qualitative and quantitative terms.

On the basis of the situation as audited at the on-site hearing, the authorities make a permitting decision. This decision either denies or grants (possibly with attached conditions) the permit for the industrial plant. The authorities leave the choice of technology to the permit applicant.

The applicant has a right to the permit for the plant inasmuch as the permit prerequisites are fulfilled. As a rule after start-up of a plant the facility is inspected for adherence to the prescribed regulations.

In accordance with the Steam Boiler Emission Act, the authorities can temporarily permit a trial run if after the permitting process uncertainty remains about the impact of the plant. The neighbours cannot appeal against the temporary permitting of such a trial operation.

Permits under the Trade and Industry Act are generally not limited in time. Permits under the Water Act are principally valid for a limited time. The limits are specified in the permitting decision, as a rule five years.

If the application is submitted on time, the applicant has a legal right to extension of the permit inasmuch as the permit prerequisites are fulfilled.

Once a permitting decision goes into force, in principle it can no longer be modified. However, in the individual licensing processes additional measures may be taken if application of BAT is not sufficient to ensure that EQOs are met. These may include "better than BAT" requirements, the definition of specific operating instructions for an installation or even the refusal of permit on a case-by-case basis.

Under the Trade and Industry Act, if an existing plant is found to unreasonably annoy neighbours or pollute the environment despite adherence to the permitting conditions, the authorities must on their own initiative or on petition of the Ministry for the Environment (due to complaints from neighbours or measurement results) impose additional conditions or require the plant operator to submit a renovation plan to the authorities for the permit. The permit decision contains reasonable time limits for carrying out the renovation. The Federal Environmental Agency has installed a nation-wide network for measuring ambient air quality and thus can identify polluters.

Additional conditions or renovation measures can only be prescribed if they are commensurate. Commensurateness is given if the cost (regarding investment and operation) of

fulfilling the conditions is not out of proportion with the intended effect of the conditions (e.g., reduction of the annoyance of neighbours by emissions).

Under the Water Act the authorities can modify a water use permit after its issue and attach new conditions, prescribe adaptive goals or temporarily forbid the use of water when this is required to protect the public interest and the rights of others. For carrying out adaptive measures, in the permit the authorities must provide appropriate time limits and apply the principle of commensurateness.

Adaptation of ordinances to existing plants

For existing plants for which decrees have already been issued, a procedure different from that above is applied. If an existing plant no longer adheres to the regulations of its corresponding emissions decree, the operator must initiate submission of a renovation concept to the authorities within a specified time limit for approval. The corresponding ordinances specify time limits for renovation and the possibility of a possible time extension. If the plant is not renovated, then it must be retired on expiration of a prescribed time limit. Under the Water Act the time limit for adaptation of existing plants to new binding emission limits is normally, but must not exceed, 10 years.

Austria has no integrated permitting process for plants (e.g., commercial permitting and water-use permit in one permit; exceptions can be found in certain older permits for indirect discharge of waste water since they do not need a separate water use permit). The reason is that the environmental ordinances are set down in various laws, and the responsibility for enforcement of the laws falls on different ministries and for permitting on various authorities.

One approach to an integrated assessment of the environmental impact is contained in the Environmental Impact Assessment Act. Here a permit is granted for the overall project, whereby the authorities assess the effects of the project on the environment, including the mutual effects between the individual effects.

Economic considerations **Factor A**

In Austria, the concepts of BAT and EQO are strictly separated. BAT describes the technical feasibility of emission reduction in existing plants. Economic aspects are considered in the extensive discussion process preceding new legal requirements that define BAT emission levels for certain areas. EQOs relate to health objectives and ecosystem protection, not to economic feasibility.

In Austria, the principle of commensurability has to be applied in the licensing process. This means that the advantage for the environment caused by certain conditions of the permit must not entail disproportionate costs for the operator. For supplementary conditions, this principle is provided in the relevant laws.

At the government level economic considerations can play a role inasmuch as issuing decrees requires finding a balance between environmental goals as well as economics and other interests.

In the context of the permitting of industrial plants, the authorities are not allowed to give consideration to economic arguments of a permit applicant. The laws provide exceptions in connection with the issuing of later conditions and requiring renovation measures.

The various laws allow considering economic interests under certain definite conditions, e.g., by less stringent regulation and extension of renovation deadlines:

Water Act

(1) Less stringent regulations

For waste water discharge the Water Act authority can apply less stringent emission limits than those prescribed in an ordinance if:

- adhering to the emission limits proves technically impossible with economically reasonable investment, and
- the public interest in the activity requiring the discharge outweighs that of protecting water purity, and
- exceeding the emission limits can be accepted temporarily with respect to the local water management situation.

(2) Extension of deadlines

For renovation of old plants, the Water Act permits an extension of legally binding deadlines for adaptive measures if:

- the water use permittee demonstrates that meeting the deadline is impossible and through no fault of the applicant, or
- significant steps toward adaptation have already been undertaken.

Steam Boiler Emission Act

Likewise the Steam Boiler Emission Act foresees the possibility of a deadline extension for renovation measures if this seems to be necessary.

In Austria all old plants have been renovated already due to legal regulations.

Financial assistance **Factor B**

Funding guidelines require that pollution reduction measures exceed legal requirements. Considerable economic assistance is provided by the Ökofonds (Ecofund) for the introduction of BAT and clean technologies in existing plants.

Monitoring and Inspection **Stage 7**

Monitoring of environmental quality is carried out by the Austrian Environment Agency and federal provincial authorities. Monitoring of emissions of individual plants is set up in several environmental laws (Water Act, Steam Boiler Emission Act). In these cases, the operator of a specific installation has to publish data on emissions at regular intervals according to the provisions of the Environmental Information Act.

Permits under the Trade and Industry Act are permanent and have to be revised if major changes of the respective plants are carried out. However, inspections are required on a regular basis to check if initial requirements are still fulfilled. The Trade and Industry Act also requires the periodic maintenance of an installation by the operator to check if the permit requirements are met. Permits under the Water Act are limited in time.

For the purpose of monitoring environmental standards (EQOs) Austria has installed a comprehensive measurement network for air and water. The federal and provincial levels divide the execution of these measurements according to their competencies. For the co-ordination of measurement data, the Federal Environmental Agency and the Federal Institute for Water Quality play a particular role. The measurement results are available to the public.

On an operational level a distinction is drawn between in-house monitoring by the company itself and external monitoring. In-house monitoring is primarily employed to collect data for a few parameters at short intervals, preferably with automatic, simple measuring devices. (For waste water discharge, self-monitoring could be continuous recording of waste water quantities, temperature and pH values; for a steam furnace, continuous emission measurements for plants over a certain fuel thermal value as set by the Steam Boiler Emission Act). The nature and scope of in-house monitoring is prescribed in the permit; the results are generally archived in the plant and made available to the authorities on request.

In-house monitoring is usually augmented by foreign monitoring, likewise prescribed in the permit, in which the plant operator commissions the inspection of certain parameters, e.g., to officially authorised offices or civil engineers. Such authorised offices also guarantee the quality of the measurements. In addition, the authorities can take their own inspection measurements, such as in the case of Water Act authorities. Accessible inspection shafts can be prescribed for this purpose.

Another control instrument under the Trade and Industry Act is recurrent assessment, in which the plant operator must inspect the plant (or have it inspected) at regular intervals (generally five years) for compliance with commercial regulations and permit conditions and must report shortcomings to the authorities.

Dangerous industrial plants must be inspected by authorised persons in intervals of at most three years as well as immediately after occurrence of a failure.

Public access to emission data has thus far been on a voluntary basis. The Environmental Information Act (*UIG*) is expected to improve the situation by providing restricted public accessibility of emission measurement data.

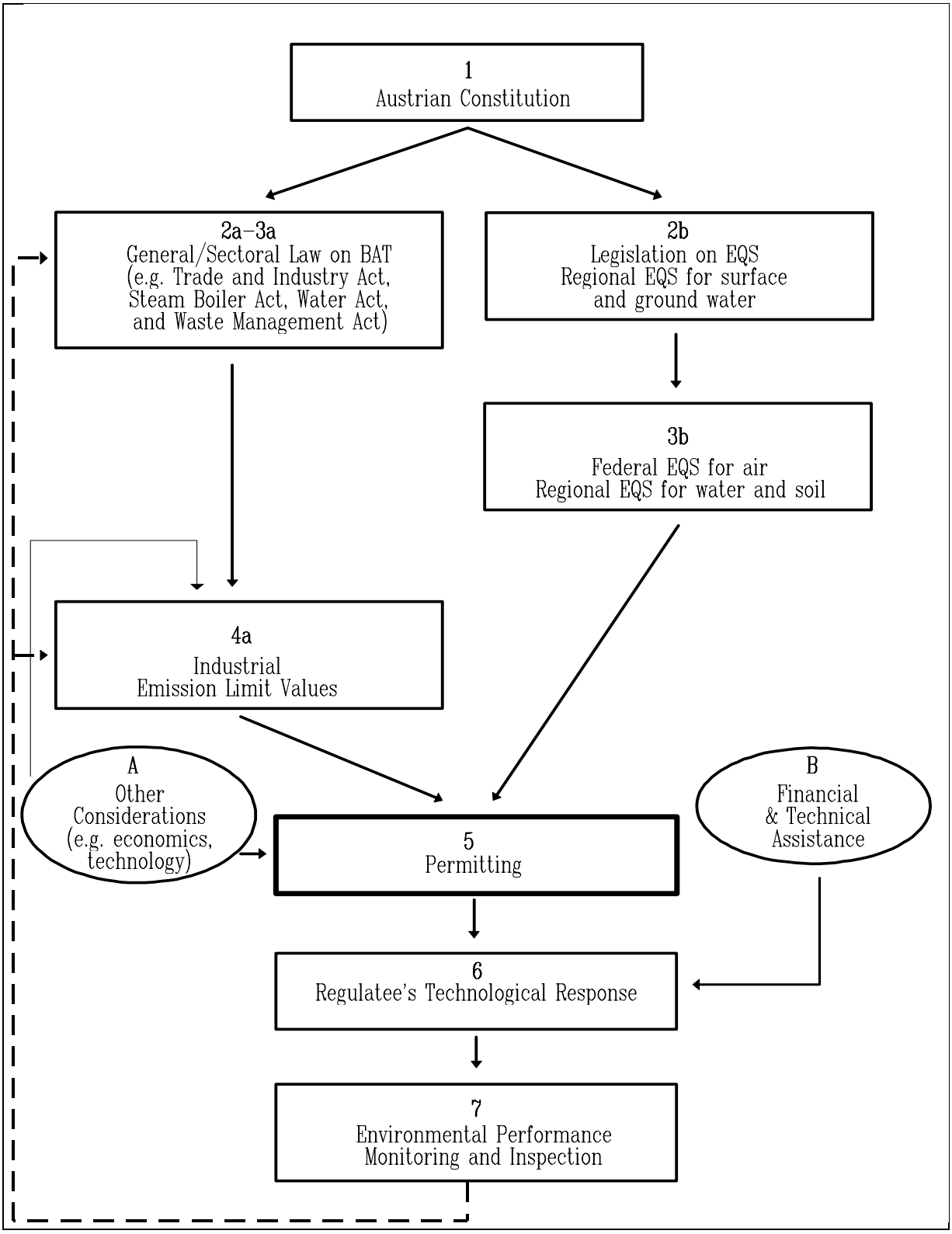


Figure 1 : Austria

BELGIUM

Regulatory framework **Federal/Regions**

Belgium is a federal Country. The Flanders, Wallonia and Brussels regions are largely autonomous for most so-called "territorial" policy matters, including environment policy. Until 1980, environmental legislation in Belgium was entirely within the field of jurisdiction of the national government. It gradually became a regional matter with the exception of product standards (including ecotaxes), the protection against ionising radiation and the movement of waste (Special Law of 16 July 1993 for the Accomplishment of the Federal Structure of the State). Owing to this political situation, environment policies and strategies in the three Regions progressively differ but remain within the limits of directives and standards of the European Union and international environmental treaties (e.g. the Paris Convention) which Belgium has signed. An official Committee (CCPIE or "Comité de Co-ordination de la Politique Internationale de l'Environnement") with representatives from the minister's departmental staff and from the administrations of the Federal Government and the Governments of the three Regions, meeting almost weekly, has been created to discuss and establish the positions of the different bodies to one common Belgian position. The recommendations of the CCPIE for matters of international commitment are forwarded to the Interministerial Environment Conference for approval.

FLANDERS

Regulatory framework **Stage 1**

A general review of the quality status of the environment and general options for its protection and nature conservation are reflected in a two-year MIRA-report (1994, 1996). The Flemish Decree (Law) of 05.04.95 concerning general environmental policy (completed on 19.04.1995 with a title about enterprises' internal environmental care) states that five-year regional (for the whole Flemish Region) comprehensive environment policy programmes and yearly action programmes have to be developed by the administration. The first programme (1997-2001) will start on 01.01.1997. The issue of water resources will be tackled in an integrated way (surface and soil water, water quality and quantity in function of the use that is made of the water body) in a river basin framework. The river basin concept has already been applied since 1992 to improve the quality of the surface waters.

A very detailed pollution prevention and control legislation for all point sources of pollution is contained in the Belgian Laws and Flemish Decrees of 28.12.1964 (B; air pollution, modified in 1967), 26.03.1971 (B; water protection from pollution; modified or completed in 1979, 80, 81, 84, 85, 88, 89, 90, 92, 93 and 94), 26.03.1973 (B; abatement of noise), 24.05.1983 (B; WQOs), 12.07.1985 (B; non-ionising radiation), 14.01.1984 (FL; protection of ground water; modified in 1990 and 91), 28.06.1985 (FL; environmental permit; amended in 1990, 93 and 94),

05.04.95 (FL; general environmental policy; completed on 19.04.1995; enterprises' internal environmental care) and its implementation regulation (Decisions of the Flemish Government) of 23.03.1989 (FL; environmental impact report; modified in 1994 and 1995), 06.02.1991 (FL; permit procedure, identification and classification of nuisance-causing installations and dangerous substances; modified in 1992, 94, 95 and on 26.06.1996; called "Vlarem I") and 07.01.1992 (FL; permit regulations; replaced by a completely revised version on 01.06.95 and modified on 26.06.1996; called "Vlarem 2").

BAT **Stages 2a-2b**

VLAREM II imposes a requirement to use the best available technology:

> *As a normally cautious person, the operator must always apply the best available technology in order to protect man and his environment, not only in the choice of treatment methods for emissions but also for the selection of measures imposed at the source (production methods and techniques implemented, control of raw materials and others). This obligation also applies to the modification of classified facilities and to those processes that do not themselves have an obligation to hold a permit or make a declaration.*
> (VLAREM II, article 4.1.2.1., unofficial translation)

For controlling air pollution, VLAREM II further stipulates that:

> *Facilities must be designed, built and operated according to a code of good practice so that air pollution from these facilities is limited as much as possible, and avoided if feasible.*
>
> *For this purpose, facilities will be operated and equipped with devices for limiting emissions corresponding to the available clean technologies that do not entail excessive costs.*
> (VLAREM II, article 4.4.2.1., unofficial translation)

For emissions of noise, VLAREM stipulates that controls have to be made according to the conditions and technological possibilities justified by the state of progress of technology (VLAREM, article 4.5.1.1.)

The latest amendment of VLAREM I (01.06.1995) provides a definition of BAT based on the European Union's IPPC Directive :

> *29° "Best available technology" (BAT): the most advanced state of development of processes and applied procedures where the practical usefulness of some chosen techniques is used, among other things, as a basis for the determination of emission limit values designed to prevent emissions into the environment or, if this is not feasible, to limit them to a minimum without anticipating the choice of technologies or particular techniques.*

(VLAREM II, article 7.1.1.1., unofficial translation)

Sectoral requirements apply to specific industrial processes, as defined in the classification list in VLAREM I. Sectoral requirements are based on best available technology not entailing excessive cost, European directives, ecological criteria and economic considerations and are set by working committees made up of representatives of government and the concerned industrial sectors. No uniform methodology is used for determining the BAT standards. The BAT-based performance standards are applied uniformly across the sector.

Hundreds of pages of the VLAREM regulation of 7-1-1992 are devoted to sectoral emission standards for discharges into air, water or soil. The existing water discharge standards have been elaborated in working groups for different industrial sectors during the period 1985-1989, with some slight updating in the 1995 VLAREM II version, accordingly they almost reflect the knowledge at that time about Best Available Technologies. For air emissions, ELVs of the German TA-Luft are applied.

Under the auspices of the Flemish government, a central BAT Information Centre has been created on 01.01.1995 at the Flemish Institute for Technological Research. The aim is to supply the permitting authorities and industry with technical and practical (i.e. BAT-related ELVs) information about BAT by means of a database (combined with energy information: BBT-EMIS), pre-feasibility studies and sector studies.

Another governmental programme (PRESTI: PREvention through STImulation) is running between OVAM (Flemish Public Waste Agency) and the representative bodies of the industries' sectors. Its aim is the dissemination, especially towards SMEs, of the existing knowledge of waste and emission prevention, BAT and CT by means of handbooks, colloquia and lesson sessions. The government has only an advisory role and provides financial support.

<u>EQS</u> **Stage 2b**

VLAREM II gives a definition of what constitutes an environmental quality standard:

> -*"environmental quality standards": standards that set the maximum allowed quantities of pollution factors in the air, waters or soils. They may also set which natural or other substances must be present in the environment so as to protect ecosystems and promote biological diversity;*
> (VLAREM II, article1.1.2., unofficial translation)

Air and water quality standards (with the exception of basic water quality standards) are taken from the relevant directives of the European Union and the German TA-Luft.

Environmental quality standards may be set in the form of limit values, guide values and target values. Limit values may not be exceeded, except in contingency situations. Guide values set quality values for the environment that have to be reached or maintained as far as possible. Target values set quality levels for the environment at which no harmful effect is to be expected.

According to VLAREM II, the permitting authority must use environmental quality standards when conducting its policy (VLAREM II, article 2.1.2.). Guide values for air are applied uniformly across the entire Flemish territory but more stringent values are applied in some densely populated areas such as Antwerp and Gent. The limit values are made more stringent to reach the guide values in protected natural areas. Water quality objectives vary on the basis of the use that is made of the water. Waters are classified for fishing, swimming, extraction of drinking water. Other general quality objectives may apply.

In addition, VLAREM II defines immission as "the modification of the presence of factors of pollution in the air, soils or waters around one or several sources of pollution owing to emissions from this/these sources" (VLAREM II, article 1.1.2., unofficial translation).

<u>Emission limit values (ELVs)</u> **Stage 4a**

A general definition of what constitutes an emission limit value is provided in VLAREM II:

> -*"emission limit value" or "emission standard": concentration of polluting substances that may not be exceeded in the emissions from the facilities during a set period of time;*
> (VLAREM II, article 1.1.2., unofficial translation)

The sectoral emission standards are binding requirements imposed in the individual discharge licenses. For discharges in surface waters, more stringent standards are imposed by the discharge license on a source-by source basis only if the environmental status of the receiving water requires a smaller immission.

There are three types of emission limit requirements. General requirements apply to all classified industrial processes. Sectoral requirements apply to specific industrial processes, as defined in the classification list in VLAREM I. Sectoral requirements are based on best available technology. General and sectoral standards are not negotiable in the permitting stage of the process. Particular requirements are applied to site specific conditions and may only be more stringent than the general and sectoral emission limit values. Site-specific requirements are imposed for the protection of man and the environment in cases where the mandatory BAT-based limits are deemed insufficient to meet the environmental quality standards, e.g. emissions of NOx and SO_2 in sensitive areas such as the urban area of greater Antwerp.

<u>Permitting</u> **Stage 5**

VLAREM I introduces the obligation to deliver an integrated environment license to all installations before they are allowed to start activities.

> *No one shall operate or modify an installation classified as inconvenient under categories 1 or 2 without prior and written authorisation from the relevant authorities.*

(VLAREM I, article 5, unofficial translation)

All installations are classified into three categories according to the total environment impact. Category 3 encompasses processes and installations that have the least or minimum environmental impact. They need only be reported to the municipal authority. Installations that have a small impact are comprised in Category 2 and need to receive a permit from the municipal authority. Category 1 covers those installations that have the greatest impact and need to receive a permit from the provincial authority. Oil refineries and steel plants are at the very top and quite smaller installations belong already to class 1. Installations constructed by public authorities are always licensed by the Regional authority.

Permits are required in the following instances: for new plants, after expiry of a permit for an existing facility, when an existing plant is modified, when an existing facility has become a "nuisance causing installation" after extension or modification, for temporary facilities. Permits for waste water discharges containing hazardous substances according to EU Directive 76/464/EEC have to be re-examined every four years.

The application for a permit must contain, inter alia, information about the operator of the facility, the process, the surrounding environment, the substances used and emitted and the pollution prevention measures to be used:

> *11. the measures contemplated and/or the devices for preventing or limiting disturbances caused by noise, vibration, air pollution, radiation, soil and water pollution as well as risk to humans outside the facility and to the environment which the facility might induce.*
> (VLAREM I, article 5, unofficial translation)

The permit application must also include an environmental impact assessment and a safety report if applicable (for a number of large installations such as oil refineries, steel mills, electricity plants, large chemical plants, etc.).

Permits are issued for a maximum duration of 20 years, except in the case of hazardous discharges to surface waters in which case a revision of the permit is required every four years. Upon request, permit conditions may be modified or supplemented by the licensing authorities when permits are reissued. Permits may be subject to appeal by the operator of the authorised facility, the licensing authorities and their advisory bodies, the people affected by nuisances from the permitted facility.

Since 1991, permits are integrated. The effluent parameters not to be exceeded by the permitted facilities are set in VLAREM II. Presently, new permits can incorporate new developments in terms of best available technology and environmental quality. With the input of the newly created BAT Information Centre, BAT will progressively be updated and systematically applied in new or revised permits.

Economic considerations **Factor A**

Economic considerations are taken into consideration in the development of sectoral standards. On an individual plant basis, no economic factors are considered. The various BAT requirements are attuned for economic considerations. In the case of air emissions, VLAREM II stipulates that, for existing facilities, the implementation of BAT requirements must:

> […] *4° not entail excessive economic costs for the concerned installation, given the economic situation of the companies belonging to the relevant sector.*
> (VLAREM II, article 4.4.3.1., unofficial translation)

In the latest version of VLAREM II, the definition of best available technology is further restricted on the basis of economic feasibility:

> *Techniques that entail costs that are disproportionately high, i.e. that:*
> *a) appear unreasonable compared to their performance in the field of the protection of man or the environment; or*
> *b) are economically excessive for a sound, well-managed company from the concerned sector,*
> *will not be considered as "best available technologies."*
> (VLAREM II, article 7.1.1.1., unofficial translation)

Financial Assistance **Factor B**

The Flemish government provides financial aid to joint environmental research between industry and some research institutes such as VLIM (Flemish Impulse Programme for Environmental Technology) of the IWT (Flemish Institute for the Promotion of Scientific-Technological Research in Industry).

There is also financial support to investments based on an ecological criterion. This financial aid is directed by the Administration of Natural Sources and Energy and is treated independently from the permitting procedure. But the permit has to be attached to the financial aid application in order to verify the ecological targets.

In accordance with the legislation of the European Union, the Flemish Region applies the regulations concerning financial support of the government to investments concerning economic expansion (employment, strategic importance) or for ecological purposes. The "ecological criterion" aims the following:

(a) going beyond the legally binding EQOs;

(b) adaptation of existing plants (operating at least 2 years before the coming into force of the new legislation) to new legally binding standards;

(c) exceptional investments aimed at the rational use of energy or improvement or processes (energy efficiency, recyclable or alternative energy sources);

(d) exceptional investments aimed at a considerable saving or recycling of raw materials with a provable positive effect on the environment;

(e) exceptional investments aimed at the improvement -towards the environment- of the quality or durability of products;

(f) exceptional investments aimed at the improvement of the security at the following levels: (i) fire control, (ii) product safety and (iii) workers condition during the production processes.

Item b) to e) are BAT or CT related.

The financial support from the government (ratio support/total investment) depends on: (i) the size of the plant based on employment (large, medium or small enterprise), (ii) the location (economic developing zone or not) and (iii) the ecological target (implementation of new standards [12%] or going beyond legally binding EQOs [15%]).

The EU framework for government financial support to environmental investments applies to all Member-States.

WALLONIA

Regulatory framework **Stage 2**

The pollution prevention and control policy in Wallonia is covered by regional decrees (surface water protection, groundwater and waste), as well as a federal law on air and the General Regulation on the Protection of workers (RGPT = Règlement général sur la protection du travail) which is still used since 1946 although amended to address environmental issues. It is the legal basis for issuing operating permits.

The RGPT, the federal law on air and a part of the water and waste decrees are going to be replaced by a new decree, the General Regulation on the Protection of the Environment (RGPE) which will provide for the issuing of a single operating permit and will include the BAT concept from the future European IPPC Directive.

BAT **Stage 3a**

For the time being, the BAT principle is transposed from EC Directives (84/360 : BATNEEC for limiting air emissions and 76/464 : dangerous substances into the aquatic environment) and some PARCOM Decisions or Recommendations.

There is also a clean technology unit in the administration which develops some pilot projects in co-operation with industry (for example : surface treatment). But at present, there is not a systematic development of BAT in all industrial sectors. In addition to BAT developed at an international level (EU, PARCOM), Wallonia also uses experience coming from other countries (for example, Germany's TA Luft).

EQS **Stage 3b**

Wallonia has transposed all EC Directives for water in regional orders and still uses the federal order of 1987 concerning basic water quality standards. New EQSs might well be defined in the framework of the Agreements on the Scheldt and Meuse rivers.

For air, EQSs defined in regional law are mainly those transposed from EC Directives (SO_2, black smoke, N_2O, ozone, ...)

Emission Limit Values (ELVs) **Stage 3a**

As Flanders in VLAREM II, Wallonia also uses general and sectoral water discharge standards which were elaborated during the period 1983-1986 at the federal level and considered as derived from BAT. New sectoral DLVs come either from EC Directives (especially daughter directives of 76/464 Directive) or from PARCOM Decisions and Recommendations. Air ELVs defined in the Walloon legislation come mainly from EC and other international agreements. ELVs elaborated in other countries are also used (TA Luft).

Permitting **Stage 5**

As long as the new regulation (RGPE) and the issuing of a single environment permit are not yet in force, the permit concerning industrial facilities is covered by two main systems :

- water discharge authorisations ;
- general operating permits which address other media (air, waste, noise).

Water discharge authorisations are granted directly by the Minister. General operating permits are granted by the Provincial authorities (Députation permanente de la Province). Both receive technical advice from the technical staff of the Administration (DGRNE).

But in case of appeal, the final permit is granted by the regional Minister of the environment. Some aspects of waste management are covered by assents given by the administration (DGRNE).

The local DLVs and ELVs are calculated case by case, combining discharge or emission sectoral standards and EQSs. If the sectoral standards are not sufficient to comply with EQSs, they are strengthened by so called «particular» DLVs or ELVs.

Monitoring and inspection **Stage 7**

Both water discharges and air emissions are controlled by the Division of Environmental Police (part of DGRNE). Its officials organise controls at random or following a complaint received from the public. It also checks the self-monitoring performed by each industry.

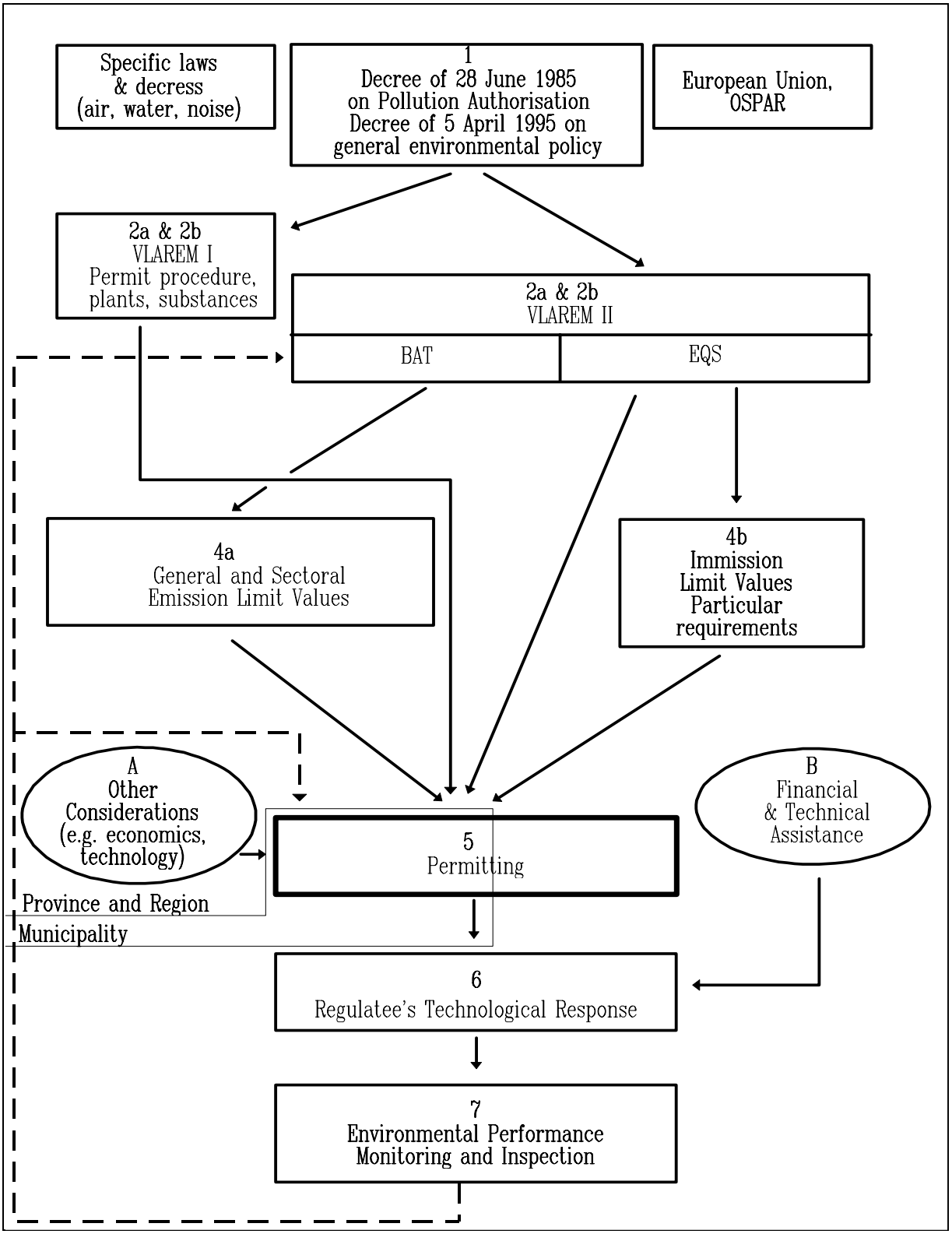


Figure 2 : Belgium (Flanders)

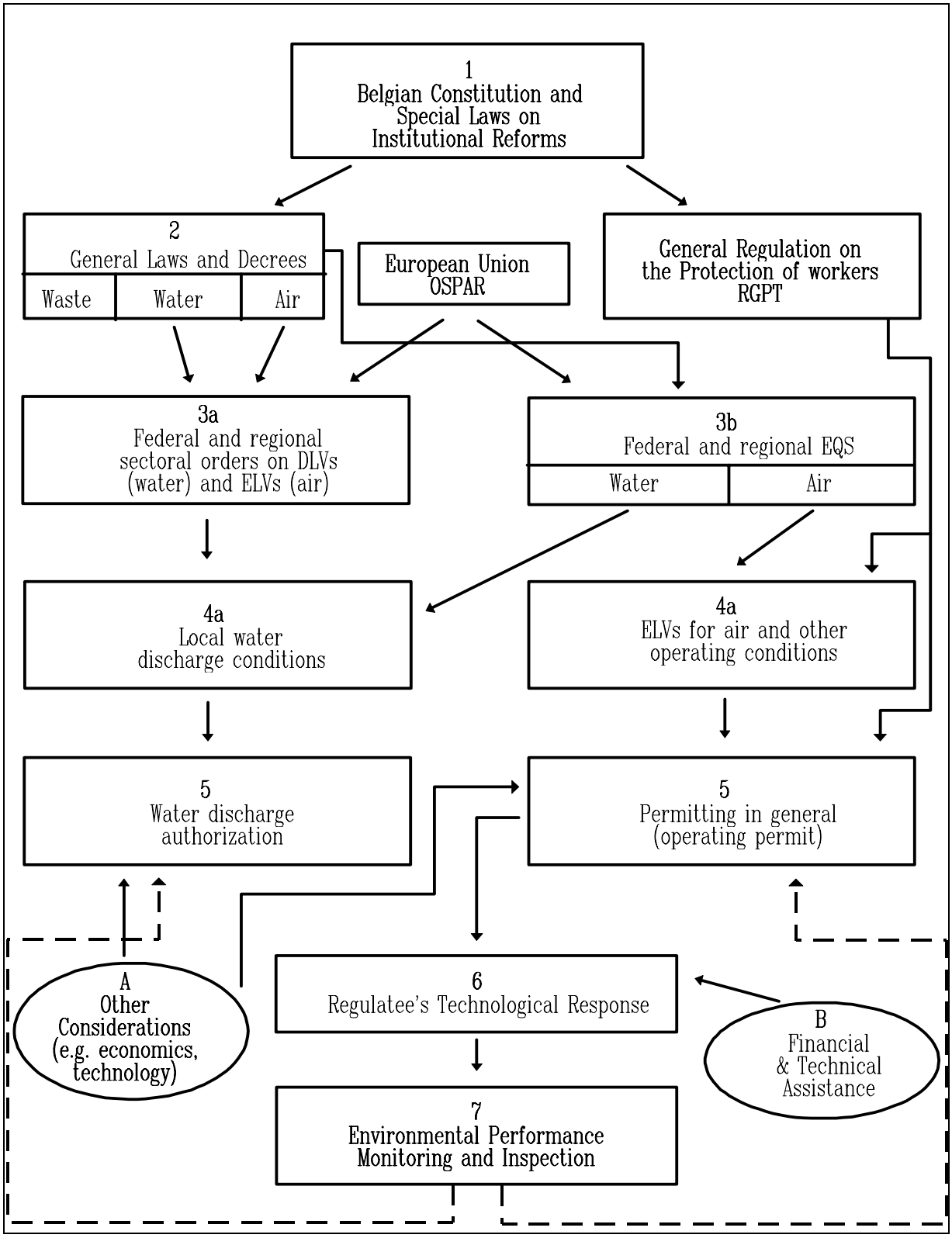


Figure 3 : Belgium (Wallonia)

CANADA

Regulatory framework **Stage 1**

Canadian environmental protection regulation is a shared federal/provincial responsibility. Federal regulation is guided by two 1995 Government of Canada Policy decisions : *Toxic Substances Management Policy* (TSMP) and *Pollution Prevention: A federal strategy for action.* Both shift emphasis towards promotion of process change technology or cleaner production and increased efficiency in resource use.

The strategy states that pollution prevention is:

> […] *the use of processes, practices, materials, products or energy that avoid or minimise the creation of pollutants and waste, and reduce overall risk to human health and the environment.*
>
> *Techniques and practices will focus on areas such as:*
>
> - *substances of concern*
> - *efficient use and conservation of natural resources*
> - *reuse and recycling on site*
> - *materials and feedstock substitution*
> - *operating efficiencies*
> - *training*
> - *purchasing techniques*
> - *product design*
> - *process changes*
> - *product reformulation*
> - *equipment modifications*
> - *clean production*

The TSMP states that:

> *The key management objectives are:*
>
> - *virtual elimination from the environment of toxic substances that result predominantly from human activity and that are persistent and bioaccumulative (Track 1 substances); and*
>
> - *management of other toxic substances and substances of concern, throughout their entire life cycles, to prevent or minimise their release to the environment (Track 2 substances).*
>
> *Pollution prevention strategies will be used to prevent the measurable release of a Track 1 substance from domestic sources.*
>
> *Pollution control and remediation strategies may be used to achieve the objective set for Track 2 substances. However, pollution prevention is often the most cost effective management strategy and in such cases will be promoted by the federal government as the preferred approach for Track 2 substances.*

<u>BAT</u> **Stage 1**

There is no universal or national definition of Best Available Technology as used for federal and provincial environmental requirements in Canada. A uniform definition of BAT is not easy in the Canadian context. Technology-based requirements may be defined as BAT or a number of other ways (such as BPT, BATNEEC or other levels of technology development).

The 1988 Canadian Environmental Protection Act (CEPA) supersedes previous pieces of legislation such as the Clean Air Act and part III of the Canada Water Act. According to the CEPA, the Minister of the Environment of the federal government has the authority to formulate

> [...]
> *(c) release guidelines recommending limits, including limits expressed as concentrations or quantities, for the release of substances into the environment from works, undertakings or activities; and*
> *(d) environmental codes of practice specifying procedures, practices or release limits for environmental control relating to works, undertakings and activities during any phase of their development and operation, including the location, design, construction, start-up, closure, dismantling and clean-up phases and any subsequent monitoring activities* (CEPA, Section 8(1)).

In the field of toxic substances, CEPA gives the Governor in Council the power to issue

> *regulations* [...] *including regulations providing for or imposing requirement respecting*
> *(a) the quantity or concentration of the substances that may be released into the environment either alone or in combination with any other substance from any source or type of source;* [...]
> *(d) the manner in which and conditions under which the substance may be released into the environment, either alone or in combination with any other substance* (CEPA, Section 34 (1))[.]

However, the CEPA does not mention the use of BAT as a requirement to be included in the guidelines and regulations.

The 1988 Canadian Environmental Protection Act (CEPA) underwent Parliamentary review in 1995 and will be renewed to promote a shift from control to a prevention approach in environmental protection activities.

Technology innovation is being promoted through Canada's Strategic Options Process. Producers and users of substances declared toxic under CEPA participate in discussions to consider alternatives and recommend the best options to meet environmental objectives.

As a result, BAT (a term that has not been formally defined under Canadian federal regulations) in decision-making will mean placing emphasis on evaluating potential technological change within an activity prior to consideration of add-on treatment technology. Environmental results and cost considerations will continue to influence decision-making.

For Track 1 substances, virtual elimination from the environment is the objective. While social, technological and economic factors have no bearing in setting the objective, such factors are taken into account when determining interim targets, management strategies and time lines for implementation.

For Track 2 substances, socio-economic factors are considered when determining long-term goals, targets strategies and timelines. Notwithstanding, prevention options are explored and generally preferred given the greater potential for environmental improvement relative to treatment or control options.

Canada also regulates water pollution from major industry sectors through regulation under the 1985 Fisheries Act. This Act has a general prohibition provision that states:

> [...] *no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter such waters.*

A number of regulations have been developed under this Act based on the application of in-plant pollution prevention techniques and waste treatment systems. Regulated limits are developed based on environmental needs, availability of effective pollution reduction methods, and socio-

economic considerations. The choice of prevention and control methods to be used remains with the facilities being regulated provided that the limits are met.

Environmental Effects Monitoring (EEM) requirements are also being included in more recent regulatory packages. The results will be used to determine the need for improved site-specific environmental protection activity.

Environmental regulation at the provincial level in Canada is extensive and generally applies BAT in a similar manner.

The Fisheries Act contain some provisions for pollution prevention and the protection of fish habitat. In particular, the Governor in Council may issue regulations prescribing "treatments, processes and changes of water" (Section 34(2)). But, as in the case of CEPA, BAT is not a requirement.

Although BAT is not instituted as a legal requirement, the federal government makes use of technology-based standards:

(a) Decisions regarding BAT are an integral part of the overall decision-making process for the control of releases to the environment. The Environmental Assessment Review Process (EARP), for instance, is an advisory and decision-making process in support of pollution prevention and environmentally sustainable practices. Projects under EARP are assessed to determine potential environmental effects and whether these effects are mitigable with BAT.

(b) BAT is used as a basis for (non-binding) guidelines and (binding) regulations which specify emission limit values (for instance in rates or concentration of releases, see *ELVs*).

In practice, some general principles are observed for the adoption of technology-based standards. For instance, the broadest range of technologies, including foreign (untried in Canada) technologies, can in theory be used as the basis for requirements. However, the level of experience with technology in Canada will always be an important consideration. Canadian requirements are rarely technology-forcing, i.e. requirements can be met using technology which is "available" today.

<u>EQS</u> **Stages 1-3b**

Under the Canadian Environmental Protection Act, the Minister of the Environment is mandated to issue

> *(a) environmental quality objectives specifying goals or purposes toward which an environmental control effort is directed, including goals or purposes stated in quantitative or qualitative terms;*
> *(b) environmental quality guidelines specifying recommendations in quantitative or qualitative terms to support and maintain particular uses of the environment* (CEPA, Section 8(1))[.]

CEPA also provides the framework for regulations. The Governor in Council may:

(a) prescribe the minimum, average or maximum quantity or concentration of the substance; and
(b) prescribe the method of determining such a quantity or concentration (CEPA, Section 87 (1)).

The provisions of the Fisheries Act concerning fish habitat protection and pollution prevention also contains references to EQSs:

The Governor in Council may make regulations prescribing
(a) substances and classes of substances;
(b) quantities or concentrations of substances and classes of substances in water; [...] (Fisheries Act, Section 34(2)).

Canadian environmental quality guidelines (CEQG) are developed for various environmental media (e.g., water, sediment, soil, biota tissue) to protect, enhance and sustain specific resource uses of aquatic ecosystems (e.g., drinking water, recreation water quality, aquatic life and wildlife protection, agricultural water uses such as irrigation and livestock watering) and terrestrial ecosystems (e.g.-agricultural, residential/parkland and industrial land uses). These science-based guidelines are developed using nationally approved protocols under the auspices of federal-provincial-territorial organisations, such as the Canadian Council of Ministers of the Environment to achieve consensus, consistency, and co-operation on national environmental quality issues.

These national guidelines are used by various agencies (e.g., federal, provincial, territorial departments; international agencies such as the UN/ECE) to assess and manage environmental quality issues. For Track 1 substances under the TSMP (Toxic Substances Management Plan), the management goal is the virtual elimination of these substances from the environment. National guidelines can be used to determine interim management objectives and as performance indicators to measure progress in national and international virtual elimination strategies. As well, CEQG can be used to evaluate the significance of adverse risks to environmental and human health to help determine priorities, targets and schedules for virtual elimination of these substances.

For Track 2 toxic substances under the TSMP, CEQG are essential science tools to evaluate the risk of these substances /with respect to the degree and likelihood of adverse effects and to interpret the significance of measured levels of substances. These national guidelines also provide scientifically-based measures in risk management, to include selecting and implementing appropriate management actions in conjunction with legal, economic and social factors.

For example, the guidelines are used to develop site-specific environmental quality objectives in conjunction with information on local environmental conditions, socio-economic factors, BAT and other factors. Furthermore, these guidelines can be used to determine priorities, select strategies and timelines to help achieve the goal of life-cycle management and to prevent or minimise releases of these substances to the environment.

CEQG are also used in environmental assessment and project review evaluations to determine whether activities during project implementation and operation would impair other beneficial uses of the environment. Furthermore, these guidelines and objectives are used to interpret environmental effects monitoring information for assessing the efficacy of technology-based control measures.

Environmental quality objectives are often developed by federal-provincial bodies (e.g. the Prairie Provinces Water Board). EQOs for water, soil and sediments are site-specific, and take into consideration the national guidelines, local environmental conditions, as well as economic, social and other factors. Air quality objectives, however, are national in scope. Joint federal-provincial development of air quality objectives began about 1969. The CCME Working Group on Air Quality Guidelines and Objectives (WGAQGO) formulates the air quality objectives. Environmental quality objectives complement BAT in the EARP process (see *BAT* above). The EARP evaluation is based partly on EQOs as an indication of whether activities, during project implementation and operation, would exceed acceptable pollution limits.

Emission limit values (ELVs) **Stage 4a**

Generally, the federal government sets national standards for discharges by regulation. Provincial governments also use regulations but for the most part emission standards are established in site-specific permits or licenses. Among the BAT-based regulations and guidelines adopted by the federal government of Canada are the following:

- 1993 Thermal Power Generation Emissions - National Guidelines for New Stationary Sources,
- 1992 Pulp and Paper Effluent Regulations,
- 1990 Chlor-Alkali Mercury Release Regulations, and
- 1990 Secondary Lead Smelter Release Regulations.

Permitting **Stage 5**

In Canada, many of the provinces operate permitting, licensing or approval systems which set environmental requirements for plants. These may incorporate provisions required under federal and provincial regulations and other policies. The permits set limits on the permissible releases and conditions for their release, with respect to items such as the quantities, concentrations and location of releases, the nature of the production processes and the pollution control facilities, the design of the effluent outfalls and stacks, and the monitoring that has to be conducted.

The permit conditions are developed taking into account technological and environmental effect parameters. In the cases of some provinces, regulations have been set specifying minimum performance values for certain parameters. Releases greater than these values may not be specified. In other instances, performance objectives have been set in policies; the permit writers consider these in their decisions. The decisions also take into account the needs of the local receiving media. Results of dispersion models and environmental quality objectives for air and water are considered.

In the case of new plants, permit conditions apply immediately. In the case of existing plants, time may be allowed for plants to come into compliance. The time required is based on economic evaluations.

The duration of permits varies from province to province. For example, in Alberta, permits have a 10-year duration but may be reviewed on plant expansion or modification. In British Columbia, permits are for an unspecified duration but may be reviewed if emissions change, where environmental effects require it and when policies.

The permitting process varies from province to province. The following type of information is typically required to support applications:

- process equipment specifications;
- process emission data (quantities, composition, physical characteristics);
- for renewal, statistics on performance during previous approval period;
- process overview and equipment modification summaries;
- flow balances;
- chemical usage;
- new plants and expansions require a comprehensive environmental assessment review (including complete details on plant and receiving environment).

In developing regulations and policies relating to permitting, extensive public input is accommodated in both the federal and provincial systems. The federal government does not operate permit systems and requirements are delivered via federal regulations. These require facilities to conduct monitoring according to prescribed methods and to report the results.

In issuing permits the provinces allow for public input and appeals in the various stages of decisions. Provisions included in permits under regulations are not subject to appeal. Those matters falling under objectives or general policy can be appealed.

With respect to federal regulations, the regulations are media-specific, i.e. separate regulations deal with emissions to air and water. In the case of provincial permitting, some provinces issue separate permits for releases to individual media, in other cases a consolidated permit is issued for all three media.

A new mill or an existing mill considering significant alteration would be subject to the environmental assessment legislation, or its equivalent, in Canadian jurisdictions. Such legislation has broad application: first, because the usual definition of environment covers the natural, economic and social environments; and second, because it can be applied to private sector activities

and most activity which involves government legislation, funding and property. The implications to permits and/or regulations could be felt on production process, mill size and effluent discharge requirements.

In Canada, both the federal government and the provinces have environmental impact assessment legislation. Projects involving the construction or expansion of a pulp and paper mill, for example, are projects which require and environmental impact assessment under both federal and provincial environmental assessment acts. To avoid holding both a federal and provincial environmental assessment of the same project, the federal and most provincial environmental assessment acts provide for the two levels of governments to enter into agreements which would see the two review processes combined into one.

Environmental Assessment is required for new plants and expansions in order to ensure that the projects are environmentally sound. The environmental assessment process considers the capability of control technologies and the environmental characteristics of the sites.

Economic considerations **Factor A**

Economic consideration form an integral part of all regulations that are developed and permit requirements that are set. In the case of regulations a comprehensive economic analysis precedes their passage and the results are considered by the governments before passing the laws. In the case of permitting as noted previously, economic factors influence the compliance schedules.

EQOs are primarily based on scientific considerations but economic factors may be taken into account during their development. For air, the economic aspects may be taken into account by the parent committee. There has not been extensive development of quantitative procedures for the economic aspect and the procedures vary considerably due to the site-specific nature of the process.

When published, all regulations must be accompanied by a Regulatory Impact Analysis Statement (RIAS). This considers the requirements/impacts of the regulation and alternatives, inter alia, in terms of costs and benefits. Terms such as "affordability" are not defined universally but are determined in the context of the threat posed by the pollutant(s) under consideration (e.g. conventional, toxic, etc). Types of costs and benefits considered include : costs to industry (capital and operating), costs to government (including monitoring and enforcement), jobs, and non-quantifiable benefits to users of an environmental resource, to health and to impacts on the national economy.

There are no programs to assist plants in meeting BAT standards, although some assistance in research may be available.

Monitoring and Inspection **Stage 7**

Compliance monitoring is conducted by governments in Canada to verify that activities are carried out in accordance with the regulations (the guiding principles for federal compliance monitoring

are referred to in the Canadian Environmental Protection Act Enforcement and Compliance Policy). A recent development in federal effluent regulations is the inclusion of Environmental Effects Monitoring (EEM). The 1992 Pulp and Paper Fisheries Act Regulations require mills to conduct periodic monitoring of water, sediment, biota and fish at each mill location. This determines the contaminants present and the health of the various populations. The results of the studies are used to determine the adequacy of controls at each site.

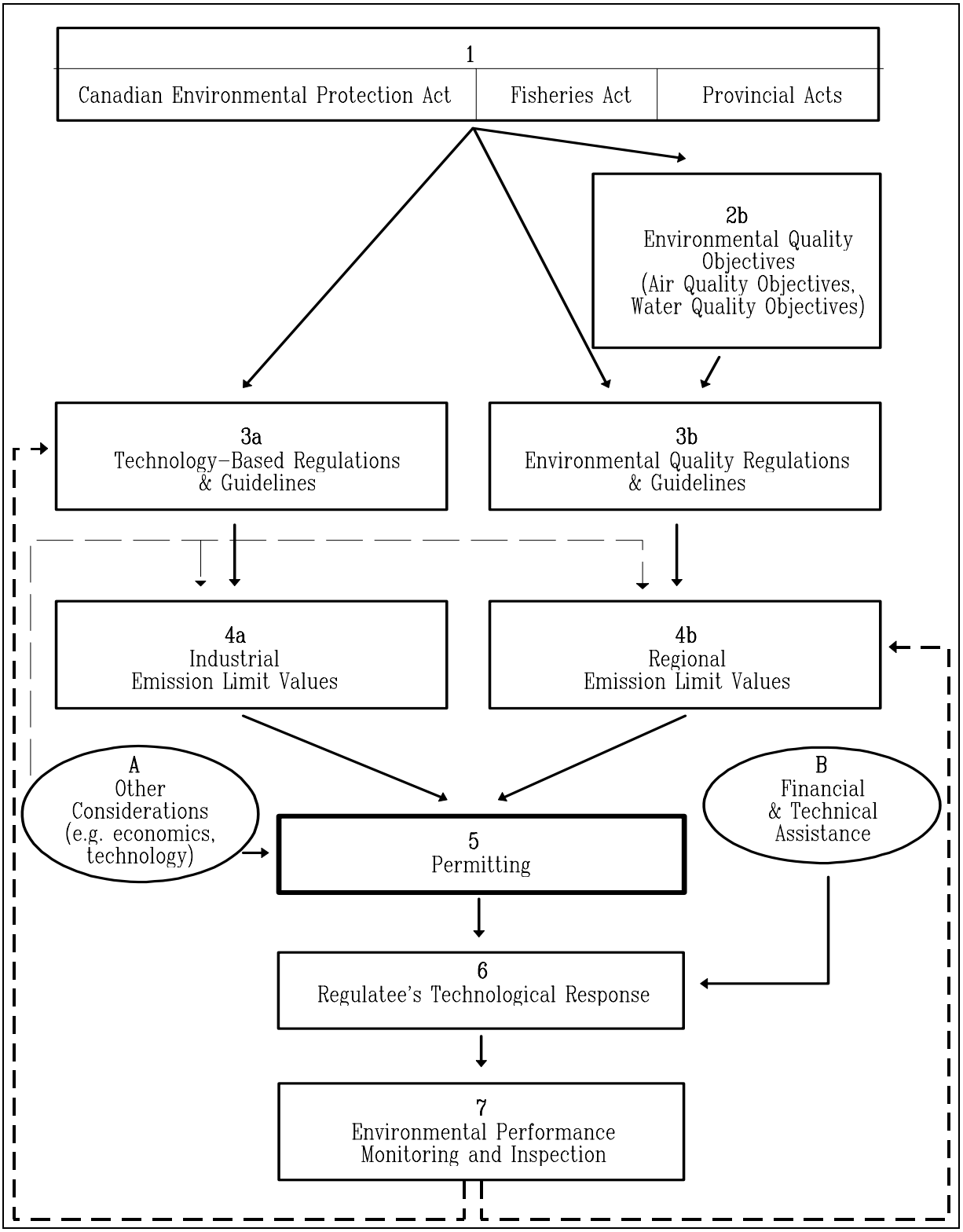


Figure 4 : Canada

DENMARK

<u>BAT</u> **Stages 1-2**

The legislative basis for setting BAT guidelines is the 1974 Environmental Protection Act, after consultation with industrial organisations:

> *In the Administration of this Act weight shall be given to the results achievable by using the least polluting technology, including least polluting raw materials, processes and plants and the best practicable pollution control measures. In this evaluation, special consideration shall be given to preventive measures in the form of cleaner technology* (Environmental Protection Act, I, 3(1)).

The principles governing BAT are contained in a series of guidelines, such as the Industrial Air Pollution Control Guidelines (IAPCG, 1992):

> *Air pollution should be limited by using the best available cleaning techniques. It is the responsibility of the company to select these. This requires a systematic assessment of the technical solutions which can meet the requirements, along with an assessment of reliability, energy savings in general and the use of cleaner technology.*

BAT is defined as the least polluting technology. BAT includes state-of-the-art activities, processes and operational methods, with construction, buildings, operation, maintenance and removal of process plants. BAT is assumed to have been well-tested -in Denmark or abroad- at a scale which makes it available in the relevant industrial context. Availability is interpreted as industrial feasibility for the plant involved or for similar types of plants (not necessarily for the individual plant).

The BAT principles are guidelines, but in practice they are used as binding requirements and regulation has to be in compliance with the BAT requirements. The permitting requirements may deviate from guidelines, for example because of economic considerations (see *economic considerations*).

BAT is set for industrial subsectors (e.g. motor vehicle repair shops, antifouling treatment vessels). By now, the Danish EPA has issued guidelines for:

-shipyards;
-plants for feedstuffs production;
-electroplating and hot galvanising.

EQS **Stage 1**

The Environmental Protection Act provides the legal basis for the establishment of EQOs:

> *When determining the extent and nature of measures to prevent pollution consideration shall be given to:*
> *1) the nature of the physical surroundings and the likely impact of pollution thereon,*[...] (Section 3(2)).
>
> *To guide the authorities, the Minister for the Environment can specify quality requirements for air, water and soil, and permissible noise levels* (Section 14(1)).

According to the Industrial Air Pollution Control Guidelines:

> *Immission means pollutants in solid, liquid or gaseous state, that are present in the air outside a plant on the surface of the ground -usually approximately one and a half metres above ground level.*

The IAPCG do not supply any immission values, however. The Danish EPA is continually working out C-values for substances that arise during the course of new cases (see *Emission Limit Values*).

The reason for determining limit values for chemical substances is to prevent hazards caused by these pollutants. The limit values are assessed on the basis of scientific criteria and the state of knowledge available within this field at the time in question (Industrial Air Pollution Control Guidelines: "Principles for determination of limit values for chemical substances").

The Danish EPA defines the general EQO, which the regional and local authorities have to use when they set the EQO for individual plants. EQOs are set for the individual plant (as maximum immission limits) and not for the overall air quality. The procedure for establishing water EQOs is similar

Establishing the EQO: the first step is to determine the NOEL "No Observed Effect Level" (NOEL). Then a set of security factors are used to obtain a level that is sufficiently acceptable/tolerable to cover the maximum dosage that a person can be exposed to.

The EQO standards are guidelines, but in practice are used as binding requirements and the regulations must be in compliance with EQO.

Emission limit values (ELVs) **Stage 4a**

The Environmental Protection Act specifies that:

> *The Minister for the Environment can lay down rules on:*

1) pollution from enterprises, plants, engines, tools, furnaces and means of transport [...] (Section 7(1)).

The IAPCG guidelines replace guideline No. 7/1974 on the reduction of air pollution from companies. The limit values in Guidelines No. 7/1974 were in a number of areas determined more by the cleaning technology available in the early seventies than on assessments of the effects of the substances discharged. Wherever there have been developments in cleaning technology in the intervening years, this has been reflected in lower limit values - for example in the emission values for dust in general.

> C-value: *The maximum amount of any pollutant a company is allowed to emit in the air as immission is called the C-value.[...] The C-values are an expression of the Agency's knowledge of the substance in question at the time of publication.[...] The C-value is concerned with the concentration of the pollutants in the immediate surroundings, and is used when determining the height of chimneys.[...]*
> *In these guidelines, emission is the discharge into the atmosphere of pollutants in the form of solids, liquids, or gases* (IAPCG, Section 3.1).

The Danish limit values have been established on the basis of foreign guidelines, in particular the German *TA-Luft* (T.I. Air).

Permitting **Stage 5**

The Environmental Protection Act lays out the permitting principles:

> *The Minister for the Environment draws up a list of heavily polluting enterprises, plants and activities covered by the approval obligation* [...] (Section 35(1)).
>
> *Enterprises, plants or activities included in the list [...] (listed activities) shall not be established or commenced without prior approval* (Section 33(1)).
>
> *Decisions on approval* [...] *shall be made by the local council or by the regional council* (Section 40(1)).
>
> *After a period of not less than eight years after the approval was granted, the supervision authority may change the approval conditions for reasons of environmental protection or if cleaner technology is developed, including less polluting raw materials, less polluting production methods or better cleaning methods* (Section 41(5)).

The Statutory Order from the Ministry of the Environment No.794 of December 9, 1991, on Approval of Listed Activities spells out the features of the permitting procedure. The order specifies:

- which activities are to be approved by the local council and which are to be approved by the regional council (amtsråd);

- the content of the application;

- the content of the decision;

- the revision of the approval terms.

The Industrial Air Pollution Control Guidelines provide further guidance on the permitting procedure. Approval of a factory which emits substances into the air will normally include emission limit conditions, maximum air flows and chimney heights or C-values. The requirements are fixed on the basis of the material submitted with the application.

The alteration of a process requires an authorisation:

> *Expansions and modifications of existing factories which involve an increase in air pollution require approval* [...]. *The kinds of expansion or modification which require approval include the establishment of new polluting plant, production expansion which causes increased pollution and the emission of other substances than those previously emitted* (IAPCG, Section 2.4).

Regarding the duration of the permits, the supervising authorities may not issue further requirements for a period of eight years (the period of legal protection) unless:

- *new information has emerged as regards the harmful effects of the pollution*;

- *the pollution gives rise to environmental hazards which were unforseeable at the time when the approval was granted, or*

- *the pollution otherwise exceeds the basis for granting the approval* (IAPCG, Section 2.5.2).

> *Once the term of the approval has expired, the supervising authority may change the terms in an approval when such changes are environmentally justified, or if better cleaning methods or less polluting production methods have been developed* (cf. Section 5 of the Environmental Protection Act). *This is means to emphasise the fact that companies must limit pollution on the basis of technological developments* (IAPCG Section 2.5.3).

Economic considerations **Factor A**

The Environmental Protection Act no longer makes any reference to economics as a factor to be taken into consideration for the adoption of pollution prevention measures (EPA, Section 2).

The Industrial Air Pollution Control Guidelines, however, refers to "realistic emission regulations that take heed to companies' possibilities to compete and carry out product development." They also advise that measures should be "financially possible." Furthermore, "the guidelines advise that deadlines can be established for meeting the requirements.... [such as] a transitional period."

The basic principle contained in the guidelines is that:

> *[t]he cleaning technique selected must, besides being technically feasible, also be economically viable for the company type in question. This means that the costs of cleaning measures must not reduce the competitiveness of the company so much that its survival and potential for development are put at risk* (IAPCG, Section 1.1).

The guidelines provide for the performance of cost-benefit analyses:

> *In fixing requirements on the basis of these guidelines, one must still assess whether there is a reasonable relationship between the costs associated with the requirements and the environmental effect that can be achieved. This means of course that one may deviate from the guidelines where the above conditions cannot be achieved by the factory type in question* (IAPCG, Section 2.1).

Relaxation of the requirements may therefore occur on the basis of economic reasons:

> *Requirements may be less strict if it is evident that the costs the company would incur by using the best available technology are not in reasonable proportion to the pollution-limiting effect of the measures* (IAPCG, Section 2.3).

EQOs are established without looking at the economic considerations.

Monitoring and Inspection **Stage 7**

The regional/local authorities are in charge of environmental supervision of the local enterprises:

> *The local council monitors compliance with*
> *1)the Act and the rules laid down under the Act,*
> *2)prohibition and enforcement orders,*
> *3)terms stipulated in approvals and licenses,*[...] (EPA, Section 65(1)).

> *(1) The regional council supervises the state of the environment in the regional area.*
> *(2) The regional council shall supervise* [...] *the listed enterprises marked a) in the rules on approval of listed enterprises* [...] *and enterprises discharging wastewater directly to watercourses, lakes or sea* (EPA, Section 66).

The local authorities make annual reports to the Danish EPA about inspections.

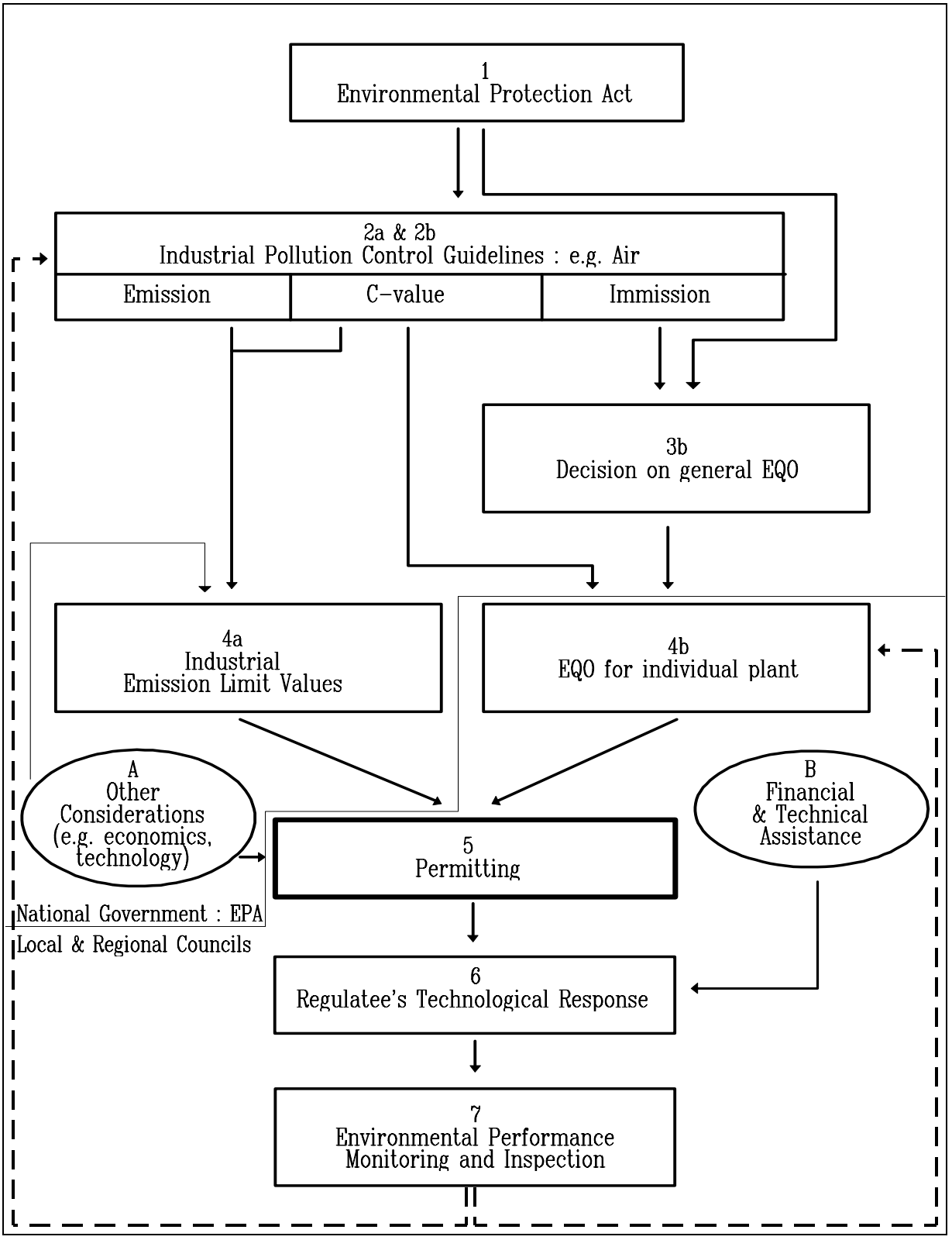


Figure 5 : Denmark

FINLAND

Regulatory framework **National/Regional**
Stages 1-2

The co-ordination and direction of environmental protection is provided by the Ministry of the Environment. This includes control of air and water pollution and the management of wastes. Together with the Ministry of Justice, the Ministry of the Environment is responsible for the preparation of legislation and regulations for the general supervision of administration of these by the local authorities. Requirements are implemented through thirteen Regional Environmental Centres located throughout the country. These were established in March 1995 and they amalgamate the organisations that previously dealt with separate media (water: 13 Water and Environment District Offices, air and waste: 12 Provincial Governments), into a single operating unit.

Permitting authorities are the Regional Environmental Centres, three Water Courts and the municipalities, depending on the size and type of pollution.

General Environmental Law **Stages 1-2**

The pollution prevention and control policy in Finland is governed by a series of media-specific laws, e.g. the Air Pollution Control Act, the Noise Abatement Act, the Water Act, the Waste Act. These acts give the Council of State the authority to lay out guidelines and regulations; e.g.

> *The Council of State may issue general guidelines and regulations necessary for the prevention of air pollution:*
> *1) on limit values for pollutants in the air and limit content in deposition;*
> *2) on limit values for pollutants in emissions into the air or pollutants emitted into the air;*[...] (Air Pollution Control Act, Section 9).

Finland is a party to several international agreements which have the same value as a legal basis as domestic legislation. For instance, the Water Act specifies that:

> *In addition to the provisions of this Act, the provisions of any international convention binding on Finland on the protection of water bodies and the sea shall also be complied with to prevent pollution of a water body.* (Chapter 1, Section 19)

BAT in Finland does not translate into sectoral emission limit values at the national level. Emission limits are set on a case-by-case basis at the permitting stage. However, the principles governing pollution prevention and control, as laid out in the Finnish legislation, are quite similar to the concept of Best Available Technologies/Techniques, as defined by the European Commission, the Helsinki Commission and the Paris Commission.

Water

Chapter 10 of the Water Act stipulates that:

> *A prerequisite for granting a permit is that the adverse effects of the measures (read: the introduction of pollution) are considered to be relatively minor compared with benefits gained and the removal of waste water or some other substance polluting the water body or prevention of the entry of such substances into the water body, is not possible in any other way at reasonable cost.* (Section 24)

New provisions were introduced in the Water Act in 1995

> *In the permit, in order to protect the waters and the sea from pollution, attention shall be paid to the best available technology. This means the most effective and technically and economically feasible production and cleaning methods developed, their management and control systems and other courses of action, by which environmental pollution can be prevented or decreased in the most effective way. This further means available techniques that can be implemented in the concerned sector at a cost which is reasonable with respect to the prevention of the pollution otherwise caused.*(Section 2a, unofficial translation, emphasis added)

Air

According to new provisions introduced in the Air Pollution Control Act in 1995

> […], *best available technology shall refer to technically and economically viable production and purification methods which are as effective and advanced as possible, including their regulation and control systems, and other functional means which make it possible to prevent, in advance, emissions from activities entailing a risk for environmental pollution, or to reduce such in the most efficient manner.*
>
> *Technically and economically viable technology should be generally available and, in the sector concerned, usable at costs which are reasonable in view of preventing the environmental pollution caused by said activity.*

(Section 2a)

Bearing in mind the permit regulations issued in accordance with Section 15, and Air Control Permit shall be issued if
[…]
3) it has been feasible to reduce the emissions caused by the activity to the level achievable by the best available technology.
(Section 14)

Waste

The Waste Act stipulates general duties of care, i.e. installations are required to minimise generation of waste and ensure that waste does not hamper the organisation of waste management, specifically installations are required by the Act to save raw materials and replace them by waste. Further, the Act requires that waste management shall employ BAT and BEP.

EQS **Stages 1-2**

There are very few environmental quality standards prescribed in Finland. The environmental quality objectives are decided at the licensing stage. Existing EQOs apply to the whole country. Different types of specially protected areas are listed in Council of State decisions and noted by the licensing body.

Water

Finland does not have a normative system of Environmental Quality Standards. Instead, a system of water classification has been developed that serves several, mainly informative, purposes (public information, land use, planning of water protection targets and licensing). For classification, different criteria are taken into account depending on actual and potential use of the water courses. Water EQOs are set at the level of the natural quality of the environment.

Air

Finland uses a set of target limit values on air quality.

Emission Limit Values (ELVs) **Stages 3a-4a**

There are no national norms derived from the BAT or EQO concepts defined above except in the case of some regulations concerning SO_2 emissions from coal-fired power and boiler plants and some guidelines on air emission limit values and targets.

For some sectors, investigations on BAT and corresponding emissions have been published, both nationally and in co-operation with the Nordic countries, but these publications have more an informative rather than a normative character. By the same token, the National Board of Waters and the Environment (now the Finnish Environment Institute) issued some guidelines for regional authorities concerning some sectors on the water protection requirements to be recommended to the licensing authorities and on supervision (e.g. on storage of chemicals, metal plating and fish farming). In the future, such guidelines may be issued directly by the Ministry of the Environment and thus become more binding on the authorities.

The technology evaluation and the emission requirements derived therefrom are performed on a case-by-case basis during the licensing procedure. Limit values are based both on environmental impact assessment and on evaluation of the technology available and improvements of its performance.

Water

There are no national discharge standards, only guidelines and recommendations issued by the Helsinki Commission and the EU.

Air

There are Council of State decisions on limit values from which the permit conditions may deviate for special reasons.

Among the relevant emission standards adopted by Finland are:

- Guidelines to Restrict the Particulate Emissions of Power and Boiler Plants
- Restricting Emissions of Sulphur Compounds from Kraft Pulp Mills
- Restricting Emissions of Sulphur Compounds from Sulphuric Acid Plants
- Restricting Emissions of Sulphur Compounds from Oil Refineries
- Restricting Sulphur Dioxide Emissions from Power and Boiler Plants Fired with Heavy Oil
- Limit values for SO_2, NOx and particulates emissions from power plants and gas turbines

Permitting **Stage 5**

Environmental requirements are set on a case by case basis, through a permitting system. In making their decisions the permitting authorities consider environmental, technical and economic factors. Decisions are based on the principles that the fundamental target is to prohibit pollution; that the polluter-pays principle is adhered to; and that requirements set on different polluters are based on equal and impartial assessment of the environmental impacts and technical and economic possibilities.

Administration of the process involves the following elements :

- An application describing the activity and its effects and proposing further pollution control measures (and sometimes even emission limits) is sent to the responsible authority.
- The application is evaluated and proposals for permit conditions are made by independent authority's expertise (inquiry).
- Documents are public and comments can be made on them.
- The competent body makes decisions on limits and other restrictions.
- Those concerned have a right to appeal.
- Amendments are made to the permits as appropriate.

Water

The Water Act prohibits the closing, diverting and polluting of surface waters unless a permit is granted by the Water Court:

> *Unless otherwise provided below, no measures that may cause pollution of the water body may be taken without a water court permit (prohibition on polluting a water body). Such measures include conducting or discharging a solid, liquid or gaseous substance or energy into the water body so as to produce, either immediately or when allowed to continue, a change in the quality of the water in the water body or its bottom that:*
> *1) is manifested as a harmful lowering of the water level;*
> *2) causes detrimental change in the aquatic environment and its functions or obvious damage to the fish stock;*
> *3) causes a health hazard;*
> *4) causes a substantial reduction in environmental amenity or cultural values or in the suitability of the water body for water supply or recreational purposes; or*
> *5) may cause some other infringement of a public or private interest comparable to those mentioned above.*
> (Chapter 1, Section 19)

No permits can be delivered for discharges to ground waters. The water permits are granted on condition that the project for which it is granted will not cause extensive harmful alterations to the receiving environment and that the benefits of the activity compare favourably to the damages engendered.

As for procedure, the Regional Environment Centre checks the notification and decides whether the activity is likely to generate water pollution. If the pollution can be avoided, the regional authority negotiates with the notifier on pollution control measures possible to prevent pollution. If the pollution cannot be avoided, the polluter must apply for a discharge permit to the Water Court. Big polluters send their application directly to the Water Court.

There are three Water Courts located throughout the country. These comprise of a judge assisted by at least two specialists expert in engineering and environmental science. They conduct public hearings and decide on the content of permits on a case by case basis.

The Water Court sets a board of inquiry which means that the application and procedure are open to the public. In the evaluation, the technology is related to proposed limit values and knowledge of achievable discharge levels at the best production plants in Finland and abroad as well as to recent technical development and applied research. For installations already in operation, relevant monitoring results and risk analyses provide important information of their performance and the possibilities to improve it.

The most important evaluation of EQOs takes place case-by-case during the licensing procedure. In predicting the environmental effects of an existing polluter under new permit conditions the gathered extensive monitoring data is used in the calibration and verification of water quality models and in other types of evaluations. More stringent requirements are imposed in specially protected areas, areas subjected to special research programs like the project Aqua, as well as areas classified as potentially important water supply areas (fresh and groundwater) and recreational areas are naturally noted by the Water courts and referred to the inquiry procedure..

Air, Waste and Noise

For activities and installations regulated under the Air Pollution Control Decree, the Waste Management Decree and the Public Health Decree, applications are submitted to the relevant Regional Environment Centre or to the appropriate Municipal Environment Board as the case warrants. The Municipal Environment Boards have limited rights to deal with and issue permits for minor polluters and to supervise environmental legislation and decisions made by the Regional Environment Centres.

According to the Environmental Permit Procedures Act, emissions of pollutants to air, noise abatement and the production of solid waste are subject to an integrated permit procedure including an inquiry. Since 1995, these integrated permits are issued by the 13 Regional Environment Centres. The move toward fully integrated permitting will be completed once the wastewater discharge permits are handled together with other emissions. The relevant legislation is under preparation.

The conditions for atmospheric emissions inscribed in the permits usually follow the national limit values and targets contained in the Council of State Decisions. When the national norm is

inadequate or obsolete, the conditions set in the permits are more stringent. Conversely, it also happens that permit conditions are not tightened in spite of the greater technical capabilities. The aim of the municipal and provincial authorities issuing emission standards in permits is to reach the EQOs. When a facility is covered by a Council of State Decision on Air Quality Guidelines, the impact on air quality should not exceed 40% of the norm in urban areas and 60% at other sites. If there are many pollutants in the same area, the requirements may be stricter. Depending on the particular circumstances under which an installation is operating, different requirements will be incorporated into the permits.

Timing

Permits issued by the Water Court stipulate, as a rule, a deadline for the next application. Thus permits are delivered for a time period which, in practice, may vary from three years to ten years. Permits under the Air Pollution Control Act issued by the provincial governments before 1996 are valid until further notice. The reviewed Act however stipulates a procedure similar to the Water Act with a deadline for the next application.

Permits have to be revised/reissued whenever a change occurs in the installation's production volume, production processes, use of raw materials or chemicals which may affect emissions or waste management. The permits may also be revised if environmental impacts arise which were not foreseen.

Renewed permits have so far always been more stringent than former ones. For new and renewed production capacity the permit conditions are stringent and presume state-of-the-art, environmentally sound technology. An old plant's permit conditions depend partly on to what extent production facilities are renewed. Therefore, the interpretation of BAT at old plants is a question of time-schedule.

<u>Economic considerations</u> **Factor A**

Financial factors are naturally integrated into an applicant's proposal. The enterprise is obliged to include cost estimates in its application.

The Water Act, for instance, specifies that

> *attention shall be paid to the best available technology. This means the most effective and technically and economically feasible production and cleaning methods developed, their management and control systems and other courses of action, by which environmental pollution can be prevented or decreased in the most effective way. This further means available techniques that can be implemented in the concerned sector at a cost which is reasonable with respect to the prevention of the pollution otherwise caused.*(Chapter 10, Section 2a, unofficial translation)

As permit conditions are set on a case-by-case basis, operating requirements are tailor-made so that environmental, technical and economic aspects are taken into account and aiming at the most efficient solutions. Negotiations relate to the preparation of applications and the inquiry, and they affect

the statements made to the competent licensing body. The competent body does not negotiate. However, a more systematic approach to economic considerations and timing related to BAT, in particular at old facilities, is called for.

As a rule, economic considerations are not taken into account when setting EQOs because economic criteria are difficult to come by and because international EQOs are complied with without amendment.

Financial assistance **Factor B**

The Polluter-Pays Principle (PPP) is strictly followed in Finland. However, small amounts of financial aid is available from the Technology Development Centre for applied research in the field of energy and raw material savings as well as environmental protection. Risk loans are also provided for product development. Aid is also available from the Ministry of Trade and Industry, the Ministry of Labour and the Ministry of the Environment.

Monitoring and Inspection **Stage 7**

The supervision of industry is mainly based on self-control. The results of the monitoring, risk analyses and reporting provide important information that feeds into the permitting procedure and determines some of the permitting requirements.

Water

The Water Act stipulates that permits granted by authorities for the discharge of industrial and municipal effluents have to include, inter alia, a condition for monitoring and reporting. The plant is ordered to make a proposal on a monitoring program to the Regional Environment Centre. Usually, the monitoring obligations cover internal operation control, external discharge control and observation of the effects on the recipient. If the area is affected by several polluters the monitoring of impacts is performed jointly.

As the permits do not prescribe who must perform the sampling and analyses, it is usually up to the permitted plant to propose and up to the supervising authorities to a approve self-monitoring scheme or a consultant paid for by the plant itself. The supervising authority reserves the right to make inspections, take samples, check diaries and talk to the facility's staff.

Air and solid wastes

Different from the waste water permits, there are for large establishments detailed conditions concerning monitoring and reporting also in the integrated environmental permits. This is because the permitting authority and the supervising authority are vested in the same Environment Centre. As a rule, the permits contain an obligation to participate in the air quality monitoring of the area carried out by the municipalities.

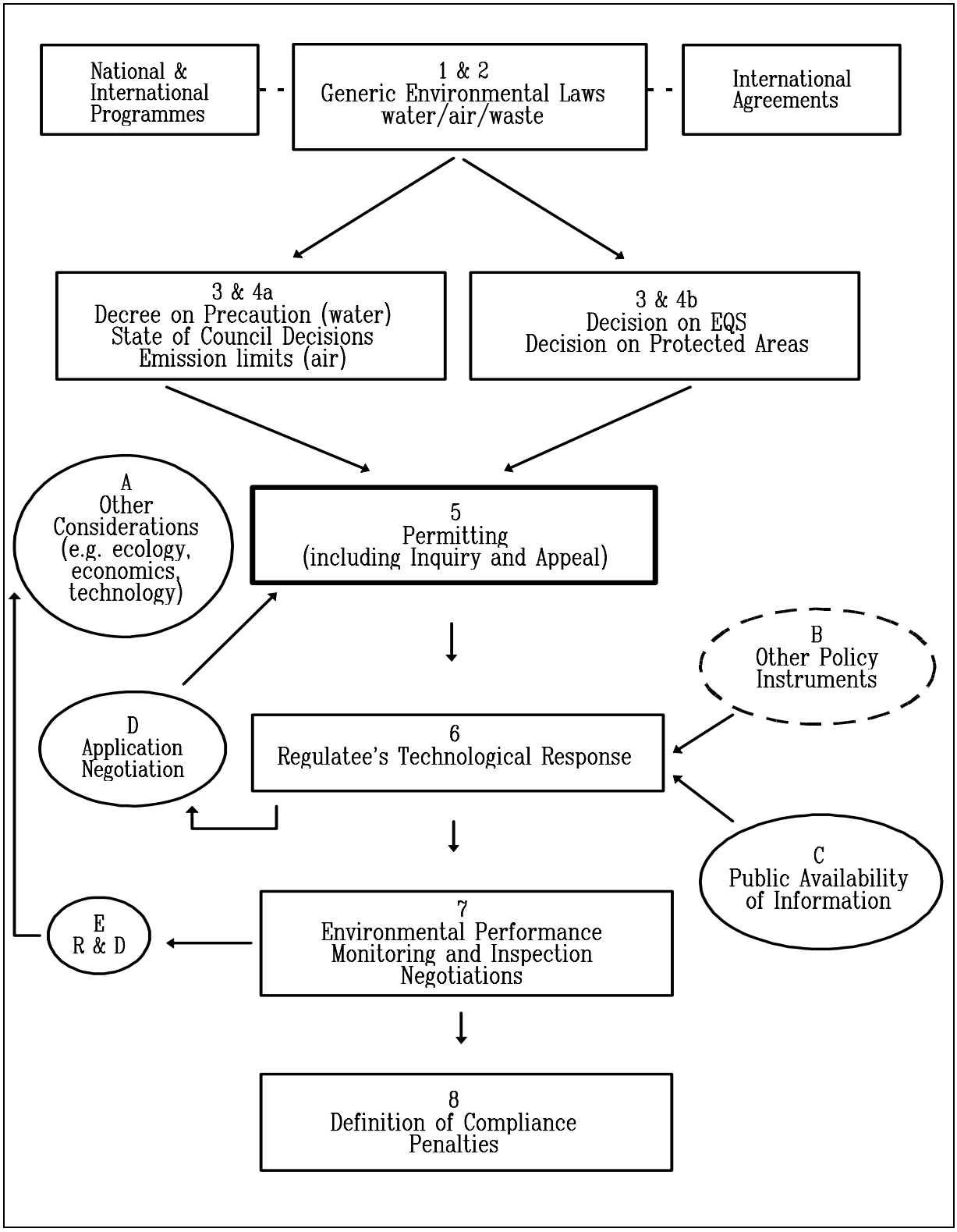


Figure 6 : Finland

FRANCE

<u>BAT</u> **Stages 2a-4a**

BAT requirements have been in use in France in one form or another since the 1810 imperial decree on insanitary facilities *(décret imperial du 15 octobre 1810 sur les équipements insalubres)*, revised by the 1917 law on "dangerous, inconvenient and insanitary facilities" *(loi du 19 décembre 1917 relative aux établissements dangereux, incommodes et insalubres)* which introduced a distinction between *autorisations* applicable to 1st- and 2nd-type facilities and *déclarations* applicable to 3rd-type facilities. An *autorisation* spells out the operating requirement of a facility subjected to it while a *déclaration* is simply a notification of operation.

The modern version of the law was adopted in 1976 with the law on classified installations *(loi du 19 juillet 1976 sur les installations classées pour la protection de l'environnement)* which now covers most polluting facilities regardless of their legal status and provides more leeway for administrative action. A concern has been to incorporate as many industrial sectors as possible within the jurisdictional ambit of the 1976 law. Prior to the 1976 law, BAT was applied in practice in authorisation procedures. What the 1976 law on classified facilities did was to incorporate the BAT principle unambiguously into national legislation. Under the 1976 Law on classified installations, an authorisation (Category I installations) or a declaration (Category II facilities) is required for the creation and modification of installations specified in a list (*nomenclature*) comprising some 200 headings of processes/activities that, on the basis of threshold sizes, must either obtain an authorisation or make a declaration. Some 500 000 installations are subject to a declaration. Some 68 000 installations are subject to an authorisation.

The Law on classified installations stipulates that minimum operating requirements are set by the Ministry of the Environment in regulations or technical instructions :

> [...] *the Minister in charge of classified installations may set by decree, after consulting the relevant ministers and the high council on classified installations, the general rules and technical prescriptions concerning certain categories of facilities regulated by the present law. Those rules and prescriptions set the measures adequate for preventing and reduce accident and pollution risks of any kind that are likely to occur as well as the conditions for establishing the installation into its surrounding environment and for site restoration after plant shutdown. Those decrees apply fully to new installations. In accordance with the advice of the relevant professional organisations, they set the compliance time and conditions under which they apply to existing installations.* (Law of 19 July 1976 on installations classified for the protection of the environment, article 7, unofficial translation)

The emission limit values specified in these instructions are based on the principle that the technology used to treat the emissions will be the best available technologies entailing an acceptable economic cost for the protection of the environment (BATNEEC). That is for the national regulation (national standard). When there is no regulation on a national standard, only circulars *(circulaires) and* technical notes *(notes techniques)* are applied to the classified installations with the same objectives as if it were a regulation yet without being legally binding. These are for new installations and -to the extent possible- existing installations. ADEME *(Agence de l'Environnement et de la Maîtrise de l'Energie)* has no role in the formulation of the requirements. ADEME is not an agency endowed with policy powers. ADEME's role is mainly to supply and co-ordinate technical information. There is no role for local governments *(départements and régions)* in the development of standards either.

BAT is an emission standard to be met and not the prescription of a specific technology. Therefore, discharge standards can be met with whatever technology is at the discharger's disposal. Inspectors may circulate information among operators of facilities on the technologies that could enable them to meet the standards, but in no way is a specific process imposed.

The decision to set a BAT is based on the performance of existing technologies. It is also done on a case-by-case basis : there is no formal procedure that links the adoption of a BAT to how widespread its use is in the industry. Theoretically, "available" is construed as meaning "available world-wide". Yet BAT most often refers to technologies developed in France and the EC in general. The word *"technique"* in *meilleure technique disponible* covers some wider notions than simply technology: costs considerations (*d'un coût économiquement acceptable* = BATNEEC), source prevention (so-called "clean technologies" as opposed to end-of-pipe technologies). But these are interpretations specific to France, they are not static definitions.

<u>EQS</u> **Stages 2b-4b**

EQOs for water do not have binding force. The first law on water was adopted in the mid-60s. A new law on water was adopted in 1992. Before the 1992 Law on Water, EQOs for water were simply indicative, not binding. EQOs are dependent on the actual quality of the media. The ultimate objective is to have type 1-A waters (classe 1 -A, the best one) everywhere in the country. Depending on the situation of a body of water, EQOs are the same.

EQOs for air are binding because they are defined through decrees (since 1991 only; prior to that date, air EQOs were set by *circulaires* and were thus not binding). The same air quality (e.g same minimum thresholds) is mandated throughout the country by EC directives on air quality. However, some regions or sites (especially those that are affected by pollution) have set for themselves precise objectives in terms of reduction of the pollution load within a certain time schedule. Thus the values set by the directive have to be complied with. Yet regions can opt to go beyond those values and aim at the typically more stringent objectives advocated by the WHO. No legislation at the national level sets any objective in terms of pollution reduction. Regional and local governments may (most often, industrialised basins such as Fos-Etang de Berre, Rouen-Le Havre and large urban areas such as Lyon, Grenoble). Wastes standards are expressed as discharge requirements (quantities of wastes disposed of).

Some discussions with health professions are organised when setting EQOs (e.g. benzene) otherwise, EQOs are just transposition of WHO directives into EQOs, so the debate with health people is limited.

Water agencies *(agences de l'eau)* have a say in the elaboration of the EQOs for water at the basin level (approved by the *comités de bassin)* but not for the BAT standards.

When the EQO is far from being breached in a region, BAT will still not be relaxed. Once a BAT has been set by national law, the standard cannot be revised downward, whatever the circumstances. If there is no national law on BAT (e.g only non-binding *circulaires),* it will be easier for operators of facilities to strike an ad-hoc agreement locally with the *Inspection.*

When an EQO is or is about to be breached in a given region: there is no formal (regulatory) mechanism according to which authorisation for new facilities are denied or granted on conditions that the pollution reduction burden be borne by all, including the existing facilities. Yet, the *Inspection des Installations Classées* tries to do just that in practice. As regards water, the new law provides for a distribution of water uses *(répartition des usages de l'eau),* especially for water abstraction within the area of a basin. Once the water use quotas have been reached and that a new facility wants to settle in that basin, there will be an obligation for the authorisation to be denied or for the quotas to be revised throughout the basin. This system is applicable only to water abstraction quotas and not to discharges of pollutants to water or into the atmosphere. The fact that there is no formal national mechanism for distributing the pollution reduction effort does not signify that nothing can be done. The *préfet* may deny an authorisation on the ground that an EQO would be breached or further aggravated should a new facility be allowed to discharge into the environment in that region. Usually, a negotiation is organised at the local level to try to reach an agreement with existing facilities on the sharing of the pollution reduction effort. Some local bodies (the *Secrétariats Permanents de la Prévention des Pollutions et des Risques* [S3PI]) have been put in place for the area-wide management of pollution from multiple industrial sources. Representatives of industry, elected officials, public administrations, environmental protection organisations, the news media and expert groups participate in these local commissions. There are eight such commissions centred around heavily industrialised areas such as the area of Fos-Berre and the estuaries of the Seine and Loire rivers.

Permitting **Stage 5**

Industrial or agricultural installations likely to pose some risk and cause pollution or nuisances are subject to the legal provisions concerning installations classified for the protection of the environment. Those installations posing relatively limited pollution risks must simply make a declaration before the *préfet* (prefect, i.e. the representative of the national government in each of the 96 metropolitan *départements*). The prefect prescribes only general requirements. Some 500 000 installations are subject to a declaration, with 10 000 new installations each year.

Installations posing significant risks and generating substantial pollution and nuisances must obtain an authorisation from the prefect after an extensive procedure (public inquiry, consultation with

locally elected officials and relevant institutions), the result of which is the prescription of specific requirements. Some 68 000 installations are subject to the authorisation procedure, with 3 000 new authorisations each year (new installations or extensions). The prefects issue an additional 1 500 orders each year for the prescription of requirements to existing installations.

Locally, the *préfets* decide to grant or deny emission authorisations (on the basis of the national technical instructions) but they cannot define/change the substance of the requirements. Sometimes, they may enter into informal negotiations with local industrialists who complain about the stringency of the requirements. The Prefect may impose more stringent regulations than those applicable at the national level. In fact, France has a two-tiered system of negotiation with the industrial sectors : first when national legislation is being drafted (e.g. inclusion of a new industrial sector under the provisions of the 1976 law or adoption of more stringent effluent limits); second when a particular industrialist is negotiating the authorisation of a particular plant at the local level. The regional directorates for industry, research and environment (DRIRE : *Directions régionales de l'industrie et de la recherche sur l'environnement)* carry out inspections on classified installations under the Prefect's authority and provide technical assistance.

The *Inspection des Installations Classées* has also an important role in deciding whether existing facilities should be ruled by the new standards. Local governments have some role in the determination of whether or not to grant an authorisation (through the *conseils départementaux d'hygiène* which issue opinions on the applications). The level of emissions for existing plants are regulated by ministerial orders *(arrêtés ministeriels),* e.g. : within the next five years, all existing installations must comply with this given level of emissions (setting BAT for existing facilities). Depending on the type of sector that is regulated, some industries are regulated for new installations and not for existing installations. In general, there is thus local flexibility in applying BAT to existing facilities (the BAT that is applied to new installations). The Inspector *(Inspecteur des Installations Classées)* will decide whether BAT for new facilities can be transposed to existing ones.

There are no distinctions of age of regulated facilities. Usually, when existing facilities come under the jurisdiction of a ministerial order, all of them are included. There may be different BAT depending on the size of facilities, depending on the stream of pollutants that finds its way into the environment. Above a certain threshold, BAT becomes more stringent. When a BAT has been set for existing facilities at the national level, there are no exemptions. Yet there are numerous industrial sectors for which existing facilities have not been subject to a national BAT regulation. Thus, every case is a different negotiation, a case-by-case procedure.

Standards imposed in foreign countries are also taken into account during the negotiation that take place between the regulators and the regulated sectors. Negotiations are handled at the level of a specific economic sector, as narrowly defined as possible.

NGOs always have a formal say in the consultation process (they are represented when the draft laws are submitted to the *conseil supérieur des installations classées and conseils départementaux d'hygiene).* In addition, some informal negotiations take place.

Compliance deadlines are more or less stringent depending on the magnitude of the pollution problem. The minimum deadline is defined at the national level, earlier deadlines are imposed locally.

Each facility is subject to an authorisation to operate *(arrêté d'autorisation)* issued by the *préfet.* Each is thus different. In fact, the negotiation process is crucial for it determines the discharge criteria on which the facility is obliged by law to operate.

There is no specific period of time before which a reauthorisation process has to be instigated. It is an ongoing process. The longest time period during which facilities may be allowed to operate without a reauthorisation is usually ten years. Most often, however, the interval is significantly shorter. The biggest and most sensitive facilities are constantly under investigation. When modifications are introduced to an authorisation, they are not necessarily comprehensive (i.e. they do not necessarily cover all media; a modification can be introduced that deals with water only).

Energy and raw materials efficiency is not really taken into account except that some joint texts have been devised with the energy people (on this matter, see *arrêté du 1er mars 1993 relatif aux prélèvements et à la consommation d'eau ainsi qu'aux rejets de toute nature des installations classées pour la protection de l'environnement soumises à autorisation).* Since energy efficiency is a means of reducing pollution, it is de facto included. Some requirements are included to that effect (water recycling processes, accounting and minimisation of water inputs).

Since the 1976 Law, integrated pollution control has been the norm. For instance, when deciding on a BAT for air emission, the generation of waste by that same technology will also be considered. The aim is to balance the impact between air emissions, water effluents, generation of wastes and noise disturbances.

In France, all the data on industrial discharges are available to the public. Locally, the *conseils départementaux d'hygiène* compile data on discharges and the same is done at the national level for the most significant (firm-specific) industrial emissions to air and water, a list of polluted sites, a list of those facilities that have breached their authorisation orders, etc.

<u>Economic considerations</u> **Factor A**

Economic costs are mainly microeconomic costs (e.g. influence of BAT on cost per ton of output ...) Cost evaluation are done on a case-by-case basis. No macroeconomic costs are taken into account.

<u>Monitoring and Inspection</u> **Stage 7**

Monitoring is not undertaken by government institutions. It is done by industrialists themselves on the one hand *(auto-surveillance),* and institutes that have signed an agreement with the government and that perform surprise tests at the regulated facilities on the other.

Aids are granted to operators of water treatment facilities in the form of a mutual fund that is financed through a system of "water levies" *(redevances).* Those aids are aimed at helping

facilities comply with the requirements. An air pollution tax is assessed on facilities that discharge into the atmosphere (and aids are granted to help them comply with the directives on air pollution). Technical assistance is provided by the *Inspection*. Tax incentives are also granted in the form of accelerated depreciation allowances for pollution reducing and energy-saving equipment.

Taxes on pollution discharges to water: either a lump sum tax or "pay-as-you-pollute" taxes (depending on the size of the facilities : for the smallest facilities, the amount of discharge cannot be precisely gauged so a lump sum tax is charged; for the bigger facilities, taxation is progressive). Tax for discharges to the air: *taxe parafiscale sur la pollution de l'air*, only 1000 companies in France are subject to that tax (beyond a set, relatively high, threshold of emission to the air). There is no link at all between the taxes on pollution and the emission standards, so that a company cannot choose to pay a tax rather than complying with a discharge standard. Thus, a water company that solicits an aid from the mutual fund to help it comply with the standards will not be treated differently from a company that asks for aid in order to upgrade its emission performance without being forced to it by law. Yet 90% of the aids that are solicited stem from administrative pressures to comply with the standards. The more a technology contributes to pollution abatement and the more innovative it is, the greater will be the amount of the aids.

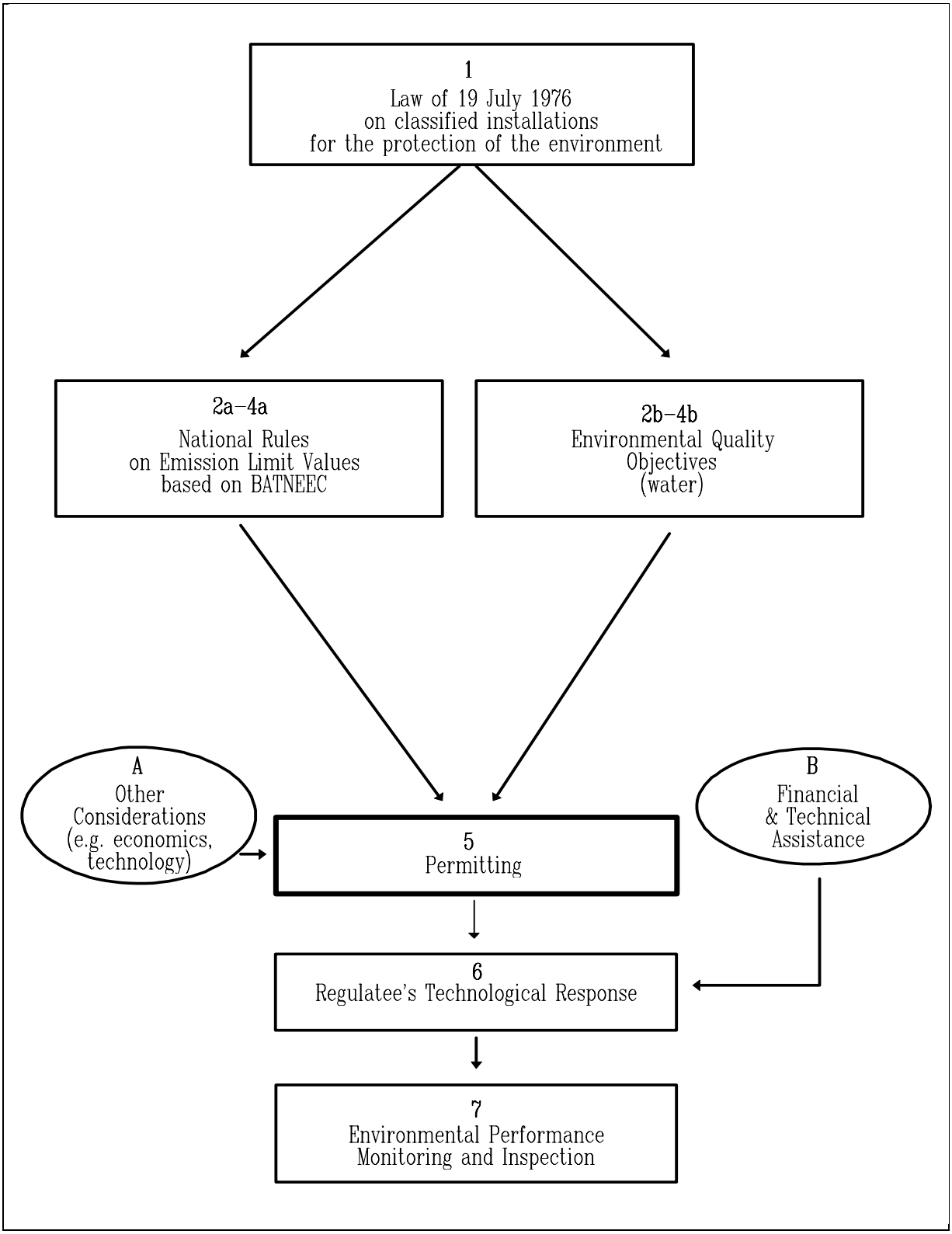


Figure 7 : France

GERMANY

Regulatory framework **Bund/Länder**

Germany is a federal state comprising sixteen *Länder* (states or provinces). The Constitution (the Basic Law) sets out the division of legislative competencies between the *Bund* and the L*ander*. Roughly spoken, the Bund has the competence for more general affairs affecting the entire country. As a consequence, the main legislation is issued by the Bund. But the Länder can also influence the Bund legislation through the Bundesrat (Federal Council). The members of this legislative body are representatives of the Länder.

The implementation of federal environmental protection laws is the responsibility of the *Länder*. Through the joint *Federal-Länder* working committees, the *Länder* have a say in the development of the federal standards, of which they are responsible for the execution.

In the field of air management, the general legislation as well as the main implementing regulation contain requirements primary in terms of BAT and additional EQSs. Regarding water pollution control, BAT standards are promulgated at the federal level. The Länder governments have the authority to establish distinct Environmental Quality Standards, although quality targets for surface waters have been issued by a joint working group of the federation and the Länder.

Permit requirements play a central role in environmental control. These permits are based on legislation and regulations passed by the federal government and delivered by the Länder. The permits control emissions to the air, water and landfills.

Since 15 November 1994, the German Basic Law contains some constitutional principles related to the protection of the environment. According to the *Grundgesetz*, the state has to protect the natural foundations of life.

BAT **Stage 3**

In German law, "state of the art" (*Stand der Technik*) constitutes the basis for establishing emission limit values.

Air

Pursuant to the 1974 *Bundesimmissionschutzgesetz* (Federal Immission Control Act), installations that are of particular importance for the environment are required to obtain a license in order to operate. The application of the best available technology for emission reduction is a binding requirement for these installations. By way of definition, the Act stipulates that:

> *State of the art, as used herein shall mean the state of development of advanced processes, of facilities or of modes of operation which is deemed to indicate the practical suitability of particular technique for restricting emission levels. When determining the state of the art, special consideration shall be given to comparable processes, facilities and modes of operation which have been successfully proved in practical operation* (Article 3, paragraph 6).

For the definition of state-of-the-art technologies, comparative procedures, installations and operational modes that have been tried and tested successfully should be used. As regards availability, it is sufficient that the technique has been successfully used and proved at comparable facilities.

The Federal Immission Control Act requires federal authorities to (a) issue ordinances identifying the types of facilities which are subject to licensing; (b) set licensing requirements for those facilities; and (c) impose emission limit values and technical control requirements for all facilities, whether licensed or non-licensed. The Länder are expected to develop air pollution abatement plans for those areas designated as investigation or smog areas.

There is no need to distinguish between hazardous and impairing/molesting impacts on the environment. According to article 5, paragraph 1, of the Federal Immission Control Act, BAT ids to be applied to both hazardous and impairing/molesting impacts on the environment. It is not a matter of classification of the substances themselves but of their impact on the environment.

The Federal Immission Control Act is implemented through a series of ordinances and regulations. The Technical Instruction on Air Quality Control (*TA Luft*, or TI Air), for instance, establishes "best available" control technology requirements and emission limits specific to individual industries (e.g refineries, iron and steel mills, cement factories, fuel storage facilities and chemical factories). Standards are binding requirements set for the individual installations. In addition to imposing emission limit values corresponding to state-of-the-art technologies, the TI Air seeks to encourage pollution prevention, recycling and reuse of waste gases and energy efficiency in production processes.

The Ordinance on Large Combustion Plants establishes strict BAT-based emission limit values for a number of air pollutants originating from the operation of power plants.

(In the illustrative diagram, only the TI Air and the Ordinance on Large Combustion Plants are given as examples. Other ordinances apply to licensed and non-licensed installations, such as the Ordinance on Licensed Facilities, the Ordinance on Waste Incineration and the Ordinance on Small Combustion Installations. More than twenty ordinances implement the requirements of the Federal Immission Control Act.)

Water

The 1986 Federal Water Management Act provides the main legal framework for the protection of surface and ground waters. According to this Act, a permission for discharging waste water shall only be granted if the load of noxious substances of waste water is kept as low as possible

according to the generally acknowledged rules of technology. All emissions of waste water must be purified prior to their discharge according to minimum requirements ("generally acknowledged rules" [GART] or "best management practices" [BMP]). In practice, GART is decisive. If the waste water contains hazardous substances, it must undergo a treatment corresponding to the level of the Best Available Technology (state of the art). BAT sets higher standards than GART but German authorities are working on a modification of the Federal Water Management Act in order to make BAT applicable to both hazardous and noxious substances. There is no official definition of BAT for water. Instead, regulators have used the definition contained in the Federal Immission Control Act. Waste management authorities also use BAT as it is defined in the *Bundesimmissionschutzgesetz*.

The water protection legislation is implemented through the Ordinance on the Industrial Sources of Water and through general administrative regulations concerning minimum requirements to be met by discharges everywhere in Germany, irrespective of the quality of the water in which the waste water is discharged (these are emission standards differentiated according to industrial sectors).

EQS **Stages 2b-3b**

The emission limit standards are complemented by the adoption of "immission values" (environmental quality standards). Environmental quality standards for water are established by the Länder and are non-binding. Environmental quality standards for the protection of the atmosphere are set at the federal level.

Air

The Federal Immission Control Act stipulates that environmental quality standards ("immission values") for the atmosphere have to be established and complied with. Article 3, paragraph 2 of the Act provides a definition thereof:

> *Immission as used herein shall be air pollution, noise, vibration, light, heat, radiation and similar effects on the environment which affect human beings, animals and plants, the soil, the water, the atmosphere as well as cultural assets and other material goods*.

Water

There is no federal requirement to establish environmental quality standards for the aquatic environment. It is the responsibility of each of the Länder to set their own ambient quality standards for water according to the local situation and the use of the water. In particular, it is in the discretion of the competent water boards to object to the granting of a permit for waste water discharge if the quality of the receiving water would be negatively influenced. Recently, however, the federation (*Bund*) and the federated states (*Länder*) have been working together on a series of very stringent, unofficial, harmonised standards for the quality of surface waters designed to harmonise the EQSs. These targets are not binding yet as they are still under examination.

Emission limit values (ELVs) **Stage 4a**

Emission limit values are based on the precautionary principle and hence on the decision concerning the choice of the best available technology.

Air

ELVs are established in the TI Air and other regulations and ordinances implementing the Federal Immission Control Act. They are set differently according to the industrial sector concerned.

Water

ELVs are contained in the administrative regulations and orders.

Permitting **Stage 5**

In Germany, the implementation of federal environmental protection laws is the responsibility of the Länder. Through the joint Federal-Länder working committees and the Bundesrat, the Länder have a say in the development and adoption of the federal standards.

In general, permits are issued for emissions to air and water. The limit for discharge to air also comprises an obligation to avoid and recycle solid waste. These separate permits are all issued pursuant to various legislative requirements, (i.e., water legislation, solid waste legislation and air pollution control legislation). In Germany, there is currently a trend toward permits that incorporate all environmental media concerned, pursuant to federal environmental protection legislation.

According to the precautionary principle inscribed in German environmental law, permits are issued only if the facility complies with general emission limit values, which are determined by the state of the art.

Air

In the case of air management, each facility has to comply with emission limit values for a large number of substances covered by the federal regulations *TA Luft*. Also they have to model the dispersion of the pollution that will be generated and include it in the broader emission pattern, taking into account the contribution from other sources. The general regulatory limits under the *TA Luft* are applied as minimum requirements. However, more stringent requirements may be set based on the results of air dispersion models which calculate the ambient concentrations of pollutants. Relevant to these ambient air quality objectives have been established for nine substances under the *TA Luft*.

Applicants have to measure the quality of the environment in the area in which they want to locate or operate. The results of the ambient air quality measurements and the dispersion models are used as a basis for the operating facility's permit requirements. In cases where the models show an air quality value laid down in the *TA Luft* being breached, more stringent requirements than those in the general regulations are applied.

The emission limit values are transcribed into the operating permits. Facilities have to measure the quality of the environment of the area in which they want to locate and operate. They have to model the pollution that they will generate and include it into the broader immission pattern. If the environmental quality is breached, the facility must use further control measures.

Water

In the case of water management, approval has to be sought from the *Länder* authorities for any discharge into the aquatic environment. Each discharge, wherever it is located, as a minimum requirement, has to comply with discharge standards set for that type of industrial operation. Federal Regulations have been passed covering about 50 types of industrial operations. Standards set in federal regulations are applied as minimum requirements, and stricter conditions being imposed in individual permits if conditions of the receiving waters require it. These decisions are based on results of water quality modelling.

As a general principle, permit requirements for existing and new facilities are the same. However, in the case of some types of facilities, the *TA Luft* makes a distinction between emission limits values for new and existing sources based on special technical conditions. There is also a difference in the periods in which existing facilities have to be brought into compliance compared to new facilities. In Western Germany, the requirements for existing facilities have been implemented since 1994. With respect to the Eastern part of Germany, special regulations apply, with respect to existing facilities, the requirements of the *TA Luft* have to be implemented before 1996, or, in special case before 2000. For new plants, the requirements have to be implemented at once.

<u>Economic considerations</u> **Factor A**

Economic considerations should not be taken into account as independent aspects. They are examined at the (upstream) legislative stage. For instance, economic evaluations were carried out while the TA Luft was elaborated. The industry had the opportunity to bring forward arguments concerning economic aspects of the proposed measures. Where necessary, the proposed measures were modified in order to incorporate the economic consequences. The advantage of this procedure is that economic aspects do not need to be reconsidered in each single authorisation procedure.

Differences have to be made between immission values for the protection against health hazards, which must not be exceeded in any case, and immission (guide) values for the protection against considerable disadvantages and substantial impairments which, after balancing of other interests, may possibly be exceeded.

Monitoring and Inspection **Stage 7**

State authorities are also entitled to set penalties, impose sanctions and fines, monitor environmental quality and designate investigation and smog areas. There are no measures of self-monitoring or self-inspection totally replacing public control mechanisms. Nonetheless, there is a number of accompanying self-inspection patterns being performed by the concerned enterprises.

In any case of danger or suspected noxious impact on the environment caused by a facility (licensed or non-licensed) according to article 26 of the Federal Immission Control Act, the authority may oblige the operator to charge a competent agency (defined by the concerned ministries of the Länder) with researching the origin, nature and extent of emissions and immissions.

Article 29 of the Federal Immission Control Act stipulates that the competent authority may oblige an operator to charge an external private expert with carrying out certain investigations concerning technological security or so-shaped documents.

Another instrument of self-control is the establishment of so-called plant commissioners for air management (article 53 of the Federal Immission Control Act), water management (article 21 of the Federal Water Management Act) and waste management (article 11 of the Federal Waste Management Act). The plant commissioner is a company employee whose task is to survey the observation of public regulations and requirements by regular control of the technical equipment. What is more, the commissioner's point of view is to be taken into account within management decisions on behalf of immission, water or waste.

Finally, Council Regulation (EEC) No. 1836/93 of 29 June 1993 allowing voluntary participation by companies in the industrial sector in a community eco-management and audit scheme. The regulation claims to be directly applicable within all member countries of the EEC. It provides a common system of internal facility examinations based on the voluntary participation of industry. The environment-concerned examinations are performed by external and independent commissioners of the enterprise or by external persons and organisations. The aim is to obtain a so-called environmental certificate.

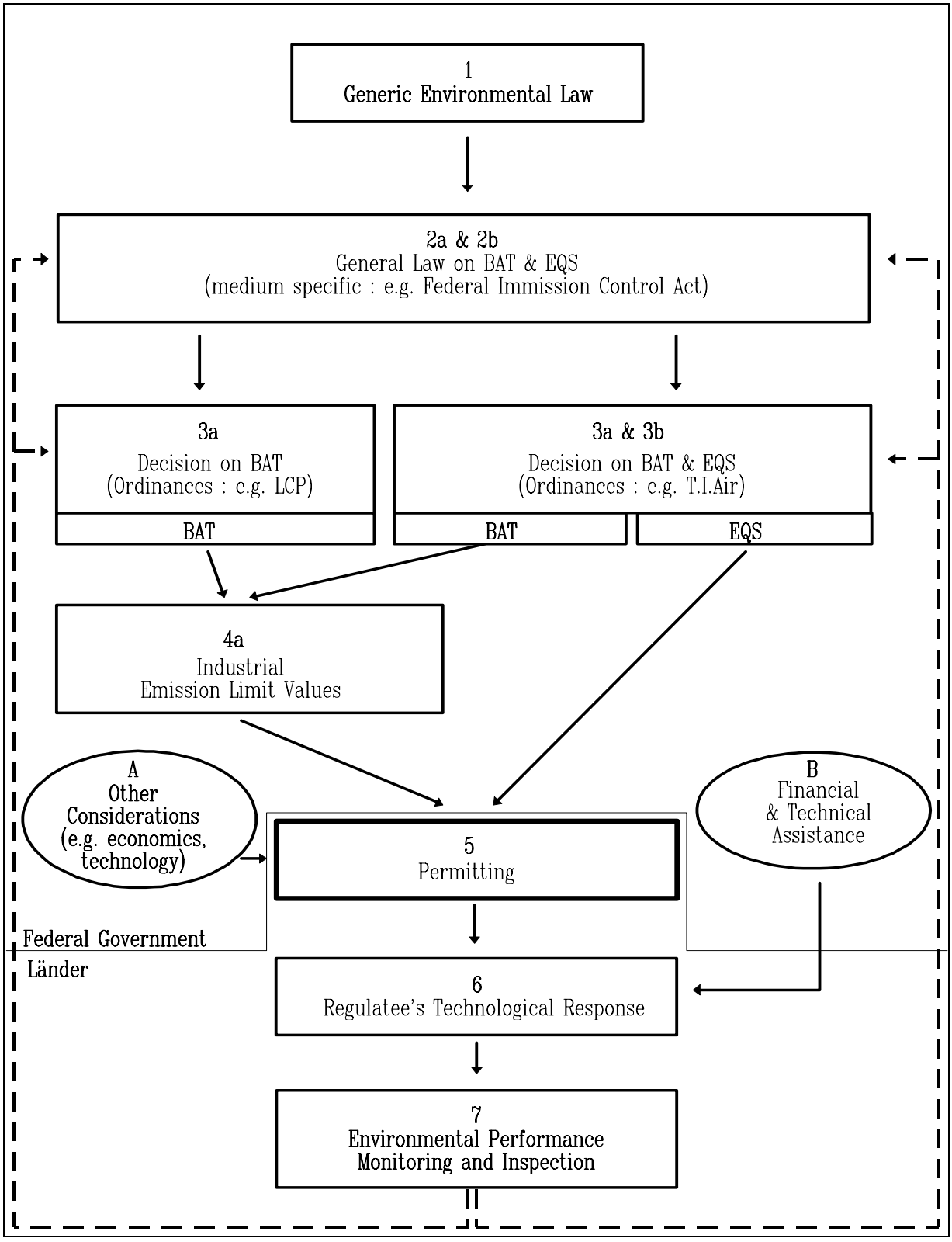


Figure 8 : Germany (air)

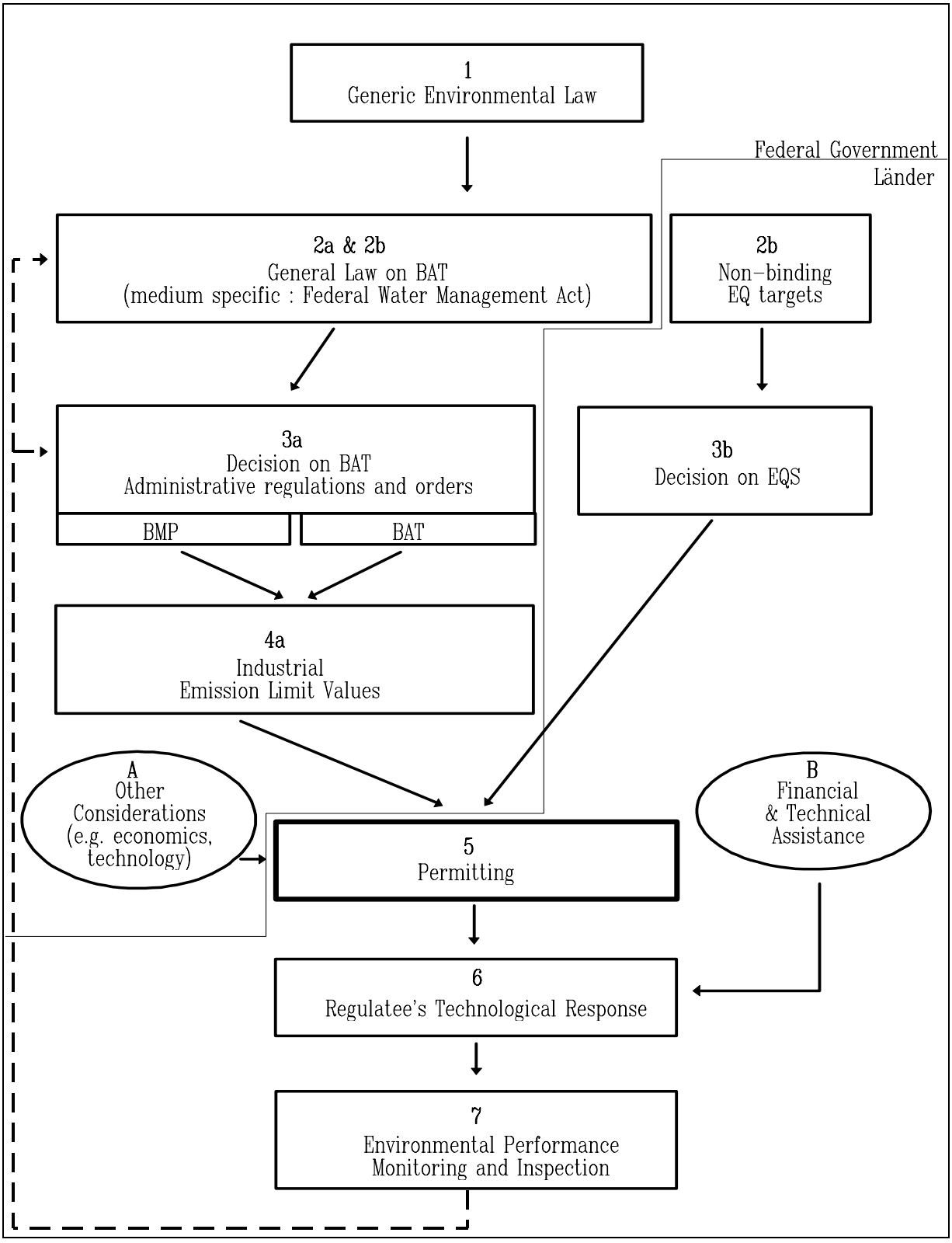


Figure 9 : Germany (water)

HUNGARY

Regulatory framework **National/Regional**
Stage 1-2

The Ministry of Environment and Regional Policy (MERP) has jurisdiction over environmental matters with the exception of some water issues which are primarily administered by the Ministry of Transport, Telecommunications and Water Management (MTTWM). The quality of Hungarian waters is under the authority of MERP while water quantity and consumption management is governed by MTTWM. Other government bodies such as the Ministry of Welfare, the Ministry of Trade and Industry and the Ministry of Agriculture may be involved in the environmental policy process.

The enforcement agency is the National Environmental Inspectorate (NEI) which is under the authority of MERP and has 12 twelve regional branches (Regional Environmental Inspectorates or REIs). The protection of the environment (air, water, waste, noise , vibration) is the primary responsibility of NEI and the REIs.

The Hungarian constitution establishes the right to a healthy environment. The Hungarian state has the responsibility for accomplishing such a goal, in part to ensure that the health of the population is not threatened.

In 1995, the Act on the General Rules of Environmental Protection (1995 AGREP) was adopted, replacing the 1976 Environment Act. Similarly, the 1995 Water Act has replaced the previous water legislation dating back from 1964 (the 1964 Water Act). However, since these laws are quite recent, most of the current pollution control instruments have been adopted under the 1976 and 1964 acts and their subsidiary legislation.

The 1976 Environment Act established in broad terms the general duty to protect the environment from pollution and other deleterious effects. Similarly, the 1964 Water Act dealt with the use of water resources. The 1995 AGREP, however, is concerned with the achievement of sustainable development and therefore provides a more detailed framework for environmental protection. In a more practical way, the AGREP lays out the responsibilities and procedures for pollution prevention and control.

BAT **Stage 2**

The 1995 AGREP stipulates that pollution must be prevented, environmental load must be minimised and environmental damage must be precluded. The precautionary principle is a central feature of the AGREP and is expressed as general requirements to avoid the generation of waste and aim at recycling. To do so, the “most efficient alternative” (MEA) must be used when operating

environmentally harmful activities. The MEA is broadly similar to the BAT requirement included in the European Union's IPPC directive. The MEA is defined as:

> *the activity involving the most benign utilisation of the environment attainable given the environmental, technical and economic conditions.*
> AGREP, Section 4(v)

The MEA requirement contained in the 1995 AGREP provides for integrated (multimedia) approaches :

> *Every environmental component shall be protected in itself and in unity with the other components, taking into consideration the interrelationships thereof and regulating utilisation and loading accordingly.*
> AGREP, Section 13(1)

The concept of Most Efficient Option (MEO) is quite similar to the MEA. It is a general requirement designed to prevent environmental pollution, minimise loadings to and uses of the environment and preclude environmental damage. The MEO principle is similar to BAT in the European Union's IPPC directive and the United Kingdom's BPEO.

EQS **Stage 3b4b**

Air

There are different air quality standards according to the use of an area (residential vs. industrial). The air quality standards are set in Order No 21/1986 on the Protection of Clean Air (1986). In addition, air quality criteria for 34 substances are stipulated as guidelines (Standard No MSZ 21854-1990 Requirements for Ambient Air).

Water

The waters of an area are listed under six different categories, depending on their uses : prominent water quality areas; sources of drinking water and recreation; industrial areas; sources of irrigation, non-priority areas on the Danube and Tisza rivers, and other water bodies. This classification governs the various discharge standards.

Emission Limit Values (ELVs) **Stage 3a-4a**

Air

Order No 21/1986 on the Protection of Clean Air specifies emission control requirements for different regions. A regulation (No 4/1986) on the order lays out the methodology for determining ELVs.

Water

Order No 3/1984 on Limit Values for the Discharge of Communal and Industrial Waste Waters to Surface Waters and Order No 4/1984 on Limit Values for the Discharge of Communal and Industrial Waste Waters to Public Sewers set discharge limit values for 32 substances and parameters. The stringency of the limit values is dependent on the type of water in the receiving environment.

Permitting **Stage 5**

The Act on the General Rules of Environmental Protection lays down the obligation and conditions for the official licensing of uses of the environment:

> *(1) Use of the environment can be commenced and pursued after one of the following documents has become legally binding:*
>
> *(a) a license from the environmental protection authority: "environmental license" [...] issued by the Inspectorate, prior to other permissions, in connection with the activity in question or as a condition thereof, for activities subject to environmental impact assessment,*
> *(b) a license for operation from the environmental protection authority: "environmental license for operation" [...] issued by the Inspectorate, for activities that require an environmental examination, and*
> *(c) a decision issued by an inspectorate or a local environmental authority [...] or a decision issued by another authority in consideration of the expert opinion of the latter, in other cases - stipulated in separate statutes - that do not fall within the scope of clauses a) and b).*
> [...]
> Act on the General Rules of Environmental Protection, Section 66

Permittable uses of the environment are defined by government decree.

The National and Regional Environmental Inspectorates have the primary responsibility for issuing licenses for industrial plants. The regional inspectorates deliver the permits while the national inspectorate handles possible appeals. The Regional Water Authorities issue permits concerning water issues (use, pollution). The Regional Environmental Inspectorates act as expert authorities (e.g. for setting discharge limits) for the delivery of water permits.

Under the provisions of the 1995 AGREP, there are two types of environmental licenses: environmental licenses are delivered after an EIA has been conducted; environmental operating license are granted once an environmental audit has been performed.

The 1993 Decree 86/1993 for Provisional Regulation of the Assessment of the Environmental Impact of Certain Activities requires that an environmental impact assessment be performed for a number of new activities, listed in an appendix, as well as significant modifications to existing activities. The EIA addresses environmental releases, the use of resources (materials, energy, land, water) and potential environmental impacts (including accidents). A detailed assessment may be required in some cases (for example, mandating the calculation of environmental impact, the assessment of the selected technology with reference to the MEA principle, monitoring methods, etc.). The REI delivers or denies an "environmental license" after the EIA has been performed, a public hearing has been held and all the appropriate authorities have been consulted (e.g. public health and local governments). An environmental license contains operation conditions and is delivered for a given period of validity.

According to the 1995 AGREP, existing activities must undergo an environmental audit before being granted a license. An audit must be conducted whenever an activity has an effect on the environment, which is a very broad and ambiguous provision. On the basis of a notification from the operator that a process has changed, the REI decides whether an audit is needed and the permit needs to be modified. The audit covers the technologies and techniques used by an installation, the potential impact on the environment (from normal operation and accidental releases), the flow of materials and waste in the process, risk management, prevention of environmental degradation and provision for decommissioning and site restoration. The REI delivers or denies an "environmental operating license" after the audit has been performed and all the appropriate authorities have been consulted (e.g. public health and local governments). An environmental operating license contains operation conditions and is delivered for a given period of validity.

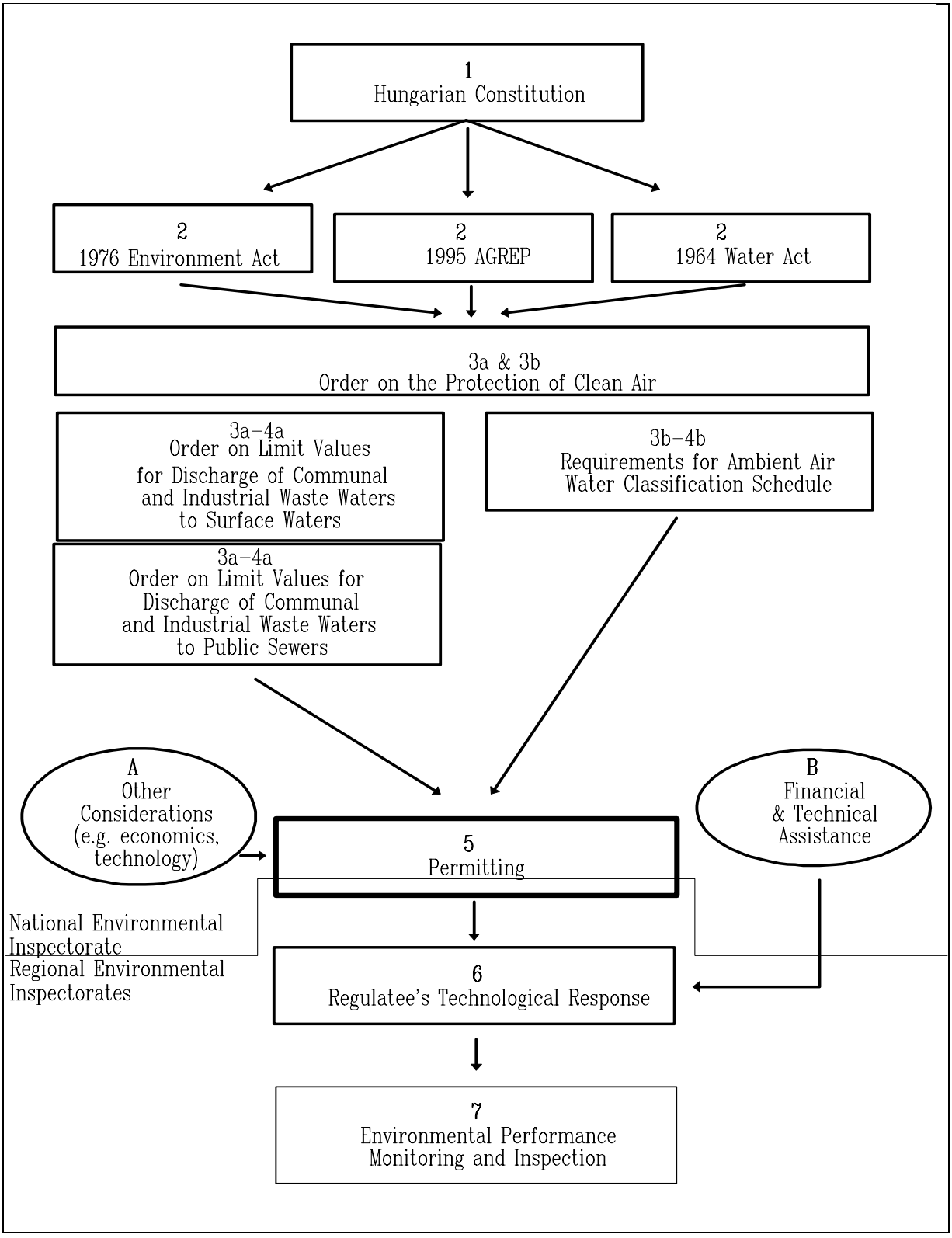


Figure 10 : Hungary

ITALY

Regulatory framework **Regional/provincial/local**
Stage 1-2a

The protection of the environment is provided for in articles 9 and 32 of the 1947 Italian Constitution. In addition, several media-specific acts of Parliament elaborate on these constitutional principles. The Clean Air Law (Law 615 of 13 July 1966) offers guidelines for air pollution control and prevention. Along with its implementing legislation, the Air Pollution Law designates the levels of government responsible for setting standards, permitting and monitoring emissions for various types of facilities. The Water Pollution Control Law ("Merli" Law) regulates the discharge of industrial and municipal effluent into surface and ground waters.

In addition, a significant proportion of the Italian environmental legislation is a transcription of European Community directives, mostly in the field of ambient quality standards and objectives.

Since 1978, the regions have been entrusted the responsibility for environmental and public health policies. However, the outline of the Italian environmental policy (both legislation and execution) is devised and formulated at the national level. The Ministry of the Environment sets the requirements of the environmental policy and prepares legislation, including that which is required for the incorporation of EC directives into national legislation. Regional, provincial, and even local governments have some latitude in the construction and implementation of the policies (e.g. permitting and enforcement, although some permitting procedures -for power stations and refineries- are undertaken at the level of the central government). The central government generally reserves the right to step in if it deems that the policies are not conducted appropriately at the regional level.

In 1993, a National Environmental Protection Agency was created in Italy. Its role, however, is limited to the promotion of environmental standards, the collection and dissemination of information, and monitoring.

BAT **Stage 2a-4a**

Air

Atmospheric emissions from industrial sources are regulated under the 1988 Industrial Air Pollution Law (Decree DPR 203). The regions have the authority to set emission limits based on Best Available Technology. The regions have to observe national emission limits and guidelines. Decree 203 defines the concept of Best Available Technology as:

> *the technological system, suitably verified and tested, which enables to control or reduce emissions to a level acceptable for the protection of health and the environment, provided that the application of such measures does not entail excessive costs.*

Decree DM 12 July 1990 on the limitation of emissions from *existing* industrial plants stipulates that the limits and guidelines have to be set in accordance with the best available technologies. This law also specifies the abatement technologies available for the regulated facilities. BAT may be prescribed as treatment technologies, performance standards or mass emissions per unit of production.

Decree DM 1 February 1991 on the limitation of emissions from new sources provides limit values that are based on standards afforded by the best industrial production and fume abatement technologies. In addition, the best technologies for achieving further reductions in the emissions of highly toxic chemicals are to be identified. It is the responsibility of the regional authorities to define the limits for new sources. However, Decree 1 February 1991 is not in force because the draft proposed by the Ministry of Environment has not been agreed by the Ministry of Industry. New plants are therefore authorised on a case-by-case basis.

In addition, the relevant EC directives are transcribed into national Italian legislation through a series of decrees. For instance, DM 8 May 1989 corresponds to EC directive 88/609 on Limits on emissions from large industrial plants.

In general, BAT criteria are updated to incorporate the latest developments in the relevant technologies.

Water

The 1976 Water Pollution Control Law (the "Merli" Law) is the principal basis for the regulation of the discharge of industrial and municipal effluent into surface and ground waters. Under the Merli Law, the regions are required to prepare and administer water purification plans with consideration for, inter alia, wastewater treatment.

A series of EC directives containing provisions on effluent limitations have been transcribed into Italian legislation. Decree DPR 133 of 27 January 1992 implements EC directives 76/464, 82/176, 83/513, 84/156, 84/491, 88/347, 90/415 on industrial hazardous waste discharge into water.

Multimedia

Decree 377 on Environmental Impact Assessment (EIA, see *EQS*) requires that measures for the reduction and recovery of environmental damages (with reference to Best Available Technology) be adopted. The EIA procedure generally expresses BAT prescriptions as performance standards.

EQS **Stage 4b**

Air

Ambient quality standards are defined at the national level but may be rendered more stringent locally in the case of sensitive ecosystems and heavily polluted areas. The Industrial Air Pollution Law (Decree 203) gives the regions the authority to establish air quality limit values in specific areas.

Multimedia

Decree 377 of 10 August 1988 requires that some new facilities (listed in the decree's Annex 1) and other major modifications to existing installations be subject to an Environmental Impact Assessment (EIA) procedure. The EIA judgement is delivered by the Ministry of the Environment, after consulting the Ministry for cultural and environmental heritage and the regional government. The impacts on the environment associated with the planned facility have to be identified, for instance atmospheric emissions and immissions, the generation of waste.

Emission Limit Values (ELVs) **Stage 4a**

Air

A 1990 decree (DM 12 July 1990) imposes limitations on the emissions of atmospheric pollutants from *existing* industrial plants. The decree establishes limit values for the emission of 289 pollutants from a variety of plant types. Among others, SOx, NOx, suspended particulates, CO, carcinogenic substances, inorganic and organic substances are thus regulated. The limit values are established on the basis of the laws applied in other EC countries and the technologies available for plant remodelling.

A 1991 decree (DM 1 February 1991) establishes limits on emissions of atmospheric pollutants from *new* industrial plants. The limits provided for in this law are similar to those of Germany (TA Luft) and the United States (Clean Air Act). More stringent ELVs are placed on SO_2, NO_2 and ammonia. The limits for suspended particulates are reduced by 50% and the limits for VOCs are reduced by 35-50%. Regional authorities define the limits for the pollutant concentrations and flows present in the emissions of new industrial plants. Decree 1 February 1991 has not been enforced however (see *BAT*) and limit values are set on a case-by-case basis.

A ministerial decree of 16 January 1995 on "Technical regulations for the re-use as energy sources of residues deriving from production or consumption cycles" imposes emission limit values on air pollutants emitted from the combustion of residues.

Permitting **Stage 5**

In Italy, separate permits are required for emissions/discharges to different media. The Environmental Impact Assessment (EIA, see *EQS*) procedure is integrated however (i.e. the environment is considered as a whole entity).

Air

According to the Law on Industrial Air Pollution (Decree DPR 203), all industrial facilities must obtain a permit regardless of their type and size. Decree 203 requires permitting for new plant construction, relocation of existing installations, substantial modifications implying changes in the quality and the quantity of polluting emissions. Most are subject to licensing by the regional authorities. A few, however, like power plants and refineries, must obtain an authorisation from the national government (Ministry of Industry, subject to consent of the Ministry of Health and the Environment, and with consultation of the concerned region). Some regions have delegated the permitting responsibility to the provinces.

Applicants for permits under Decree 203 must provide information regarding the plant's production cycle, abatement technologies, the quantity and quality of the planned emissions, and the date of entry into production. Permits delivered under Decree 203 have no expiry date but have to be reissued on the basis of technological evolution or if warranted by the state of the environment. The environmental compatibility judgement issued by the Ministry of the Environment is not time-limited; licenses issued according to Decree No. 203 may be updated at any time taking into account the development of the technology and the state of the environment.

Permits are issued on a case-by-case basis. For *new* facilities, the permitting authorities have to take into account the relevant emission limit values and ensure that air pollution prevention measures are applied. For *existing* facilities, reports have to made to the relevant permitting authorities, specifying the levels of emissions, the nature and extent of the upgrade and the technology used to prevent air pollution.

Water

Permits for municipal wastewater discharges are issued by the provincial authorities. Permits for industrial wastewater discharges are administered by the municipal governments.

Economic Considerations **Factor A**

Air

Decree 203 defines Best Available Technology with the condition that it should not entail excessive costs. No official definition of what is meant by "excessive costs" has ever been issued.

However, the Constitutional Court has clarified the use of the concept "best available technology not entailing excessive costs" by Decree No. 203 as follows:

- emission limit values, to be defined by regional authorities, shall ensure the protection of human health and of the environment, apart from any consideration about costs;
- further prescriptions, stricter than general emission limit values, may be issued only if they do not imply excessive costs;
- regional authorities are not obliged to take into account costs when they define stricter emission limit values for very polluted areas (economic considerations are important in order to define timing and ways for complying to the prescriptions).

Multimedia

The Environmental Impact Assessment (EIA) procedure (see *EQS*) must include an economic evaluation of the process and abatement options. The Ministerial decision is based on Best Available Technology not entailing excessive costs and the relevant experience in other countries.

<u>Monitoring and Inspection</u> **Stage 7**

Air

Decree DPR 203 requires provinces to survey emissions according to guidelines provided by the regions. The monitoring of emissions is usually conducted by the facilities themselves. Ambient quality monitoring, however, is performed by the regional authorities. Emissions of SO_2, NOx and dust from large combustion plants and incinerators must be continuously monitored.

Water

Monitoring and record-keeping of discharges into natural waters are performed by the provincial governments. The provincial authorities also verify compliance with the standards.

Multimedia

Monitoring of environmental quality is required for installations subject to Environmental Impact Assessment (EIA) review under Decree 377.

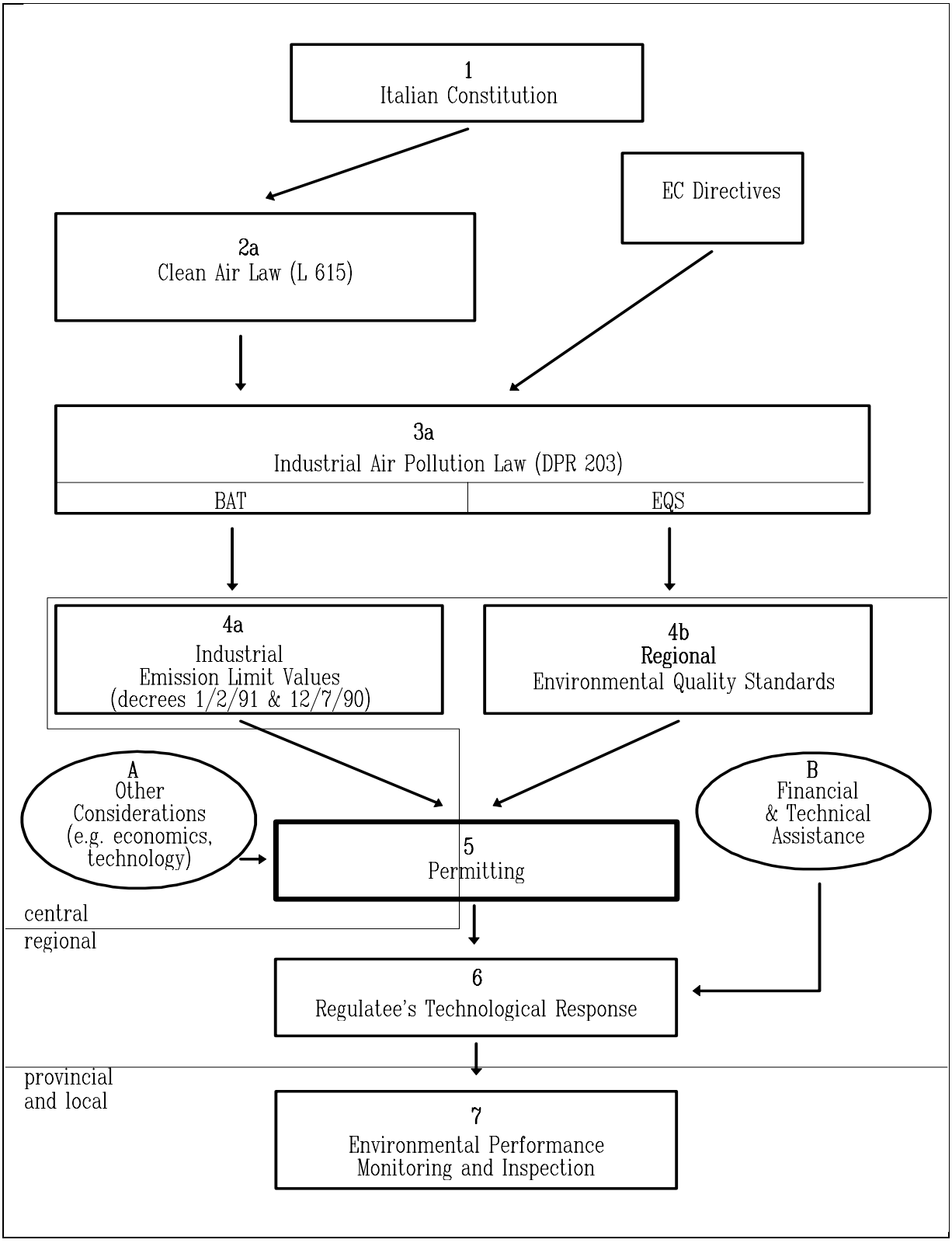


Figure 11 : Italy (air)

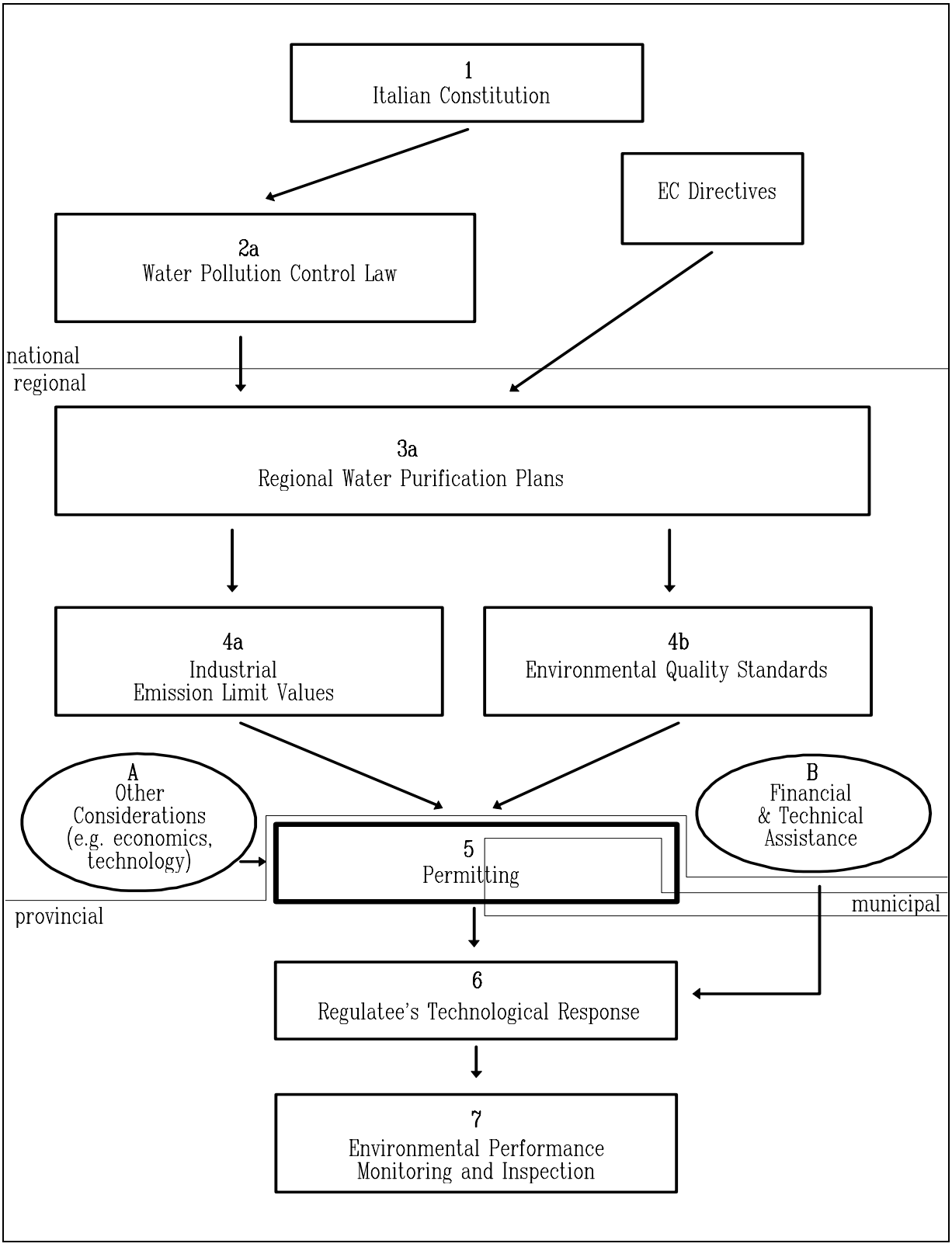


Figure 12 : Italy (water)

JAPAN

Regulatory framework **Central government/prefectures**

The Environment Agency was established in 1971. The mandate of the Environment Agency is to promote policies for pollution control, nature conservation and other environmental issues. Implementation of the environmental laws under the responsibility of the Environment Agency are principally delegated to prefectures and in some cases to municipalities. Prefectures are authorised to establish more stringent regulations for air and water pollution control than the national level. All prefectures have enacted ordinances for pollution control and 545 municipalities have local pollution control ordinances.

In the Japanese environmental regulatory system, the Prime Minister or the Director General of the Environment Agency have the authority to establish emission limit values for the pollutants at stake. As a rule, the Director General of the Environment Agency solicits the opinion of the Central Environment Council. The members of the Central Environment Council, appointed by the Prime Minister, are highly experienced experts drawn from the scientific community, from industry, from the mass media. Former government officials and representatives of consumer advocacy groups also sit on the Council. In order to facilitate the consideration of technical aspects, the Council usually establishes a technical committee composed of experts from the field of medicine, biology, physics, engineering and other related areas. The results of the deliberations by the Council are reported to the Director General of the Environment Agency.

The framework of environmental policies was established through an intensive process of adoption of legislation and implementation from the end of the 1960s through the 1970s. This process started with early laws such as the Basic Law for Environmental Pollution Control (1967) and the Air Pollution Control Law (1968). These policies were later supplemented by the enactment of 14 laws related to the environment following the *Environmental Pollution Session* in 1970. Among others, they included amendments to the Basic Law for Environmental Pollution Control, to the Air Pollution Control Law, to the Waste Disposal and Public Cleansing Law, and enactment of the Water Pollution Control Law.

The principal aim of the Basic Law for Environmental Pollution Control is to protect human health and conserve the living environment by controlling air, water, and soil pollution, noise, vibration, ground subsidence and offensive odours. Its measures include regulations on emissions, on land use and facility location, development of pollution control facilities, monitoring, research and study, and subsidies. The law also provides for planning and measures in areas of the country with serious pollution problems. Categories of facilities to which emission standards are applied have been extended, such as in the case of the control of nitrogen oxides (NO_x). Other innovative measures include examples such as the area-wide control of sulphur oxides, (SO_x). Other laws aimed at regulating the examination of hazardous chemical substances prior to production and import were adopted following accidents involving chemical poisoning (PCBs, mercury, etc.).

In the 1980s, problems such as air pollution by NO_x in urban areas and water pollution by organic materials were at the forefront of the environmental agenda. In 1982, the area-wide pollution control system was applied to reduce NO_x. The Water Pollution Control Law was amended in 1983 and the area-wide pollution control system for organic materials was adopted for Tokyo Bay, Ise Bay and the Seto Inland Sea. The Law on Special Measures for the Conservation of Lake and Reservoir Water (1984) led to the designation of important water use and to the adoption of comprehensive plans for lake restoration. Moreover, to prevent groundwater contamination, a guideline on intrusion of waste water was adopted in 1984 and was followed by an amendment to the Water Pollution Control Law (1989) to ban intrusion of waste water containing hazardous substances,

More recently, new regulations have been adopted in relation to domestic issues. Legislation was enacted to promote measures aimed at the reduction of NO_x emissions from motor vehicles in metropolitan areas, to promote appropriate management of industrial and hazardous waste and to encourage recycling and waste reduction.

BAT **(Stage 2a-4a)**

There are no systematic rules for determining the figures for emission limit, but the BAT considerations may be one of the factors in the final decision. The legislation itself contains no direction for deriving the precise figures but it requires setting national emission standards for protecting human health and the living environment. It does not provide any definition of best available technologies. No official reference whatsoever is made to BAT.

EQS **Stage 1-3b**

Environmental Quality Standards are the main instrument of environmental protection in Japan. They are introduced at the highest level of the legislation : the 1993 Basic Environment Law stipulates that:

> *With regard to the environmental conditions related to air pollution, water pollution, soil contamination and noise, the Government shall establish environmental quality standards, the maintenance of which is desirable for the protection of human health and the conservation of the living environment* (Article 16.1).

The Basic Environment Law is implemented through several media-specific pollution control laws such as the Air Pollution Control Law, the Water Pollution Control Law, the Noise Regulation Law, the Agricultural Land Soil Pollution Prevention Law. In these laws and regulations, the framework for the maintenance of media-specific EQSs is laid out.

The Environment Agency sets Environmental Quality Standards for particular substances and parameters after consultation with the Central Environment Council. Environmental Quality Standards

for the Protection of Human Health are nationally uniform standards that apply throughout the country (e.g. ambient air and water quality in public water bodies). EQSs on air, water, soil and noise pollution have already been established. EQSs are determined on the basis of the protection of the human health (23 parameters) and of the living environment (9 parameters). Those for the Conservation of the Living Environment are categorised, for instance, in terms of water usage and applied to each designated water body.

In the case of water protection, standards are set for each category (river, lake, marsh, sea areas, etc.) The water area category is designated by the Director General of the Environment Agency or prefectural governor. Standard parameters and values are set on a case-by-case basis. River waters are classified into five categories according to the object of using the water area (natural environmental protection, water supply, fisheries, industrial water, agricultural water, bathing, environmental protection). Standard values for five parameters (pH BOD, SS, DO and the number of coliform groups) are determined for each category.

Lake waters are classified into four categories according to the object of using the water area (natural environmental protection, water supply, fisheries, industrial water, agricultural water, bathing, environmental protection). Standard values for five parameters (pH, BOD, SS, DO and the number of coliform groups) are set for each category, and standard values for two parameters (total nitrogen and total phosphor) are determined from the viewpoint of eutrophication.

Sea waters are classified into three categories according to the object of using the water area (natural environmental protection, fisheries, industrial water, bathing, environmental protection). Standard values for five parameters (pH, BOD, DO, the number of colibacilluses and extracts of n-hexane) are determined for each categories, and standard values for two parameters (total nitrogen and total phosphor) are determined from the viewpoint of eutrophication.

The standards for air applied uniformly throughout Japan.

<u>Emission limit values (ELVs)</u> **Stage 4b**

The Basic Environment Law provides the legislative for the State's imposition of emission limits. According to the statute:

> *The Government shall take the following regulatory measures to prevent interference with environmental conservation:*
> *(1) Regulatory measures necessary to prevent environmental pollution, inter alia, by setting the standards with which corporations must comply regarding such activities as emission of substances causing air pollution, water pollution, soil contamination or offensive odours; generation of noise or vibration; and the taking of underground water causing ground subsidence* [...] (Article 21).

Several types of Emission Limit Values are used in Japan. The permissible emission amount of sulphur oxides from the facility (q) is determined by the Air Pollution Control Law, which is formulated by the K coefficient and the square of the stack height (He) (i.e. $q=K*10^{-3}*He^{2}$). The

Director General of the Environment Agency has the authority to set K values, which vary from one region to the next, in order to reflect the state of pollution. Also, emission limit values for other air pollutants (e.g. nitrogen oxides [NOx], soot and dust) are determined by the Director General of the Environment Agency. But each prefectural governor has the authority to implement stricter standards to meet the requirements imposed by the applicable Environment Quality Standards (EQSs). Most air ELVs are of the latter type.

The procedure is principally similar in the field of water pollution. The central government determines a minimum requirement for effluent standards. The prefectural government that deems them insufficient to ensure compliance with the relevant EQSs will strengthen the effluent standards. The discharge standards concerning hazardous pollutants apply to all facilities designated by the Water Pollution Control Law. The discharge standards for pollutants threatening the living environment (e.g. BOD, COD, suspended solids) apply to facilities discharging $50m^3$/day or more of wastewater.

When these regulations are insufficient to achieve the environmental quality standards, additional pollution reduction effort are undertaken at the regional level (see *Regional pollution prevention and control efforts*).

Regional pollution prevention and control efforts

Areas where emission limit values are insufficient to maintain the prevailing air EQS (e.g. because of density of population or concentration of industrial activity), are designated by the State as Area-wide Total Pollutant Load Control Regions. The national government decides on the geographic regions in which such programmes are to be introduced. The concerned prefectural governors have to formulate Area-wide Total Pollutant Load Reduction Plans. Each of these control plans is centred around a particular polluting substance. Emissions of nitrogen oxides, for instance, are controlled in a more stringent fashion in 3 such regions and sulphur oxides in 24. Within the designated areas, and based on scientific data, an allowable amount of total regional emission is calculated for each pollutant and distributed to each factory in the area.

There also exist Area-wide Total Pollution Load Control Programmes in large semi-closed coastal water areas under the Water Pollution Control Law. The Seto Inland Sea, Tokyo Bay and Isle Bay are designated as the water areas in which the programmes are implemented. As is the case with Air Area-wide Total Pollutant Load Reduction Plans, a holistic approach is adopted for calculating the total COD load into the designated water areas. The total pollution load standards of COD are the core of measures to reduce COD loads, which are applied to industries and public sewage treatment plants discharging $50m^3$ water per day and more. The standards set on an industry-category basis have been strengthened three times taking account of the progress of treatment technologies in order to achieve the EQSs for COD.

At the prefectural and local levels, ordinances can set stricter emission and effluent standards than those prescribed by the Air Pollution Control Law and the Water Pollution Control Law at the national level.

There are specific legislations concerning lakes, reservoirs and semi-enclosed inland seas.

<u>Permitting</u> (notification) **Stage 5**

The Air Pollution Control Law and the Water Pollution Control Law require the person who intends to install the facility under control to submit a notification to the prefectural governor.

In Japan, the issuance of permits is performed by the prefectural governments. Prefectural authorities analyse the data and information submitted by the notifier. The notification supplied by the notifier lays out the specifications of the facilities to be installed (e.g. size of boilers, height of smokestacks, etc.). Information to be submitted by the applicant for registration to the Air and Water Pollution Control Law[s] include:

- Name of the soot and smoke facility, size and capacity of the facility, amount of discharged air pollutant, air pollutant treatment method, discharge method, fuels to be used, type, quality and quantity of the material;

- In addition to the above, environmental impact assessment and pollution control agreement may require the following information: need for the new construction, production overview, soot and smoke emitting facility in the case of a new construction, process overview, situation of air pollutant release, air pollutant treatment method, air pollutant prediction and result.

The prefectural governor is authorised to order the notifier to change or abandon his/her installation plan if the governor finds that the facility is not likely to meet the emission or effluent standard.

In the case of large enterprise, such as power generation, voluntary agreements with the regulatory authorities are often entered into. In these voluntary agreements, the large enterprises commit themselves to more stringent emission limit values than those required by the laws. There are no incentives for entering into voluntary agreements. Enterprises can benefit from good reputation from the local public.

When modifying the structure of the specific facility, way of use, waste water treatment method, degree of contamination of waste water, etc., are planned, description of the planned modification must also be submitted.

Environmental protection is regulated through a media-specific approach. National standards are specified as to protect the public health and the living environment through the Air and Water Pollution Control Law. As mentioned previously, local governments have the authority to set up more severe emission or effluent standards if environmental quality standards (EQSs) are not met.

Economic considerations **Factor A, Factor B**

Economic considerations may be taken into account during the debate within the Central Environment Council. The capacity of an industrial sector to bear and respond to the anticipated costs may thus be indirectly integrated in the regulatory process. During this process, the various agencies and ministries concerned by the contemplated regulation put forward their own perspective. At this stage, permitting authorities do not have the authority to engage in negotiations with the permittee on the basis of economic considerations. Consequently, the relevant ministries provide occasional financial support to assist industries in the installation of the abatement or prevention equipment needed to meet the standards. These accompanying measures partly explain why the rate of implementation of the regulations is so high in Japan in spite of their stringent requirements.

Monitoring and Inspection **Stage 7**

Japanese laws contain provisions for monitoring. For instance:

> *The governor of the prefecture shall monitor and survey from time to time the level of air pollution*
> (Air Pollution Control Law, article 22)

Environment monitoring is conducted by prefectural governors and mayors of designated cities), and the monitoring results are made public on a periodic basis every year. In the case of air pollution, this is stipulated in the Air Pollution Control Law. The monitoring technique is formulated in a manual and is made uniform. Local monitoring stations created in the 1970s form an extensive network: approximately 1,700 stations monitor SO_2, 1,800 monitor NO_2, 500 CO and non-methane VOCs, 1,200 photochemical oxidants and 1,700 suspended particulate matter (SPM). In line with the air pollution trends, the number of stations monitoring NO_2, SPM and oxidants are still increasing. Measuring non-conventional pollutants, such as hydrogen sulphide, ambient ozone concentrations and SPM components, has become an important function of the national stations. Acid precipitation monitoring stations have been established nation-wide since 1983.

Large-scale business installations monitor themselves the environment surrounding their own facilities. The results are often not disclosed.

Monitoring results greatly influence emission standards. Since the achievement of environmental standards is the administration target, the emission standards are set up in principle so that environmental standards will be met, and monitoring results are thus very important.

In the case of water protection, local public bodies are also responsible for monitoring the quality of waters, in accordance with the Water Pollution Control Law. The techniques used are also formulated in a manual and made uniform. Prefectural governments disclose the quality of water for public use every year. The monitoring results are utilised to plan and promote the measures for protection of the water quality. As in the case of air pollution control, business installations are responsible for the monitoring activities in accordance with their pollution control agreement. Emission control is the responsibility of the discharger, who keeps a record of emissions.

Prefectural governors conduct on-the-spot inspections whenever appropriate, thereby checking whether or not the emission standards are met. According to the Air Pollution Control Law each person who installs a facility has a duty to check his emissions. Some large-scale business installations monitor themselves the environment surrounding their own facilities.

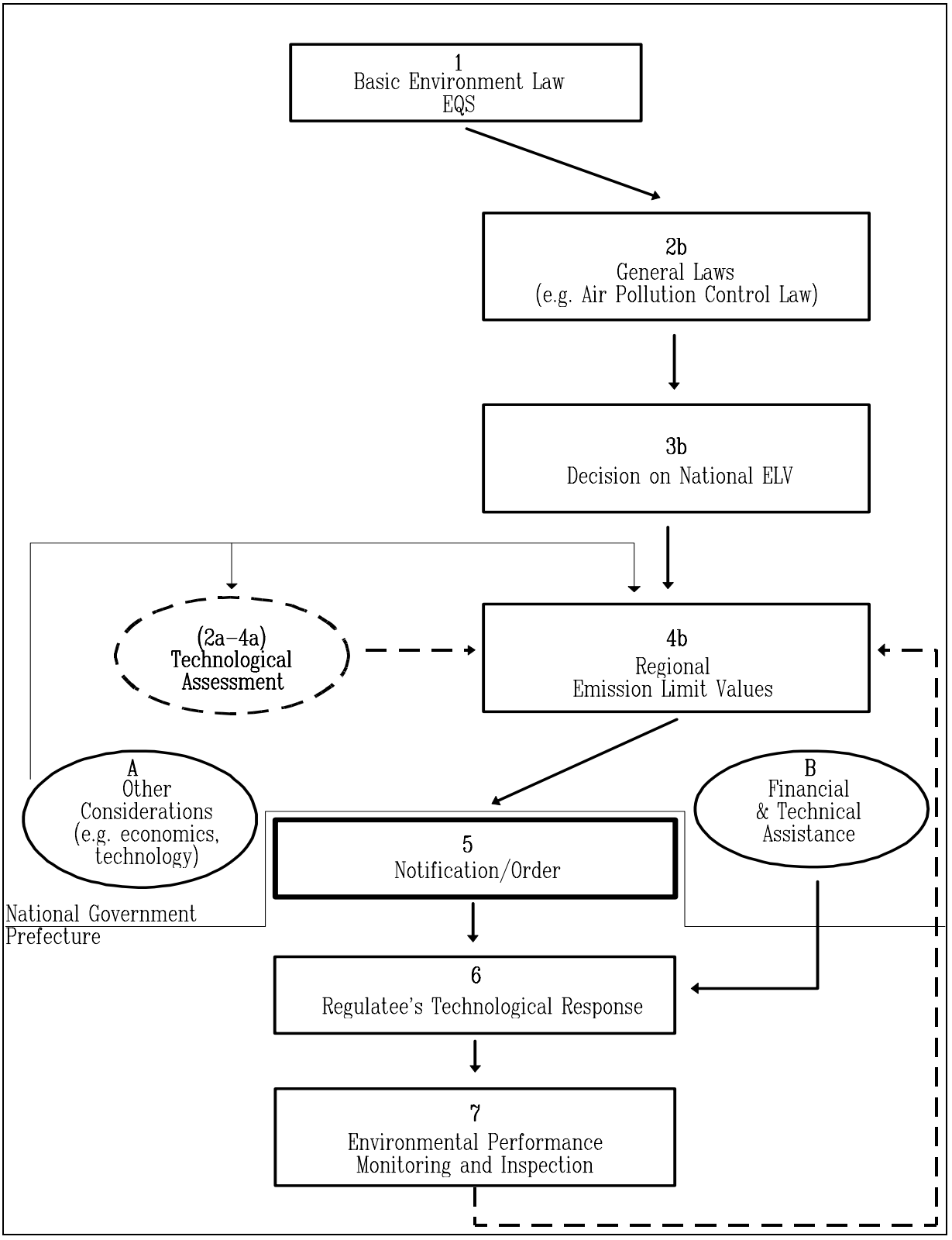


Figure 13 : Japan

KOREA

Regulatory framework **Stage 1**

In Korea, the general environmental principles and rules are expounded in the 1990 Basic Environmental Policy Act (BEPA). The law imposes an obligation on the relevant governments to take measures for the protection of the environment:

> *The State and local governments shall take legislative and financial measures necessary for implementing policies for the environmental preservation.*
> (BEPA, article 32)

The Basic Environmental Policy Act provides for the establishment of geographic areas where special measures may be ordered:

> *(1) The Minister of the Environment shall designate and notify publicly as a special countermeasure area for the environmental preservation the area where the environment is or might be polluted remarkably, or the natural ecosystem is or might be changed remarkably through consultation with the heads of the related central administrative agencies and city/province governors, and establish special comprehensive countermeasures for preserving the environment in the area to have the competent city/province governor enforce it.*
> (BEPA, article 22)

BAT **Stage 2a-3a**

There are no explicit Best Available Technology requirements written in the Korean legislation. The concept of BAT is nonetheless generally accepted. The various medium-specific environmental preservation and pollution control laws mandate the installation of "pollution preventive facilities" as a prerequisite for the granting of a permit. (This requirement is not applicable where emissions/discharges are deemed in compliance with emission limit values (see *ELVs*).) The meaning of the term "pollution preventive facilities" is explained in general terms in each of the control laws. "Pollution preventive facilities" are specified by ordinances of the Environment Minister, except in the case of waste for which "disposal facilities" are prescribed by Presidential Decree. The emission/discharge standards associated with the "pollution preventive facilities" are also specified by ordinances from the Environment Minister.

Noise

If a person who has obtained a permission on installation or modification of emission facilities […], *installs or alters the emission facilities, he shall install noise and vibration preventive facilities* […] *to make the noises and vibration emitted from such emission facilities to be emitted at the level lower than the permissible emission standards* […] *except in the following cases*:

1. Where the Minister of Environment deems […] *that the noises and vibration are emitted at the level lower than the permissible emission standards in view of the function and process of such emission facilities; and*

2. Where the Ordinance of the Environment Minister provides that even though the noises and vibration are emitted in excess of the permissible emission standards, it might not inflict any damage on the living environment.

(Noise and Vibration Control Act, article 10)

[…] *The term "noise and vibration preventive facilities" means facilities eliminating or reducing noises and vibration emitted from noise and vibration emission facilities, which are prescribed by the Ordinance of the Environment Minister.*

(Noise and Vibration Control Act, article 2)

Water

If a person who has obtained a permission on installation or modification of discharge facilities […], *installs or alters the discharge facilities, he shall install water pollution preventive facilities* […] *to make pollutants discharged from such discharge facilities to be discharged at the level lower than the permissible discharge standards* […], *except in the following cases:*

1. Where the Minister of Environment deems […] *that pollutants are discharged at the level lower than the permissible discharge standards by the function and process of such discharge facilities;*

[…]

3. Where it is prescribed by the Ordinance of the Environment Minister that it is possible to properly dispose of pollutants by any manner other than installation of preventive facilities.

(2) Any person who installs and operates discharge facilities […], *shall install facilities or take other necessary measures to restrain the discharge of pollutants under the conditions as prescribed by the Ordinance of the Environment Minister.*

(Water Quality Preservation Act, article 11)

[…] *The term "water pollution preventive facilities/equipments" means facilities as prescribed by the Ordinance of the Environment Minister, which remove or reduce water pollutants discharged from waste water discharge facilities.*
(Water Quality Preservation Act, article 2)

Air

(1) If a person who obtained the permission on installation or alteration of emission facilities […]*, installs or alters such emission facilities, he shall install air pollution preventive facilities* […] *so as to emit pollutants emitted from such emission facilities under the permissible emission standards* […]*, except in the following cases:*
1. Where the Minister of Environment deems […] *that pollutants are emitted at lower level than the permissible emission standards by the performance and process of such emission facilities;*
2. *Where it is provided by the Ordinance of the Environment Minister that it is possible to treat pollutants by any way other than installation of preventive facilities.*
(Air Quality Preservation Act, article 11)

In addition, if the Minister of Environment deems that emissions may be reduced beyond the levels of emission standards, he may impose more advanced preventive facilities.

[…] *The term "air pollution preventive facilities" means facilities/equipments which eliminate or reduce air pollutants emitted out of air pollutant emission facilities, and which are prescribed by the Ordinance of the Environment Minister.*
(Air Quality Preservation Act, article 2)

Waste

(1) The owner, possessor or manager of land or building discharging the general waste and located in the general waste control area […] *shall dispose of for himself the general waste of those discharged from the land or building, which are disposable easily by any method causing no impediment in preserving the living environment, such as incineration, reclamation, etc.*
(Waste Management Act, article 15)

"General waste" refers to municipal/domestic waste.

[…] *The term "special waste disposal facilities" means facilities which safely dispose of special wastes by means of incineration, crushing,*

neutralisation, solidification, reclamation, etc., and which are prescribed by the Presidential Decree.
(Waste Management Act, article 2)

"Special waste" refers to hazardous/industrial waste.

In addition, the laws contain obligations for the permitted plants to comply with the applicable emission/discharge standards:

- any entrepreneur shall comply with the permissible emission standards as prescribed in article 8 of the Noise and Vibration Control Act (Noise and Vibration Control Act, article 14);

- any entrepreneur shall not take the following actions when he/she operates pollution discharge and prevention facilities/equipments: [...] to emit/discharge pollutants in excess of the permissible emission/effluent standards when discharge and preventive facilities are not in operation normally without justifiable reason (Water Quality Preservation Act, article 15 & Air Quality Preservation Act, article 15).

Finally, the Minister of the Environment may also restrict any utilisation of land and installation of facilities in the special countermeasure area (article 22 of the BEPA).

EQS **Stage 1**

Among the principles contained in the Basic Environmental Policy Act is the duty for the governments to protect the environment through the establishment of environmental standards:

(1) For the purpose of protecting the health of citizens and creating the comfortable environment, the Government shall set up the environmental standards, and make the propriety of such standards to be maintained depending on any change in the environmental conditions
(Basic Environmental Policy Act, article 10)

The law provides for the establishment of more stringent environmental standards in specific regions:

(3) If it is deemed necessary taking into consideration the particularity of the regional environment, the mayor of the city or provincial governor [...] *may set up separate environmental standards by by-laws of the local government with the approval of the Minister of the Environment*.
(Basic Environmental Policy Act, article 10)

The environmental quality standards are determined by Presidential decree. The Enforcement Decree of the Basic Environmental Policy Act contains the applicable environmental quality standards (ambient air, noise and quality of water). The standards are revised periodically

and introduced through presidential decrees amending the Enforcement Decree. The EQSs apply uniformly throughout Korean territory.

<u>Emission Limit Values (ELVs)</u> **Stage 1-4a**

The Basic Environmental Policy Act stipulates that the Government may impose emission/discharge limit values for the regulation of pollutants released into the environment:

> *The Government shall take for the purpose of the environmental preservation any regulation over discharge of substance causing air, water, soil or marine pollution, generation of noises, vibration or offensive door, and disposal of waste.*
> (Basic Environmental Policy Act, article 20)

The emission/discharge limit values associated with the "pollution preventive facilities" are prescribed by ordinances from the Environment Minister.

Noise

> *The permissible emission standards of noises and vibration emitted from noise and vibration emission facilities* [...] *shall be determined by the Ordinance of the Environment Minister after hearing the opinion of the head of the central administrative agency concerned.*
> (Noise and Vibration Control Act, article 8)

Water

> *(1) The permissible effluent standards of pollutants discharged from waste water discharge facilities* [...] *shall be determined by the Ordinance of the Environment Minister after hearing the opinion of the head of central administrative agency concerned.*
> *(2) If it is deemed necessary for preventing water pollution in the special countermeasure area* […], *the Minister of Environment may determine more strict permissible discharge standards than as referred to in Paragraph (1) with respect to discharge facilities installed in such area, and determine a special permissible discharge standards with respect to discharge facilities installed newly in such area.*
> (Water Quality Preservation Act, article 8)

The Minister of Environment may also regulate discharged pollutants in total quantity where water pollution exceeds EQS. (Water Quality Preservation Act, article 9)

Air

> *(1) The permissible emission standards of air pollutants* […] *emitted from air pollutant emission facilities* […] *shall be determined by the Ordinance of the Environment Minister after hearing the opinion of the head of the central administrative agency concerned.*
> *(2) If it is deemed necessary for prevention of air pollution in the special countermeasure area* […], *the Minister of Environment may determine any permissible emission standards more strict than those referred to in Paragraph (1) for emission facilities installed in such area, and any special permissible emission standards for new emission facilities installed in such area.*
> (Air Quality Preservation Act, article 8)

In addition, the Minister of Environment may regulate in total quantity pollutants emitted from business places in zones where air pollution exceeds EQSs (Air Quality Preservation Act, article 9)

<u>Permitting</u> **Stage 5**

Anyone constructing new plants or expanding/modifying existing facilities should submit an application for a permit to the regional environmental management offices or local governments according to the location of the facilities. Applicants should provide the following information to the relevant permitting authority:

- description of the pollution discharging facilities, including a production flow diagram (PFD);
- amount of raw material and energy consumption to be necessary for production;
- expected daily and annual operating time;
- predicted amount of emissions/effluents and noise;
- type and size of pollution control equipments.

If a permit is granted, it usually contains conditions, including on the amounts of pollutants discharged. When anyone wants to change the permit conditions, he/she should:

- advise the relevant authority in case of relatively small changes;
- follow the procedure outlined above for other changes.

When a new construction or expansion is subject to Environmental Impact Assessment (EIA) which is prescribed in the Environmental Impact Assessment Law, it is required to complete the EIA procedure before applying for a permit.

The objective of the EIA system is to seek harmony between economic development and environmental preservation so that those responsible for the project can determine and assess the environmental impact and formulate effective measures to cope with it during the planning course of the project. The assessment results and the review by the Minister of the Environment should be reflected in the project plan. Before the project is approved by the administrative agency in charge, it should be checked to determine whether the conclusions of the consultation process were properly reflected. In other words, implementation of the project should begin only after all these procedures have been completed.

One of the most important procedures for environmental impact assessment is the incorporation of the views and opinions of local residents. This procedure was introduced together with the implementation of the EIA Act of 1993. Under the system, the draft assessment had to be disclosed to the public, and a presentation session or public hearing had to be held, if necessary. The Environmental Impact Assessment Act, which was enacted in 1993, stipulates that the draft assessment should be held at the same time. In particular, in the case where a request would be made by more than half or the residents who had submitted their opinion, or for thirty or more residents, the public hearing must be held with the attendance of experts.

Reviewing the Environmental Impact Statement (EIS), the Minister of the Environment recommends to the project planner to abide by more stringent emission/effluent standards than those prescribed in the relevant laws. The recommendation of the environmental authority usually prompts project planners into proposing strengthened limits in drafting the EIS, which would help them not only to facilitate consultation with the environmental authority but also to give a good impression to local residents. In this sense, project planners are very likely to adopt the most efficient and updated technologies to meet the suggested emission/effluent standards.

The Enforcement Decree of the EIA Act specifies the requirements. The environmental effect evaluation statement has to contain the following elements:

- concrete analysis and evaluation of evaluation statement draft;
- analysis and evaluation on any alternative to the business plan, if any;
- analysis of inevitable environmental effects;
- opinions of local residents and head of relevant administrative agencies matters concerning preventive measures.

Noise

> *Any person who desires to install emission facilities shall obtain the permission of the Minister of Environment under the conditions as prescribed by the Presidential Decree.*
> (Noise and Vibration Control Act, article 9)

The modification of installations cannot be undertaken without a permission or a report on modification. In addition, once the installation or modification has been completed, the entrepreneur shall report it to the Minister of Environment. No operation shall be conducted without such judgement of conformity (Noise and Vibration Control Act, article 13) The Minister of Environment may revoke permits or suspend operations if operators fail to meet the standards. In case of danger for the environment or health, the Minister may order restrictions on operating hours.

Water

> *(1) Any person who desires to install discharge facilities, shall obtain the permission of the Minister of Environment under the conditions as prescribed by the Presidential Decree.*
> [(2) a permission for the substantial modification of installation is required;]
> *(3) In granting a permission or permission on modification* […], *if it is deemed that pollutants discharged from the discharge facilities make it difficult to maintain the environmental standards, or might inflict any serious danger or injury on the health and property of residents or breeding and growth of animals and plants, the Minister of Environment may restrict such permission under the conditions as prescribed by the Presidential Decree.*
> (Water Quality Preservation Act, article 10)

As with other control laws, no operation is allowed without a report of installation/modification being issued by the operator to the Minister of Environment.
(Water Quality Preservation Act, article 14)

The Minister of Environment may also order improvement in discharge if standards are not met. MoE may restrict operating hours or suspend operations if health or environment are deemed threatened.(Water Quality Preservation Act, articles 17)

Air

> *(1) Any person who desires to install emission facilities, shall obtain the permission of the Minister of Environment under the conditions as prescribed by the Presidential Decree.*
> (2) a permission for substantial modification of installations is required
> (Air Quality Preservation Act, article 10)

Once a report on completion of installation of emission facilities is produced, a report has to be made to the Minister of Environment. No operation is possible without this conformity judgement. (Air Quality Preservation Act, article 14)

The Minister of Environment may impose improvement requirements if emitted pollutants are deemed to exceed the permissible ELVs. "The Minister of Environment may order suspension of operation to the whole or part of emission facilities." Restriction on operating hours and transfer of business are other options open to the Minister.

Waste

> *(1) Any person who desires to carry on as an industry the collection, transport or disposal of general waste* […] *shall obtain the permission of the city/province governor by category of business after satisfying requirements, such as facilities, equipment, technical capability, etc. conforming to the standards as prescribed by the Ordinance of the Environment Minister. This provision shall also apply in case where he desires to modify important matters of permitted ones, which are prescribed by the Ordinance of the Environment Minister.*
> (Waste Management Act, article 17)

Permits for facilities located in industrial complexes are issued by the regional environmental offices under the Ministry of Environment. Permits for other facilities are issued by local governments.

Permits are not delivered for a specific duration. They are valid as long as industry meets the applicable emission/discharge standards.

<u>Economic considerations</u> **Factor A**

Economic considerations are taken into account during the standard setting procedure. Emission/discharge standards are based on the performance of technologies which are readily available/used by industry. Therefore, in principle, economics is not a factor in the establishment of permitting requirements. Moreover, emission standards should be met at any time. If the industry fails to meet the emission standards, payment of emission/effluent charges as well as improvement/change of the facilities are required by the Ministry of the Environment.

<u>Financial and Technical Assistance</u> **Factor B**

The Government has an obligation to promote policies aimed at environmental preservation:

The State and local governments shall take legislative and financial measures necessary for implementing policies for the environmental preservation.
(Basic Environmental Policy Act, article 32)

The State or local governments may take and give any taxation measure and other financial support necessary for supporting the installation and operation of facilities to be used for the environmental preservation performed by the entrepreneur.(Basic Environmental Policy Act, article 34)

In practice, this duty translates into:

- long-term, low-interest loans and tax breaks/reduction to industries that develop and install new technologies;

- the Environment Friendly Business Management System under which plants in compliance with standards benefit from fewer site inspections and good publicity.

<u>Monitoring and Inspection</u> **Stage 7**

A/Environmental pollution

Environmental pollution monitoring is undertaken by the government:

(1) The Government shall investigate at all times the situation of the environmental pollution.
(2) In order to conduct properly the investigation [...], *the Government shall maintain the monitoring and measuring system of the environmental pollution.*
(Basic Environmental Policy Act, article 15)

The Minister of the Environment conducts nation-wide environmental quality monitoring for air, water, noise and vibration, which is mainly focused on pollutants prescribed in the environmental quality standards.

Noise

(1) In order to grasp the actual situation of noises and vibration throughout the country, the Minister of Environment shall install measuring networks and make regular measurement.
(2) mayors and provincial governors may install measuring networks and measure. (Noise and Vibration Regulation Act, article 3)

Water

(1) In order to grasp the actual situation of water pollution throughout the country, the Minister of Environment shall install water quality monitoring networks and measure the degree of water pollution.
(2) mayors and provincial governors may install measuring networks. (Water Quality Preservation Act, article 3)

Air

(1) In order to grasp the actual conditions of air pollution throughout the country, the Minister of Environment shall install a ambient air monitoring network and measure at all times the degree of air pollution.
(2) mayors and provincial governors may install measuring networks. (Air Quality Preservation Act, article 3)

In severely polluted areas, monitoring is more frequent and thorough.

B/Source pollution

Source emission/discharge monitoring, however, is performed by the operators themselves. The pollutants monitored and the frequency of monitoring is determined in terms of the size of the facilities and the type of pollutants.

Noise

Any operator shall, upon operating his emission facilities, measure for himself noises and vibration emitted, or have measuring agent […] *measure them* […]
(Noise and Vibration Control Act, article 20)

Water

(1) Any entrepreneur shall, upon operating his discharge facilities, make a self-measurement of discharged pollutants or have a measuring agent […] *measure such pollutants, and record the results as it is, and keep under the conditions as prescribed by the Ordinance of the Environment Minister.*
(Water Quality Preservation Act, article 22)

Air

> *(1) When an entrepreneur operates his emission facilities, he shall make a self-measurement of emitted pollutants, or have a measuring agent* […] *make the measurement, and then record the results as it is, and keep it under the conditions as prescribed by the Ordinance of the Environment Minister.*
> (Air Quality Environment Preservation Act, article 22)

The Minister of Environment may also order measures "necessary for operation of emission and preventive facilities, such as stack monitors and other necessary instruments to confirm whether or not emission and preventive facilities are operated normally." (Air Quality Preservation Act, article 15) In addition to self-monitoring, the regional environmental offices and governors conduct on-the-spot monitoring and inspection.

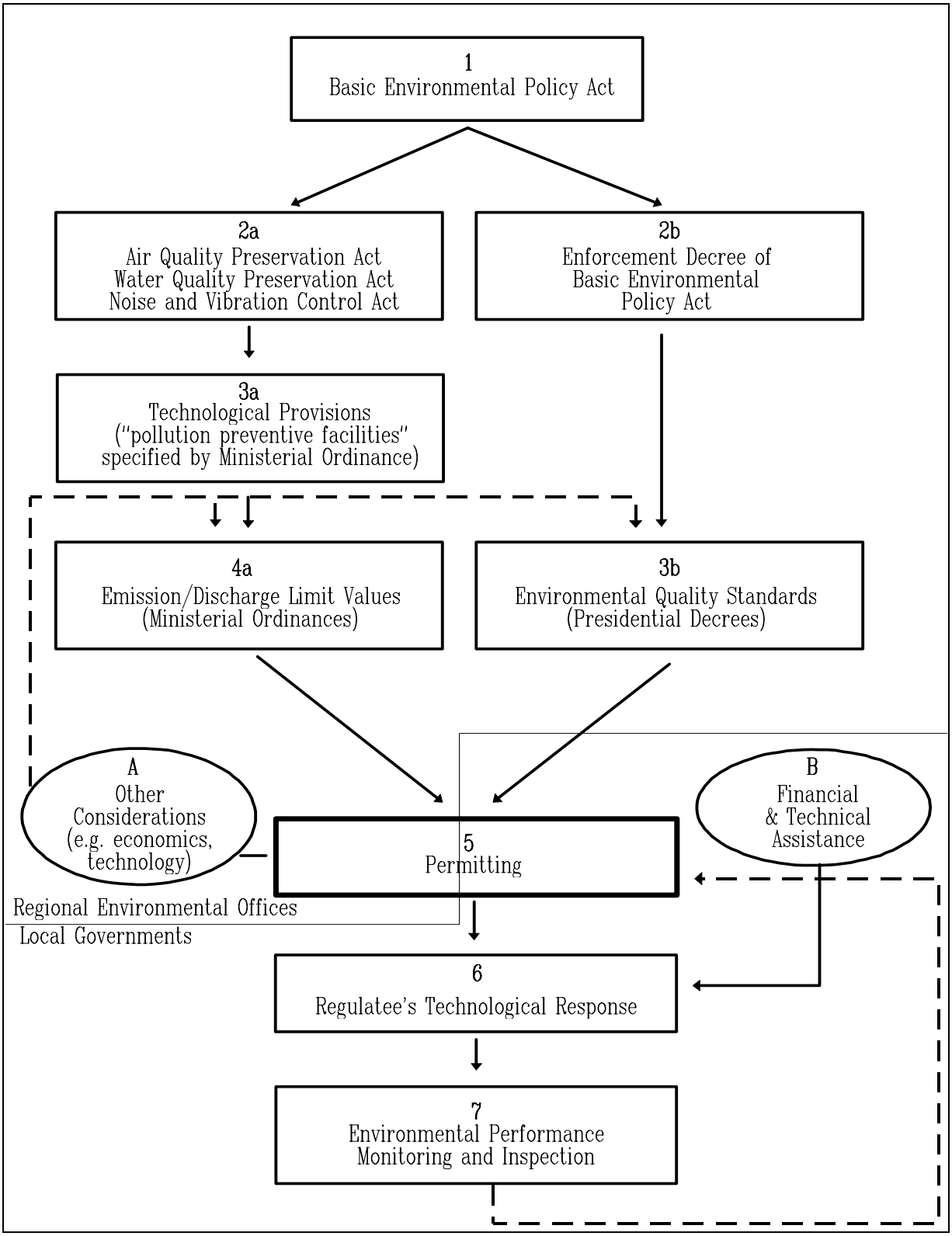


Figure 14 : Korea

NETHERLANDS

Regulatory framework **Stage 1**

The Dutch Constitution stipulates that "Government care concerns the habitable quality of the country and the protection of the environment" (article 21).

Framework laws have been adopted for the protection of the environment. In March 1993, for instance, the Environmental Management Act (EMA) came into force. The EMA contains regulations concerning the protection of the environment and provides for an integrated approach of environmental pollution. Licensing systems previously contained in different laws were incorporated into the EMA.

The Surface Water Pollution Act is the framework law for the water compartment. Each of the stages in this entry will elaborate upon the water section separately.

BAT **Stage 2a**

The precautionary principle is the basis for the first track of Dutch environmental policy: source-oriented requirements.

There is neither a specific general or sectoral act on BAT. In Chapter 8 of the EMA, rules are given concerning listed installations who cause a certain amount of environmental pollution. In general, these installations need a permit. The basic principle is that

> […] *3. A license shall be subject to any regulations which are necessary to protect the environment. If any adverse effects on the environment caused by making the license subject to such regulations cannot be avoided, the license shall be made subject to such additional regulations as may be necessary to provide the greatest possible protection to the environment from the said effects, unless this cannot reasonably be required* (Section 8.11).

The decision on BAT is part of the permitting procedure (see *Permitting*). The Dutch law does not provide technical standards for BAT, but only guidelines for use in regulations (permits). The standards are thus set in permits and are subject to appeal. Besides, orders in council are also increasingly issued in lieu of the licensing rules. Orders in council are regulations with a general impact in which BAT prescriptions are given.

The permitting authority should give prescriptions in the permit in order to achieve the highest protection level as possible, unless this is unreasonable. The judgement of the permitting authority is therefore based on the ALARA principle. This means that the pollution caused by an

installation must be as low as reasonably achievable. This includes technical, economical, location and social factors. The tools to achieve the highest protection level are Best Available Techniques (BAT).

The closest to a definition of BAT would be the reference to the concept of "state of the art." State of the art are measures to limit emissions of a source, process-integrated or as an add-on technology, successfully applied in own country or abroad in a financially healthy company of the same branches.

Except for water, there is no structurally operating medium working on guidelines concerning environmental technology. To a certain degree, the Dutch Emission Guidelines (NER) for emissions to air gives a standard for BAT. Those guidelines mainly provide emission levels according to the state of the art, but little technological information.

Water

The 1970 Surface Water Pollution Act is a framework law in which BAT is not incorporated. Executive provisions such as the BAT concept are described and elaborated in governmental policy documents and recommendations of the Co-ordination Committee on the Implementation of the Surface Water Pollution Act (CUWVO). CUWVO is a commission that sets guidelines for techniques concerning water pollution. BAT is translated in terms of emission standards or technical measures in several sector-specific administrative orders.

Also applicable are the requirements contained in international agreements to which the Netherlands is a signatory, e.g. OSPAR and UNECE Convention on Transboundary Watercourses and Lakes (see entry for *International Agreements*).

The general practice concerning water BAT is that:

(1) BAT for groups of point sources have a recommendation status. By jurisprudence it has become common practice, that deviation should be well-motivated. Recommendations have been laid out by CUWVO for approximately 20 relatively homogeneous groups of point sources. CUWVO recommendations are reviewed periodically.

(2) For individual plants in heterogeneous sectors, BAT is determined on a case-by-case basis in binding requirements laid out in permits (see *Permitting*). For several sectors, legally binding general regulations are under preparation in the form of administrative orders.

A technical measure is considered suitable if it has been tried out successfully once under comparable circumstances (or tested by the discharger concerned, or guaranteed by suppliers of relevant equipment), abroad as well as in the Netherlands. Transfer of emissions to the atmosphere or solid waste is taken into account. Insight in technologies developed and/or used is available at RIZA, an expert service of Rijkswaterstaat. Water authorities are obliged to request advice from RIZA on BAT.

It is often difficult to formulate uniform maximum emission standard per substance or group of substances and to standardise definitions of the best technical means and the best practical means for each substance or group of substances. Usually, emission standards are drawn up for a particular sector of industry or production process.

If, for an installation, a covenant or Corporate Environmental Protection Plan (CEPP) exists, in these instruments the EQS and the ALARA principle (BAT) must have been taken into account. The CEPP and covenant influence the decision-making of the permitting authority. Final judgement on the license-requirements is up to the licensing authority.

Also taken into account are the following parameters: nature and site of production process, volume and concentration of pollutants in effluent, new or existing discharges.

BAT is the combination of BTM and BPM. BTM and BPM were defined in Water Quality Programmes in the period 1975-1989 and reinforced in the Policy Document on Integral Water Management.

The CUWVO recommendations distinguish between different types of substances:

1/ For non-blacklisted substances, a distinction is made between harmful and harmless substances. In the case of discharges of harmful substances, the Best Practicable Means (BPM) have to be used. BPM is defined as follows:

> *The technologies by means of which the largest possible reduction in pollution is obtained once due allowance has been made for economic aspects, i.e. what is acceptable from a cost point of view for a normally profitable company* (CUWVO).

Harmful substances are those characterised by their persistence, their moderate-to-high toxicity and propensity to accumulate in sediments and organism. Among these harmful, substances are the heavy metals that have not already been placed on the black list as well as some oxygen-consuming substances.

In the case of harmless substances, requirements are based on the needs of the receiving waters. Harmless substances are characterised by lower levels of toxicity and includes naturally-occurring substances such as sulphate and chloride.

2/ For pollutants placed on the black list of substances, discharges have to be prevented to the fullest extent possible, whatever the quality of the receiving waters, by using the Best Technical Means (BTM). BTM is defined as follows:

> *The technologies which produce an even greater reduction in pollution at greater expense and which can, in practice, be applied to the aquatic environment* (CUWVO).

Black-listed substances are those that, in the light of their persistence, high toxicity and propensity to bioaccumulate, pose a serious threat to the environment (CUWVO).

The first track of Dutch environmental policy is the application of the source-oriented precautionary principle through BAT. The second, effect-oriented policy track examines whether the policy pursued under the source-oriented track actually maintains or restores the desirable level of environmental quality.

There is no specific Act on EQS because Chapter 5 of the EMA lays out the rules concerning EQS.

> *In the interests of protecting the environment requirements may, in so far as this is of more than provincial concern, be laid down by order in council regarding the quality of parts of the environment from a date stated therein* (EMA, Section 5.1).

The ambient quality values may be of two types : limiting values and standard values.

> *A limiting value gives the quality which must at least have been attained at a time specified in the order and which, once attained, must be maintained. A standard value gives the quality which may have been attained at a time specified in the order and which, once attained, should as far as possible be maintained* (EMA, Section 5.1).
>
> *If the quality of a particular part of the environment in an area to which a quality requirement applies is better than that specified in the requirement, then* […], *the existing quality shall apply instead of the specified in the requirement* (EMA, Section 5.2).

The Ministry of Housing, Spatial Planning and the Environment (VROM) sets the national quality objectives. The EQOs are implemented by the State government and the provincial governments.

On national or regional level, EQS can be laid down in administrative decree or provincial ordinance.

The following have to be considered when setting an EQO:

- available scientific and technical data;
- available information relating the current state of the environment ;
- developments which can reasonably be expected to take place which are of importance with a view to protecting the environment;

- the options for restricting -as far as possible- the risks to the environment caused by environmentally damaging factors occurring as a result of the EQO;

- any financial and economic consequences which may reasonably be expected to arise from the implementation of requirements to be laid down.

Technically, the limit values for EQOs are set at or below the Maximum Permissible Concentration (MPC), but not lower than the Negligible Concentration (NC) level. Between those two values the ALARA principle (as low as reasonably achievable) is observed and best available technologies are applied at the source. MPC is the value at which full protection of all organisms, including those high up in the food chain, is ensured.

Air quality standards (AQS) are binding limit values concerning six pollutants : SO_2, black smoke, NO_2, CO, lead and benzene. In addition, non-binding guide values for 24 substances (such as VOCs, PM_{10}, ozone and asbestos) have been issued in policy documents. Finally, air quality objectives to be attained in the future have been set for NO_2, SO_2 and benzene.

The Environmental Management Act entitles the Minister for Environment to designate as non-attainment areas the regions that encounter serious air pollution problems.

Water

The water management authorities (part of the Ministry of Water Management) for (large) state-managed waters and Provinces for (regional) non-state-managed waters are responsible for meeting the EQOs. Various water bodies are assigned specific functions (e.g. navigation, nature and landscape, bathing water, drinking water, etc.). The assigned functions entail minimum quality and quantity requirements. Binding limit values and non-binding guide values are applied.

In Netherlands, there are 3 types of water EQOs: (a) ecosystem-related; (b) water-use related; (c) ecotoxicology-related.

The EQOs are laid down in National Policy Documents on Water Management, for which the government, in particular the Ministers of Water Management and of the Environment, is responsible. Some EQOs stem from the joint Rhine Action Programme (e.g. the “return of salmons” objectives). For substances not on the black list, water quality should not be allowed to deteriorate significantly.

EQSs apply to the whole territory of the Netherlands or to specific regions (natural areas for instance). Ecotoxicology-related EQOs apply to all the waters of the Netherlands. EQOs based on ecosystems and water uses do not. EQOs must be seen as general quality objectives that are valid for every situation in the environment. There are also a limited number of quality objectives for specific use designations such a fishing water, drinking water, etc., however, in general these are less stringent.

No emission reduction requirements are imposed when the EQOs are met everywhere in the Netherlands. If the EQOs are not met, supplementary requirements are called for.

Emission Limit Values (ELVs) **Stage 4b**

The Ministry of Housing, Spatial Planning and the Environment (VROM) sets binding national emission standards. In addition, Ministerial decrees have been adopted for the implementation into national law of the daughter directives of EC framework Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community.

The government can set binding emission limit values. The standards thus set in decrees must be based on the ALARA principle too. Both for the permit and the decrees there is a duty to revise them regularly, e.g. every five years. They must be revised in the light of both the technological and environmental developments that have taken place. For NOx and SO_2 emissions from combustion plants, the limits are set in decrees.

In the provinces, the Queen's Commissioners have the power to take measures to reduce emissions of air pollutants during spells of smog formation when the quality standards are breached.

Water

The administrative authorities must ensure that the "standstill" principle is exercised : the total discharges of a blacklisted substances must not increase within a particular area. Therefore, supplementary requirements may be brought to bear

Under the Surface Water Pollution Act, maximum emission standards for designated substances are established.

Permitting **Stage 5**

According to the 1993 Environmental Management Act, industrial plants are required to obtain a permit to be allowed to operate or even before constructing the installation.

The licensing requirements previously contained under different, medium-specific laws have been incorporated into one single law (the Environmental Management Act) covering all media (except water) and therefore providing for integrated permitting.

According to the Environmental Management Act, provincial governments have the authority to grant licenses for the larger/more complex plants. Municipal governments issue licenses for smaller/less complex plants under EMA.

Because there are no national BAT requirements, Best Available Technology principles are applied on a case-by-case basis at the permitting stage. There is no standard methodology for

determining BAT criteria. Licensing authorities are aware of the potentials of new technologies through the Dutch Emission Guidelines (NER) and the recently installed INFOMIL, a helpdesk for Dutch regulators. In complicated situations, they rely on consultants, which should be fully aware of the potentials of the technology. Licensing authorities also have their formal and informal networks to avoid bad decisions.

In their decision-making concerning the permit, the licensing authorities may only deviate from target values, and then only on a well-motivated grounds. They are not allowed to deviate from limit values.

All permits, including those for discharges under the Surface Water Pollution Act, are subject to periodical reviews.

Water

The Surface Water Pollution Act stipulates that

> *It is prohibited to deposit waste, pollutants or noxious substances in surface water in whatsoever form by means of installations for that purpose without a permit* (Section 1).

The management functions concerning the provincial waters have been delegated to the water boards (*waterschappen*). As part of their authority, the water boards issue the licenses for industrial waste water discharges into surface waters. The municipalities grant permits for industrial discharges into the municipal sewerage networks, except for 18 black-listed substances for which permits are issued by the water boards.

Permits for companies discharging black-listed substances need to be reconsidered at least once every 4 years.

<u>Economic considerations</u> **Factor A**

EQS

The economic aspects of the regulated sector and the future technology are subject to discussion. Estimates of the costs associated with the requirements are given by the model scenarios. Decisions on economic aspects are taken on a case-by-case basis as there are no applicable standards of economic feasibility.

The Environmental Management Act stipulates that:

> *At least the following shall be considered in a decision establishing an order in council* […] :

> […] *e. any financial and economic consequences which may reasonably be expected to arise from the implementation of the requirements to be laid down* (Section 5.1).

The permitting authority must weigh in the decision-making the interest of the environment and other considerations such as economic, technological and social aspects.

BAT

Economic considerations are taken into account. Individual companies must comply with BAT, but authorities may decide that under the given (economic) circumstances of the company higher standards will apply.

Economic criteria become more irrelevant as the harmfulness of the substance increases.

Very basic measures need to be taken on very short notice, irrespective of their costs. Companies are then required to study residual emissions and draw up a clean-up plan. Economic considerations attached to plan are discussed by the discharger and the licensing authorities. The types of costs considered are investment and operating costs. Studies have been committed to advise licensing authorities about the relation between investment costs and the achieved environmental benefits of certain technical measures.

Financial and Technical Assistance **Factor B**

An economic instrument is used to advance the introduction of BAT**:** Accelerated Depreciation on Environmental Investment. Know-how about the diffusion and guidance to small- and medium-size enterprises. In addition, there are subsidy schemes for research and development: the Innovation-oriented Technology Research Programme, Scheme to promote the development of Environmental Technology, Programme to Promote Environmental Technology in Industry.

Monitoring and Inspection **Stage 7**

The permitting authority has the duty to monitor regularly if the permit is still up to date. They hereby take into account the technical developments and the condition of the environment. Furthermore, the authority should inspect the installation and enforce the obligations laid down in the prescriptions.

Provincial authorities and municipalities are empowered to monitor compliance with permitting requirements.

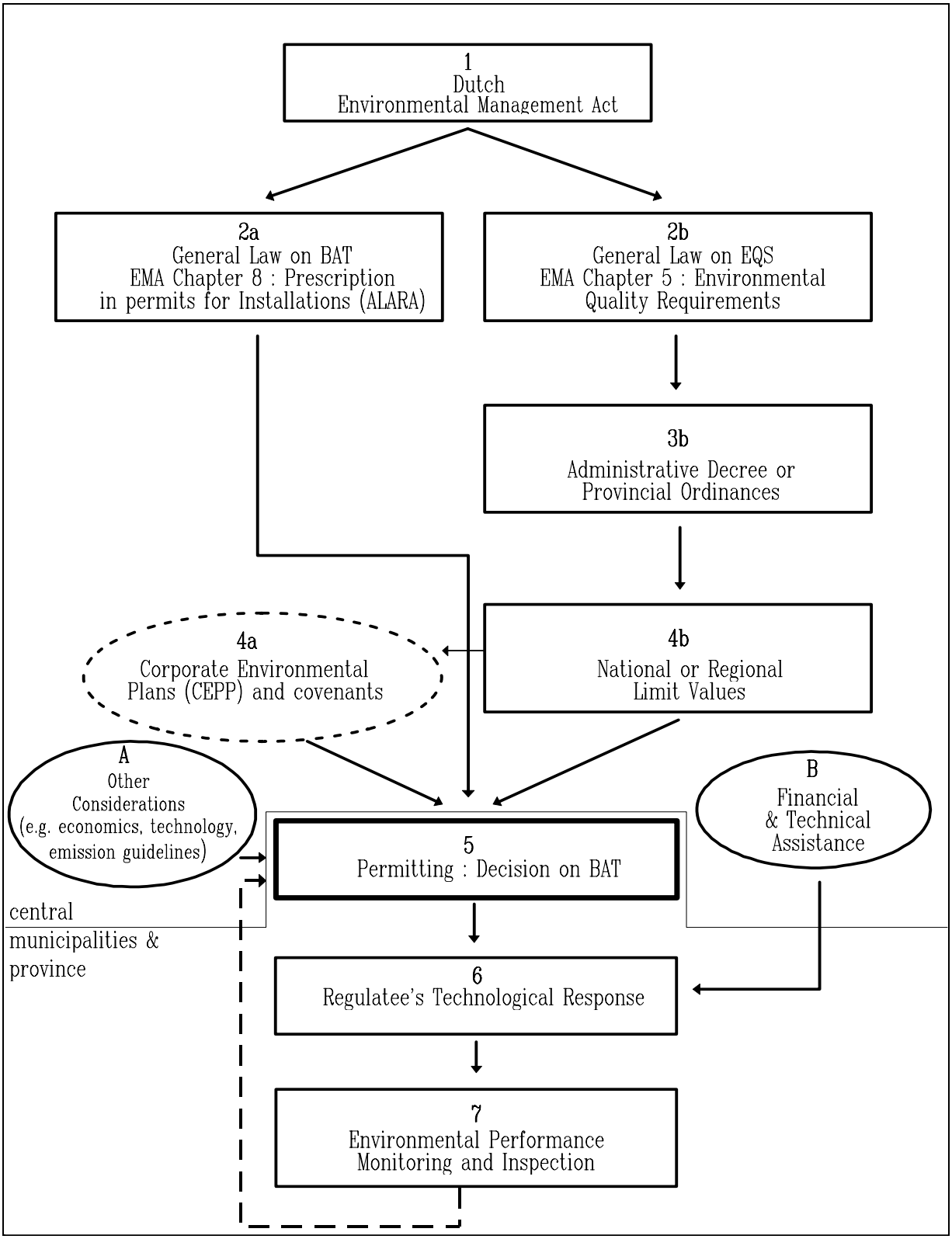


Figure 15 : Netherlands

NEW ZEALAND

Regulatory framework **National/regional**
Stage 1

The Ministry for the Environment is responsible for administering the national environmental legislation: the Resource Management Act, as well as administering Government policies on the environment. The Ministry is also responsible for setting national environmental standards and guidelines after consultation with industry, the various regulatory authorities involved and the public. Permitting of industrial sources of pollution, however, is performed by the regional councils. The Resource Management Act 1991 gives the regional councils the authority, inter alia, to prepare and implement policies and objectives for integrated management of the natural and physical resources of the region, and the control of discharges of contaminants into or onto land, air, or water and discharges of water into water.

In 1991, the Resource Management Act was passed, replacing into one single integrated piece of legislation the previous media-specific laws related to the protection of environmental resources such as the 1972 Clean Air Act and the Water and Soil Conservation Act of 1967. The Resource Management Act is more effect-oriented than source-oriented. It focuses on the actual quality of the receiving environment more than on the quality of the emissions and discharges from pollution sources.

BAT **Stage 4**

Section 108 of the Resource Management Act 1991 states that a discharge permit may contain a requirement for "the holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment of the discharge and other discharges […]".

Best practicable option (BPO) is defined as:

> *"Best practicable option", in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard among other things to:*
>
> *a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
>
> *b) the financial implication, and the effects on the environment, of that option when compared with other options; and*
>
> *c) the current state of technical knowledge and the likelihood that the option can be successfully applied.*

BPO is an important concept for the establishment of permitting requirements where there are no previously determined environmental parameters. As applied under the Resource Management Act, BPO is a synthesis of specific environmental, economic and technical constraints. However, BPO can only be applied where it is the most efficient and effective means of preventing or minimising adverse effects on the environment. Other alternatives, including setting minimum environmental standards, need to be considered prior to including BPO conditions. A BPO is determined for each facility and is applied as a requirement for plant managers to implement by whatever means they select. Environmental quality concerns are dominant: the necessary environmental quality standards are set first. From there, the costs and performance of the proposed technology to be installed to attain such environmental standards is assessed. Regional council experts and hired experts perform the assessment.

The permit does not mention technologies except those that the plant operator plans to introduce or use in the plant. The BPO may be expressed as treatment technologies, operating practices or performance standards.

<u>EQS</u> **Stage 3b**

Under New Zealand legislation, allowance for assimilation is clearly identified. Environmental quality standards are applied and may be prescribed as national standards:

> *(1)* […] *the Governor-General may from time to time, by Order in Council, make regulations, to be called national environmental standards, for either or both of the following purposes:*
> *(a) Prescribing technical standards relating to the use, development and protection of natural and physical resources, including standards relating to-*
> *(i) Noise;*
> *(ii) Contaminants;*
> *(iii) Water quality, level, or flow;*
> *(iv) Air quality;*
> *(v) Soil quality in relation to the discharge of contaminant;*
> *(b) Prescribing the methods of implementing such standards.*
> […]
> Resource Management Act 1991, section 43.

Water quality guidelines have been prepared for water colour, clarity, undesirable biological growths and further guidelines are in preparation on the protection of aquatic ecosystems. Water quality objectives are being developed at a regional level for the various catchment areas. There are no environmental quality standards for air but there are air quality guidelines, based on international standards. Soil quality guidelines have been prepared for some substances to guide the clean-up of contaminated sites.

Emission limit values (ELVs) **Stage 4**

There are no national regulations on the minimum levels of environmental performance. Decisions are taken on a case-by-case basis (see *Permitting*). The regional councils decide on the basis of the quality of the receiving media. In sensitive ecosystems, more stringent emission limits are usually set. Detailed site analyses are used as models to evaluate the environmental impact of emission levels. In addition, foreign standards are taken into consideration. International developments in standards are monitored by the central government and forwarded to the regional authorities.

Permitting **Stage 5**

The need for permits is laid out in the Resource Management Act 1991:

> *(1) No person may discharge any-*
> *(a) contaminant or water into water; or*
> *(b) contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or*
> *(c) contaminant from any industrial or trade premises into air; or*
> *(d) contaminant from any industrial or trade premises onto or into land-*
> *unless the discharge is expressly allowed by a rule in a regional plan and in any relevant proposed regional plan, a resource consent, or regulations.*
> *(2) No person may discharge any contaminant into the air, or into or onto land, from-*
> *(a) any place; or*
> *(b) any other source, whether moveable or not,- in a manner that contravenes a rule in a regional plan or proposed regional plan unless the discharge is expressly allowed by a resource consent or allowed by section 20 (certain existing lawful activities allowed).*
> Resource Management Act 1991, section 15

Permits (referred to as *resource consents*) are granted by the regional councils. Decisions for permits are made on a case-by-case basis, mostly upon the basis of the effects of the activity on the quality of the receiving environment. In sensitive ecosystems, more stringent emission limit values are imposed. Applications for resource consents must contain a description of the activity for which a consent is sought, its actual and potential adverse effects and the measures used to mitigate them.

A discharge permit may contain a requirement for "the holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment of the discharge and other discharges […]" (Resource Management Act 1991, section 108). Other requirements such as the duty to enter into a covenant on the performance of the permit requirements may be added. Administrative charges may be levied. Financial contribution may be imposed. In addition, an assessment of environmental effects (AEE report) has to be performed. Negotiations on contentious matters are common in the permitting procedure. In addition, all applications for consents, except minor ones are publicly notified. The decisions of the regional council are subject to appeal before a Planning Tribunal. Permits are issued for a fixed duration, usually 10 years but for up to 35 years.

In certain circumstances, the consent authority can review the conditions of the consent and make changes. Under the Resource Management Act a permit is viewed as a contract between the regional council (representing the community) and plant owners. During the life of a permit, review of its conditions can be undertaken only if:

- there are clearly defined changes in the permit conditions and/or impact on the receiving environment. This would cover situations of plant expansion or modifications, where these would result in increased water use or a change in the effluent content, that would affect the receiving environment. Similarly a new boiler may require that part of the consent to be amended. Generally a permit would not require modification, if the modified plant is able to operate within the conditions of the existing consent limits.

- provisions for such a review is provided for by the conditions placed on the permit at the time of issue;

- the regional council implements a detailed management plan for the receiving environment, at which time conditions for all permits within the catchment can be reviewed within six months of the plan being finalised.

The term of a consent cannot be changed.

The Resource Management Act emphasises Statutory Plans as the means of establishing policies and rules within which the individual consents are granted. Comprehensive plans are developed for the management of the environment over an entire district region or basin. The district must have a district plan (wider land use) for their district, while regions can have a range of plans based on area or activity. These plans can set environmental bottom lines or standards, established by the councils. In some cases these may consider the application of best practical option, for that resource, particularly where it is not practicable to do individual Assessments of Environmental Effects (AEE) on many minor uses, e.g. septic tank discharges, dairy shed discharges.

At present New Zealand is moving to multimedia permitting through the Resource Management Act, although as existing terms on consents (air, land, water) cannot be changed, it will take time to bring separate existing consents onto the same review time. It should also be noted that generally the district council land use planning is in perpetuity (subdivision). The intention of the new legislation is to ensure that all of the activities are integrated within a single process directed towards ensuring that the relationship of effects on air, land and water is fully assessed. This includes abstractions and discharges. This is expected to take time to implement, however, as existing permits do not all expire at the same time and have a number of years to run. Despite the lack of a formal multimedia permitting process, council staff integrates the effects of control of releases in one media on the other. Concerns are thus addressed by this process. There is also a procedure for joint hearings between regional councils and district councils to ensure <u>all</u> consent issues are considered at the same time.

An application for a permit must be accompanied by an Assessment of Environmental Effects (AEE) report. This would include all known or anticipated environmental effects, a statement of whether they would be within acceptable standards/guidelines, and for those cases where

standards/guidelines are expected to be exceeded, indication of how these adverse effects would be avoided, remedied or mitigated.

Economic considerations **Factor A**

The economic considerations are embedded in the definition of the best practicable option upon which resource management has to be based:

> *"Best practicable option", in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard among other things to:*
> […]
> *b) the financial implication, and the effects on the environment, of that option when compared with other options;* […]

Economic considerations are important in determining the BPO for a specific situation but the financial capacity of a particular company to finance the works is given little consideration. A plant may be forced to close if the concerns for environmental quality warrant measures that cannot be afforded by the operator.

The Resource Management Act 1991 provides a broad definition of economic costs:

> *"Benefits and costs" includes benefits and costs of any kind, whether monetary or non-monetary.*
> Resource Management Act 1991

If imposing a cleaner technology on a permit applicant would burden the company too much financially, dispensation is given or a period of phase out can be implemented.

Financial & Technical Assistance **Factor B**

The Minister for the Environment may make grants and loans on such conditions as he or she thinks fit to any person to assist in achieving the purpose of this Act (Resource Management Act 1991, section 26). This section, although contained within the Act, has not actually been utilised for the purpose of assisting applicants to obtain or comply with resource consents.

Monitoring and Inspection **Stage 7**

Monitoring requirements are laid out in the Resource Management Act 1991:

(1) Every local authority shall gather such information, and undertake or commission such research, as is necessary to carry out effectively its functions under this Act.
(2) Every local authority shall monitor-
(a) The state of the whole or any part of the environment of its region or district to the extent that it is appropriate to enable the local authority to effectively carry out its functions under this Act; and
(b) The suitability and effectiveness of any policy statement or plan for its region or district; and
(c) The exercise of any functions, powers, or duties delegated or transferred by it; and
(d) The exercise of the resource contents that have effect in its region or district, as the case may be,-
and take appropriate action (having regard to the methods available to it under this Act) where this is shown to be necessary.
Resource Management Act 1991, section 35

The information thus gathered is publicly available.

The monitoring requirements for the operating company (parameters, frequency of measurements, samples, use of independent laboratories) are contained in the specific permits, and so is the monitoring procedure to be followed when technology changes. Industries are expected to implement continuous compliance monitoring. Regulators implement audits. Results from monitoring resource consents and the state of the environment feed into the further development of standards and establishment of permitting requirements in specific receiving environments.

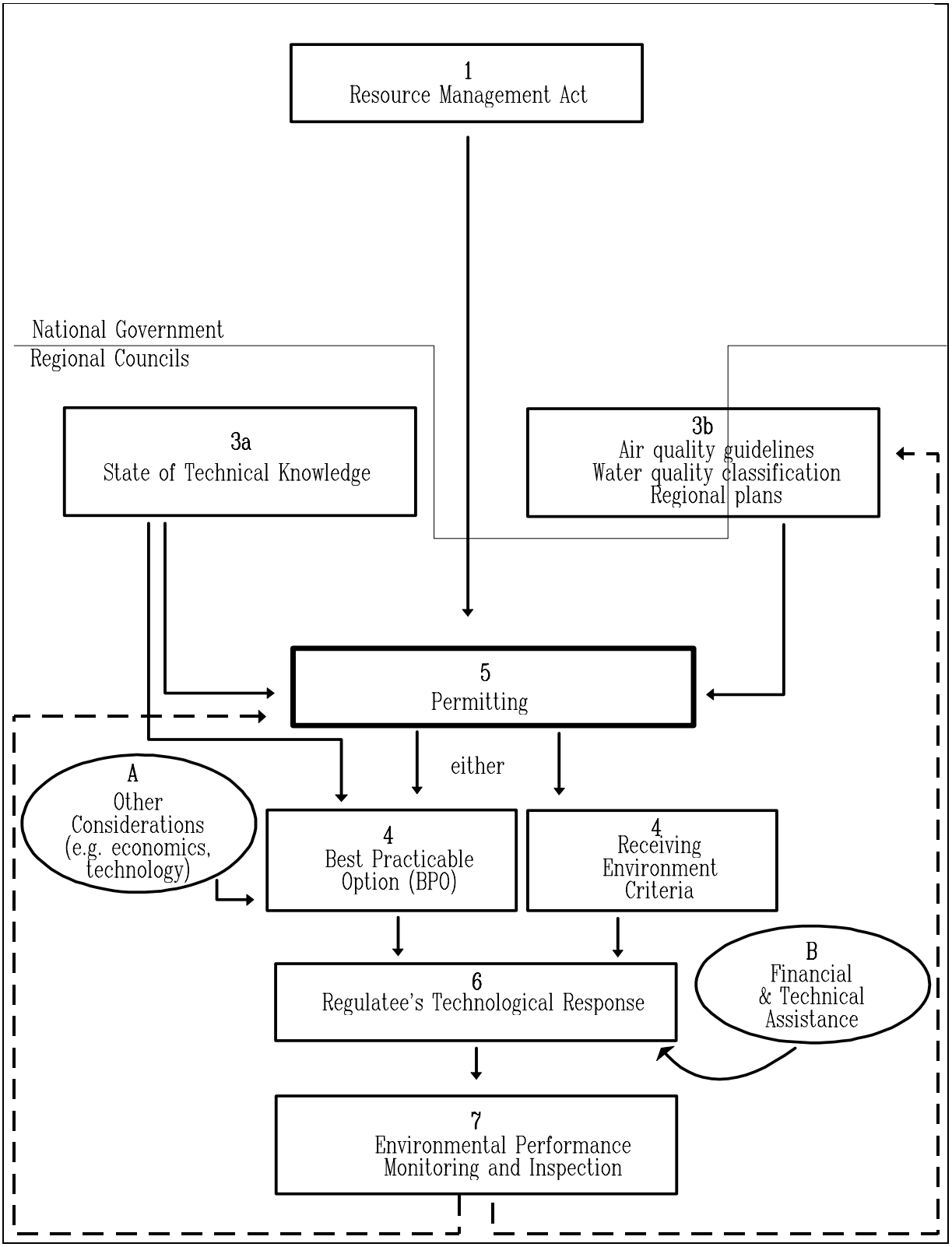


Figure 16 : New Zealand

NORWAY

Regulatory framework **Stage 1**

The right to a clean environment and the principle of natural resource management have been introduced in the Norwegian constitution. Under the Pollution Control Act, the Norwegian Ministry of Environment is responsible for the development of regulations controlling industrial pollution and guidelines affecting environmental quality. It is also responsible for the administration of the Norwegian Pollution Control Authority (SFT).

BAT **Stage 2**

No formal definition has so far been established in Norway. However, it will as a part of the European Economic Area Agreement, implement EC directives on Integrated Pollution Prevention and Control (IPPC), including a definition on BAT.

The understanding of BAT in Norway now is very much in line with the description of the Paris Commission, where the term "best available techniques" means the latest stage of development (state-of-the-art) of process, of facilities or of methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste. In determining whether a set of processes, facilities and methods of operation constitute the best available techniques in general or individual cases, special consideration shall be given to:

- comparable processes, facilities or methods of operation which have recently been successfully tried out;
- technological advances and changes in scientific knowledge and understanding;
- the economic feasibility of such techniques;
- time limits for installation in both new and existing plants;
- the nature and volume of the discharges and emissions concerned.

Techniques include both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled.

In respect to permit decisions, according to the Pollution Control Act (§2), the Act shall be used to "achieve satisfactory environmental quality on the basis of a total appraisal of health, welfare, the natural environment, cost related to control measures and economic considerations. The prevention and abatement of pollution and waste problems shall be based on the technology which, on the basis of

a total appraisal of present and future use of the environment and of economic consideration, gives the best result." This means that BAT, strictly defined on a technological basis, is not used as an absolute requirement in the permitting process. When determining the conditions in the individual permits, an overall evaluation must be conducted, based on several aspects (condition of the recipient, main polluting problems, cost-effectiveness of measures, etc.). Nevertheless, BAT is an important aspect and is linked to environmental goals, cost-benefit and cost-effectiveness considerations.

EQS **Stage 2-3b**

The Pollution Control Act provides the basis for the adoption of Environmental Quality Standards:

> *The pollution control authority may lay down regulations concerning:*
> [...]
> *2. threshold values for the occurrence of certain substances, noise, vibrations, light or other radiation in the environment, and what measures are to be taken if the threshold values are exceeded* [...] (PCA, paragraph 9).

Generally speaking, the point of departure for Norwegian environmental policy is the environmental quality in the various geographical areas. Recipient-orientation is therefore a key feature of Norwegian environmental policy as far as local and regional pollution problems are concerned.

No concise definition of Environmental Quality Objectives can be given. A distinction must be made between scientifically-based guidelines and politically-based legally binding EQOs. The former do not take into account economic considerations. When establishing legally binding EQOs, economic aspects are, however, central, and a comprehensive cost-benefit analysis is performed (see *Economic considerations*).

Expert groups are established to elaborate the scientific framework of and background for the EQOs. These groups consist of representatives from research institutes, universities, the State Pollution Control Authority and other environmental agencies. The groups are mandated to propose the EQOs.

So far, no legally binding EQSs have been established in Norway. For the time being, assessments are based on guidelines, a system for classification of environmental quality for water and air quality guidelines. These guidelines form the background for the formulation of measures, e.g. in the individual permit process.

The general criteria for classification of water quality and the guidelines/standards for air quality apply to the whole country.

Water

A classification system of environmental quality for freshwater, fjords and coastal waters has been elaborated. Two fundamental principles are outlined for determining the classification of water quality in Norway:

a) The classification of quality and degree of pollution. The basis for this system is the estimated natural water quality without any form of influence from man. It is the influence of pollution on the water quality, or the difference between the natural water quality and the water quality today that is classified. Another classification scheme is the actual content of pollutants, i.e. measured values.

b) The system for assessment of water quality for various uses is based both on the existing water quality and some physical and practical properties of the environment. The water quality criteria are specific for various uses.

The quality status and degree of pollution for a given water body is classified in five different classes/degrees, while the assessment of water quality for various uses (i.e. suitability) is classified in four different classes.

The result is a complete system for assessment of Norwegian water resources, in which the water resources' pollution level can be classified and the suitability for different uses classified accordingly. Through these two systems, central and local governments are able to undertake a complete assessment of the water resources.

Air

The term "air quality guidelines" or more specifically "air quality guideline values," is similar to that the World Health Organisation (WHO), that is to say, the report did not take into account evaluations of technical and economic possibilities of complying with the recommended values.

SFT established a working group consisting of members from research institutes as well as representatives from SFT. The task of the group was not to present proposals for national norms for air quality, but to present the fundamental data on the effects on health and the environment that are required to stipulate such norms. As far as SFT is concerned the air quality guidelines will serve as a measure to evaluate the state of the environment and the need to take action. In practice, the damaging effect of the emissions must be weighed against the gain to society from the activity concerned.

Based on a study of the literature, the group has described the association between air pollution and adverse effects on health and vegetation (dose-effect relationship) for the substances NO_2, NO, ozone, SO_2, suspended particulate matter, acid aerosols, CO, etc.. The group has proposed air quality guidelines for levels of exposure which, according to present knowledge, the populations and the environment can supposedly tolerate without suffering serious harm. An attempt has been to take into account sensitive groups in the population and vulnerable groups of plants, and to consider possible interactions between the component concerned and the other pollution components being investigated. For several compounds, e.g. NO_2 and ozone, new more stringent guidelines are proposed. The main reason is that recent investigations demonstrate effects at lower levels than have been apparent before.

Another important concept in Norway the critical load concept. The critical load concept has been found valuable for the development and the implementation of control strategies for transboundary air pollutants. The critical load for surface waters is defined as:

> *A quantitative estimate of the loading of one or more pollutants below which significant harmful effects on specified sensitive elements of the environment are not likely to occur according to present knowledge*."

The purpose of determining critical load is to set goals for future deposition rates of acidifying compounds such that the environment is protected. Critical loads are determined separately for different receptors, such as soils and lakes. The critical load for a particular will vary from site to site, depending on its inherent sensitivity. The critical load concept is used as a basis for determining emission reductions such as required by the Convention on Long-Range Transboundary Air Pollution (the Geneva Convention). New emission reductions will be based on the principle of critical load and cost-effectiveness.

<u>Emission Limit Values (ELVs)</u> **Stage 2b & 5**

The Pollution Control Act stipulates that Emission Limit Values may be set. When setting emission requirements, the pollution control authorities make an evaluation of the environmental quality in the area under consideration, i.e. a case-by-case evaluation.

Large stationary sources are, as a rule, handled individually. This is due to the limited number of enterprises operating within each industrial branch and to the recipient-oriented policy. It has therefore not been considered appropriate to develop general emission standards which are binding requirements. In practice, minimum discharge "standards" do, however, exist for some industrial branches which are used as a basis when permits are being prepared.

<u>Permitting</u> **Stage 5**

A fundamental principle of Norwegian pollution control policy is that any pollution is prohibited in the absence of a permit. The permits are designed to ensure that pollution is kept to a minimum. Once again, the Pollution Control Act lays out the relevant principles and procedures:

> *No person may possess, do or initiate anything which may entail risk of pollution unless this is permitted by law* [...] (PCA, paragraph 7).
>
> *The pollution control authority may upon application grant a permit for activities which may lead to pollution* (PCA, paragraph 11).

The Norwegian Pollution Control Authority (SFT) has the authority to require permits from certain activities:

> *The pollution control authority may lay down regulations stipulating that anyone wishing to carry out certain types of activities which, by their nature, may lead to pollution must apply for a permit* [...] (PCA, paragraph 11).

And to set permitting requirements

> *Specific conditions may be laid down in the permit issued pursuant to [paragraph] 11 in order to prevent the pollution from leading to damage or disamenity. The stipulated conditions may include conditions concerning protective and cleaning measures, recycling and the length of the permit's validity* (PCA, paragraph 16).

Permits to discharge pollutants to the air and water are issued by the SFT. Permits for solid waste disposal are, in some cases, issued by local environmental authorities.

Permit applicants must complete a form and include information describing:

- the location, the nature of the plant, employment and any change in activity;
- the type of process used and the production capacity;
- both direct and indirect releases of effluents, from the process and solid waste disposal sites, including quantities, chemical analyses and toxicity tests results, and details of pollution control measures;
- details of the receiving waters;
- atmospheric releases including quantities, analyses and description of abatement measures, such as control equipment, stack heights and results of dispersion;
- model studies;
- sources of noise, and results of measurements in the locality;
- neighbours' concerns and details of planned abatement measures;
- contingency plans to address any abnormal releases to water and air;
- description of internal, pollution prevention systems that will be applied to control releases;
- description of means to measure various releases and draft monitoring programs for air and water.

Applications for permits are advertised and neighbours and other parties have the opportunity to provide comments and concerns regarding the application. Similarly the local authorities in the counties and municipalities are contacted for their views. The applications are available to the public. A copy

of the application is sent to the local authority in the municipality for public viewing. Announcements of this are made in local newspapers.

A separate department, The Department of Industry, within the SFT is responsible for handling applications for discharge permits. This is broken down into different units that handle applications from various types of industry. The department is also responsible for following up on permits by reviewing reports on internal control measures that have been installed, and participating in inspections and audits that are run by the SFT's Pollution Control Department. The Department administers monitoring programs in areas polluted by industry and offshore operations, and follows up on programs implemented to develop cleaner technologies. It also participates in International activities.

The Pollution Control Department within the SFT is responsible for ensuring compliance with the Pollution Control Act and the Product Control Act and any regulations pursuant to these acts, as well as any permits to individual enterprises. In addition the Department identifies risks of any accidental discharges and proposes relevant risk-reduction measures.

The permitting authority's decisions are based on case by case consideration of each application. In setting permit requirements, consideration is given to the nature of the discharges, the conditions of the receiving environments, the cost-effectiveness of available control options, and cost-benefit analysis of the pollution abatement measures that could be taken. The latter weigh the benefits of reduced pollution against the cost of controls. Economic analyses which consider the financial effects of control on the enterprise, influence the compliance schedule but not the final value of the limits that are set.

The construction of new plants or the expansion of existing facilities triggers a permit review. Permit review and approval usually takes nine to 12 months to complete. Once granted, permits have an indefinite life, but may be withdrawn after 10 years :

> *The pollution control authority may cancel or change the conditions in a permit, or may stipulate new conditions, and if necessary withdraw a permit if*
> *1) it turns out that the damage or disamenity caused by the pollution is much greater or different than anticipated when the permit was granted,*
> *2) the damage or disamenity can be reduced without unreasonable cost to the polluter,*
> *3) new technology makes it possible to reduce the pollution to a significant degree,*
> *4) the conditions in the permit are unnecessary in order to counteract the pollution*
> *5) the advantage to the polluter or to others from modification or cancellation of the conditions are much greater than the damage or disamenity this will imply for the environment, or*
> *6) this follows moreover from the rules that are valid in other respects concerning reversals of administrative decisions. The permit can in any case be withdrawn or changed when 10 years have passed since the permit was issued* (PCA, paragraph 18).

Decisions of the county authorities can be appealed to the SFT, and decisions by the SFT can be appealed to the Ministry of Environment. Any interested parties may make an appeal, (plant owners, neighbours or environmental organisations).

Integrated permits are issued covering releases to water, air, solid waste disposal and noise abatement. Limits are set as maximum discharges to the various media. Often permits for existing facilities include stepwise reduction schedules over a limited time, to meet the environmental requirements.

The permit issuance process usually requires an evaluation of the water and air receiving environments, so that the effects of pollution can be assessed prior to setting the permit conditions. Normally there is also a demand for an evaluation of the recipient after the required discharge levels are achieved. This is used when considering whether further measures are required. For new activities that may cause pollution, there is a demand for an Environmental impact Assessment (pursuant to the Building and Planning Act), prior to the permitting process.

Previously, the permits generally contained requirements concerning which technology should be used together with the corresponding emission limits. According to current practice, only the emission limits are specified, leaving it up to the enterprise to choose the techniques which meet the limits. In cases where satisfactory measuring methods do not exist, a specific technique must, however, be prescribed.

Existing technology is not always sufficient to attain the objectives of for environmental quality. In such cases, an important element when granting permits is therefore to formulate requirements not only based on existing technology, but also to incorporate an incentive to develop technology. The enterprises in question are required to examine the possibilities for further reductions of pollutants, possibly step by step. New and more stringent emission limits are set in accordance with the possibility of the new technology.

Economic considerations **Factor A**

The Pollution Control Act lays out the following as one of the guidelines governing the application of measures taken to combat or prevent pollution:

> [...] *The Act shall be used to achieve satisfactory environmental quality on the basis of total appraisal of health, welfare, the natural environment, costs related to control measures and economic considerations* [...] (PCA, paragraph 2, emphasis added).

According to the Act, BAT also has to be economically justified (see definition in *BAT*). By the same token, alterations and withdrawals of permits have to be warranted on the basis of economics:

> *Decisions* [...] *shall take into account the costs which a change or reversal of a decision will involve for the polluter* [...] (paragraph 18).

When setting environmental quality guideline values, no reference to economic feasibility is allowed (see *EQS*). When establishing legally-binding EQOs, however, economic aspects are central and comprehensive cost-benefit analyses are performed. Different economic affordability for different types of pollutants is taken into consideration when elaborating on the benefit part of the cost-benefit analysis. The same applies to the precautionary principle.

In Norway, cost-benefit and cost-effectiveness assessments are included in the permit review process, these influence the emission limits that are set and the time-frames for implementation of controls. It is noted that economic feasibility influences the time frame for the installation of controls but not the absolute values of the limits. The cost of pollution control technology and the environmental impact of the discharges, are weighed against the economic costs to the plant to install controls measures.

Financial and Technical Assistance **Factor B**

The Norwegian Pollution Control Authority administers a program to provide some funds to assist in development of Cleaner Technology. Support for various projects depends on fulfilment of certain criteria, of which the following are the most important:

- the project must help to solve high priority environmental problems in Norway;
- the enterprise ("the owner of the problem") must contribute financially;
- the results of the program should be transferable to other enterprises.

Monitoring and Inspection **Stage 7**

All enterprises in Norway have to fulfil Regulations concerning Internal Control (laid down by Royal Decree of 22 march 1991). The Internal Control Regulations contain provisions which stipulate that the person responsible for an enterprise has an obligation to arrange for a systematic follow-up of current requirements, as laid down in the Working Environment Act, the Pollution Control Act, the legislation relating to fire and explosion hazard and fire prevention, the Product Control Act, the Civil Defence Act and the Act relating to Inspection of Electrical Installations and electrical Equipment. The purpose is to promote health and good working environment, protect the external environment and improve safety.

The internal control system shall contain inter alia:

- the management's objectives for the environmental and safety activities of the enterprise;
- a description of how the enterprise is organised, including the area of authority and responsibility of the environmental and safety activity of the enterprise, with reference to possible job instructions;

- written routines and procedures for ensuring that the enterprise complies with Acts and regulations, also showing who is responsible for examinations;

- a description of how the internal control system is systematically and regularly updated and how employees and other affected parties are informed of the changes.

The supervisory authorities according to the above- mentioned Acts also supervise the implementation and compliance with the regulations.

The basis for the Internal Control Regulations is provided in the Pollution Control Act:

> *The pollution control authority may lay down regulations concerning systems of internal control to ensure that the requirements laid down in or in pursuance of this Act are complied with* (PCA, paragraph 52).

In addition, the Pollution Control Act stipulates that:

> *The pollution control authority shall monitor the general pollution situation and pollution from individual sources* (PCA, paragraph 48).
>
> *The pollution control authority shall have unrestricted access to property where pollution may occur or has occurred, or which is or may be exposed to pollution, when this is necessary for the exercise of its duties pursuant to this Act* (PCA, paragraph 50).

The national monitoring programme is responsible for monitoring of watercourses, fjords and coastal areas, air quality in cities and towns and long-range transboundary air pollution. The aim of this programme is to evaluate the need for remedial actions and the result of such actions. Furthermore, the programme shall give a general survey of the pollution situation and supply information on how the various pollution problems are distributed over time.

Individual permit-holders who contribute largely to the pollution situation in an area, can be required to finance part of the national monitoring programme in that area, or to finance a special monitoring programme if the area is not covered by the national programme.

Depending on the potential size of their emissions and the vulnerability of the surrounding environment, industrial activities with an emission permit are placed in one of four surveillance categories, which govern the frequency of inspections/audits carried out by the pollution control authority. The pollution permit also contains demands on a programme for self-monitoring of emissions, the size of which varies with the surveillance category. A report containing, inter alia, results of the monitoring programme is submitted to the Pollution Control Authority annually. The public has access to the reports from the authorities and the permit holders on request.

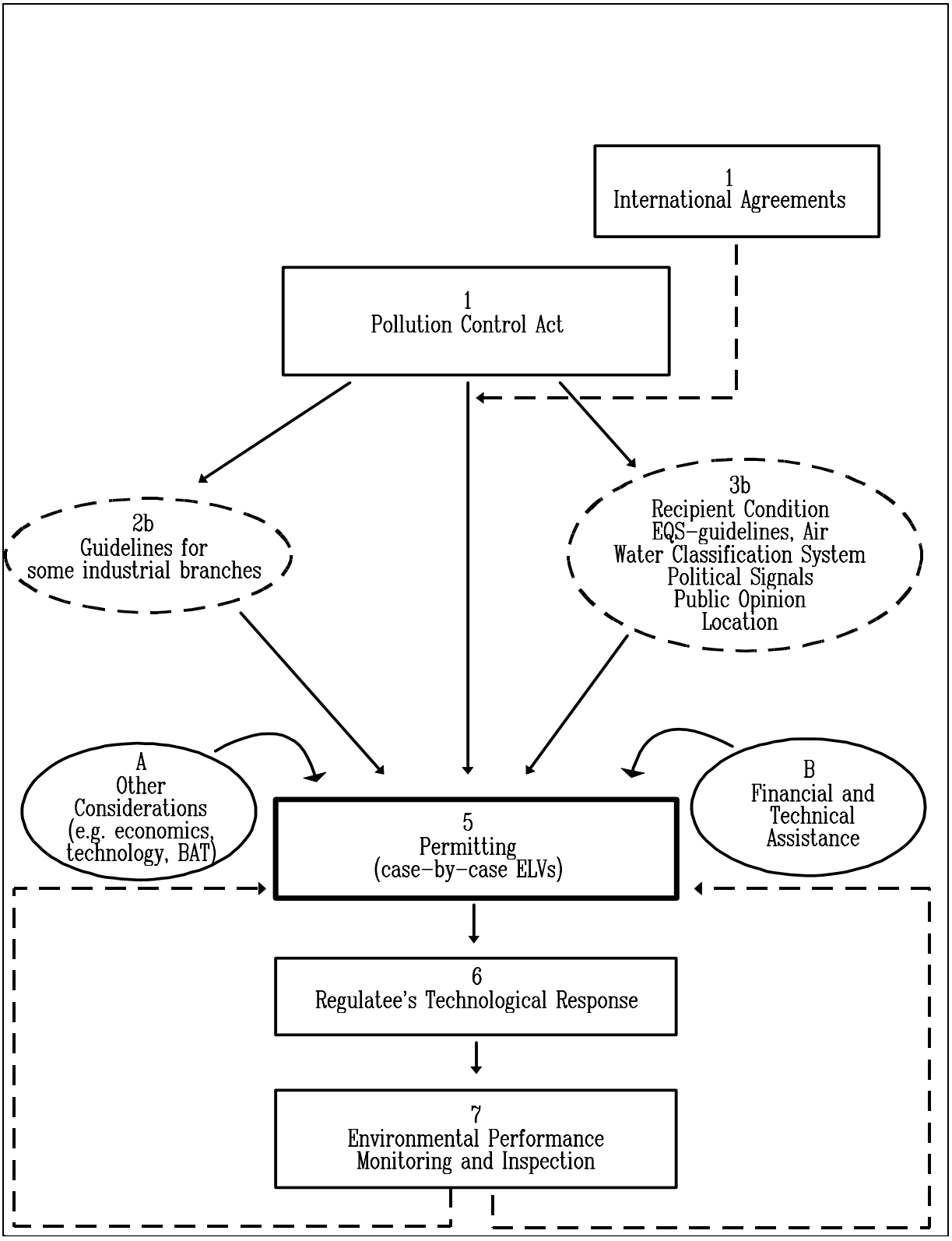


Figure 17 : Norway

SWEDEN

Regulatory framework **National government/counties**

At the government level, responsibility for the environment is largely vested in the Ministry of the Environment. The Swedish Environmental Protection Agency (SNV) is the central authority for environmental supervision. It is responsible for the delivery of decisions by the Parliament (Riksdag) and the Government in the field, including permitting, and keeps informed of new developments in processing so as to be able to propose necessary control measures. It is responsible for the implementation of matters that fall under the Environmental Protection Act

The Environmental Protection Act controls environmentally hazardous operations. This covers operations on property and in permanent plants that are a source of disturbance to the neighbourhood. These include disturbances due to air and water pollution and noise. Activities causing disturbances require permission. In the case of operations that have the potential to cause grave disturbances, this permission is granted by the National Licensing Board for Environmental Protection. If disturbances are of a minor nature, instead notification must be given to the local health and environmental board.

The SNV, in addition to providing advice to the Licensing Board on permits, is also the central supervisory agency of government, and supervises the activities of County and Local Administrative authorities, providing assistance as necessary. Continuous supervision is carried out by the County authorities for the most polluting activities and by the local administrations for the rest. The Licensing Board is a central autonomous authority and has a status similar to that of a court.

Day-to-day pollution control activities are supervised by the County Administration Boards. This includes monitoring and enforcing permit requirements. The division of assessment tasks between the National Licensing Board and the county administrative boards is governed by the Environmental Protection Ordinance. This specifies which activities are assessed by the National Licensing Board and which by the county administrative boards. The National Licensing Board assesses the activities that typically give rise to the greatest disturbances in their surroundings, while activities entailing minor disturbances and/or discharges are assessed by the county administrative boards.

BAT **Stage 1**

The 1969 Environment Protection Act provides the basis for the regulations adopted to prevent disturbances to the environment. The Act introduces the obligation to obtain a permit for a large number of activities. The conditions for operation under a permit are laid out:

> *Anyone performing or intending to perform an environmentally hazardous activity shall take such protective action, tolerate such restriction of the activity and take such other precautionary measures as may reasonably be demanded for preventing or remedying detriment*. [...]
>
> *The extent of the obligation imposed by the provisions of paragraph 1 above is to be assessed on the basis of what is technically feasible for the activity in question, and taking both public and private interests into consideration* (Section 5).

The requirements contained in the Environment Protection Act are worded in general terms. The central BAT requisite is that the operators of environmentally hazardous activities must take measures that are technically and economically feasible as well as environmentally justified. The measures that manufacturers may be obliged to take may relate to both the installation and implementation of purification devices, but also to changes in the manufacturing process itself. The most efficient technical devices and methods used in Sweden or abroad should be used. The technology must be tried and tested and in practical use : it is not sufficient for it to be in the experimental stage.

The imprecise wording of the law is compensated by the adoption of regulations that are specific to each permitted facility (see *permitting*). Consequently, the circumstances in the individual cases determine the operational requirements applicable for the protection of the environment.

No general or sectoral law on Best Available Technologies has been adopted, particularly for large, stationary sources. For emission sources that are identical and numerous, a trend toward general requirements may be foreseen. Individual circumstances will thereby come to play little or no part at all. The adoption of individual requirements have allowed the specific conditions of different facilities to be taken into account. General regulation for a whole sector is more sluggish and more indiscriminate in its effects.

A central concept contained in the Act on Chemical Products is the substitution principle. As far as possible, a chemical product should be replaced by one that is less hazardous to the environment or health. The substitution principle can be understood as a subset of the BAT principle.

EQS **Stage 2b**

EQS for fresh and sea waters are designed to ensure the survival of healthy, balanced populations of naturally occurring species. Quality goals must be established for lakes and watercourses on the basis of which decisions can be made as to measures to be implemented and future planning in the catchment area.

There are national air quality standards on sulphur dioxide, particulates and nitrogen dioxide and at the local level the municipal authorities in the physical planning process can decide on limit values on noise, vibration, light or other such disturbances that are assessed according to the Environment Protection Act. So far, there are very few EQO standards prescribed in Sweden. However, according to the proposal for a new Environmental Code such standards are to be more frequently used.

Sweden complies with the relevant environmental quality directives promulgated by the European Union in the various media concerned. Sweden has introduced limit values for SO_2, black smoke and NO_2. Although these limit values may be exceeded, the relevant municipalities must record the levels. In addition, the EU threshold values have been adopted by Sweden for ground-level ozone. A risk to health and the environment is posed if these values are exceeded. Target values for air quality indicate the concentration levels of pollutants not to be exceeded to have a healthy environment. Target values are not binding, only recommended maximum values. In addition, Sweden uses assessment criteria to gauge the effects on health and the environment of the concentration of various substances such as particulates.

Emission limit values (ELVs) **Stage 3a-4a**

The Environmental Protection Agency issues recommendations concerning the industrial emission limit values. However, the facilities are assessed individually (see *permitting*) and, therefore, the emission/discharge requirements vary as to the facility concerned.

The government has embarked on a vast review programme of the discharge/emission conditions contained in the permit issued under the Environmental Protection Act. The requirements of those permits that are up for renewal will be tightened. The objective for the year 2000 is to bring emissions down to a level where no harm is done to the environment.

Regional pollution prevention and control efforts **Stage 3b-4b**

The Environmental Protection Act provides for more stringent regional pollution abatement programmes. The Swedish government is authorised to prohibit all discharges (Section 8). The government may also select protected areas:

> *Should it be particularly important from the public viewpoint to protect a land or water area that is exposed to an environmentally hazardous activity, the Government may designate the area and its immediate surroundings as an environmental-protection area.*
>
> *Where such an area is concerned, the Government or, if authorised by the Government, the county administrative board shall issue detailed directives concerning protective action, restrictions and other precautionary measures for activities in the area.*(Section 8a)

Permitting **Stage 5**

The obligation to obtain a permit for a large number of activities is laid out in the Environment Protection Act:

> *The National Licensing Board for Environment Protection may, on application from anyone performing or intending to perform an environmentally hazardous activity, grant a permit for the activity after examination under this Act* (Section 9).

The 1989 Environment Protection Ordinance lists all the environmentally hazardous activities which require a permit. The Ordinance also specifies whether the permit has to be obtained from the National Licensing Board for Environment Protection or from the relevant county administrative board. For activities that typically entail a major environmental impact, a permit has to be secured from the National Licensing Board for Environment Protection. Activities with less impact on the environment have to be licensed by a county administrative board. Sweden is divided into 24 counties, each with its own administrative board that performs various central-government functions.

Limits are established form case by case considerations, through hearings conducted by the Licensing Board. The permit conditions, including limits are subject to negotiations in the hearing process. Three members and a chairman sit on the National Licensing Board for Environment Protection, all appointed by the government. Members have significant expertise, in the individual fields of industrial processes, environmental impacts and legal matters.

The government is represented by the Swedish Environmental Protection Agency (EPA) at the hearings. The EPA has broad expertise in technical and economic aspects of environmental control from the industry, and in environmental effects. Based on its evaluation of emissions from the industry the EPA proposes its evaluation of what is Best Available Technology, for the mill, as the starting point for consideration by the Licensing Board. The costs for control and the impact on the environment are also provided.

The Water Act also imposes the obligation for an enterprise to obtain a permit. Similarly to the procedure established by the Environment Protection Act, individual circumstances play a major part in the assessment for permit purposes.

It is not immediately evident from the permissibility rules which requirements should apply to various types of activity. The installations subject to licensing under the above-mentioned legislation are assessed individually. The specific circumstances under which the facility has to operate are factored into the permitting requirements. The permits issued by the Board consider the views of various stakeholders including the EPA, industry, environmental groups, the local community and the public. The Board considers and balances the views of all parties when rendering a decision. Permits granted to individual mills specify the emission limits and other conditions such as the installation of specific technologies.

In making its decisions the Licensing Board may decide on limits which are less stringent than BAT, for a mill, based on its assessment of the individual merits of the case, for that plant. This considers the assimilative capacity of the receiving environment, the economics associated with the installing technology at the mill, and the financial condition of the mill.

A permit has to be issued even prior to the beginning of the construction of an installation. The assessment processes are the same whether they are handled by the National Licensing Board or by the respective county administrative boards. The permitting process is triggered by new plant construction, plant expansion or alteration of the process which may affect the environment. Applicants must provide details regarding:

- current and proposed future discharges/emissions from the process;
- generation and disposal of waste and noise;
- a description of future remedial measures and the costs for such measures;
- an environmental impact statement.

After the assessment and the review process, the permits are delivered, specifying the discharges and the quantities of pollutants allowed. The duration of permits is unlimited. However, the conditions for the permits can be reviewed after 10 years. Generally, the expiry date lies between 3 and 10 years.

Economic considerations **Factor A**

The Environment Protection Act contains language relating to the assessment of economically justified measures:

> *In assigning priorities between various interests, particular attention shall be paid, to the nature of the area that may be subjected to disturbance and the severity of the effects of the disturbance and, on the other hand, to the usefulness of the activity, the cost of protective action and other financial implications of the precautionary measures concerned* (Section 5, emphasis added).

Under the provisions of the Environment Protection Act, the Licensing Board must determine extensive abatement action and precautionary measures in the light of what is reasonable from a technical and financial point of view. Another policy instrument which incorporates economic considerations is the SEK 30-40 principle where the permitting authority, in accordance with the National Resources Act, prescribes that measures to reduce emissions, such as NOx, should be taken up to a cost of 40 SEK/kg NOx reduced.

The basis for consideration is what a company typical of the industry can manage. In principle, the financial position of the company examined will be disregarded. Therefore, a company that is experiencing some difficulty must not be given a competitive advantage in relation to one that is performing well. This rule applies to new enterprises in particular. For older business operations to be maintained in an unchanged state, or modified only to a small extent, the rule is that greater attention

should be paid to the company's current financial situation. What is some times allowed are the somewhat longer times for implementation of the necessary measures at existing mills.

Monitoring and Inspection **Stage 7**

The plant owner conducts monitoring according to a programme that has been determined by the county administrative board. The county administrative boards exercise supervision over activities requiring permits under the Environment Protection Act. The monitoring results are considered in the permitting process and are available to the public.

One major task involved in supervision is to check that the conditions stated in the permit decisions are complied with by companies. For this purpose, the supervisory authority adopts a control programme. This specifies which tests should be taken and how often, where and for how long the programme should take place. The task of the authorities is to ensure that control is arranged in a proper manner so that they can assess whether the conditions are being followed. The test results are then reported to the supervisory authority, which compares them with the conditions. The control programme therefore lays down regulations on the obligation to report to the supervisory authority.

Another important question regulated in the control programme is inspection. As a rule, it is stipulated that an activity must be inspected annually by a consultant who must be approved by the supervisory authority. The scope and frequency of inspections is regulated. The supervisory authorities may also conduct inspections directly.

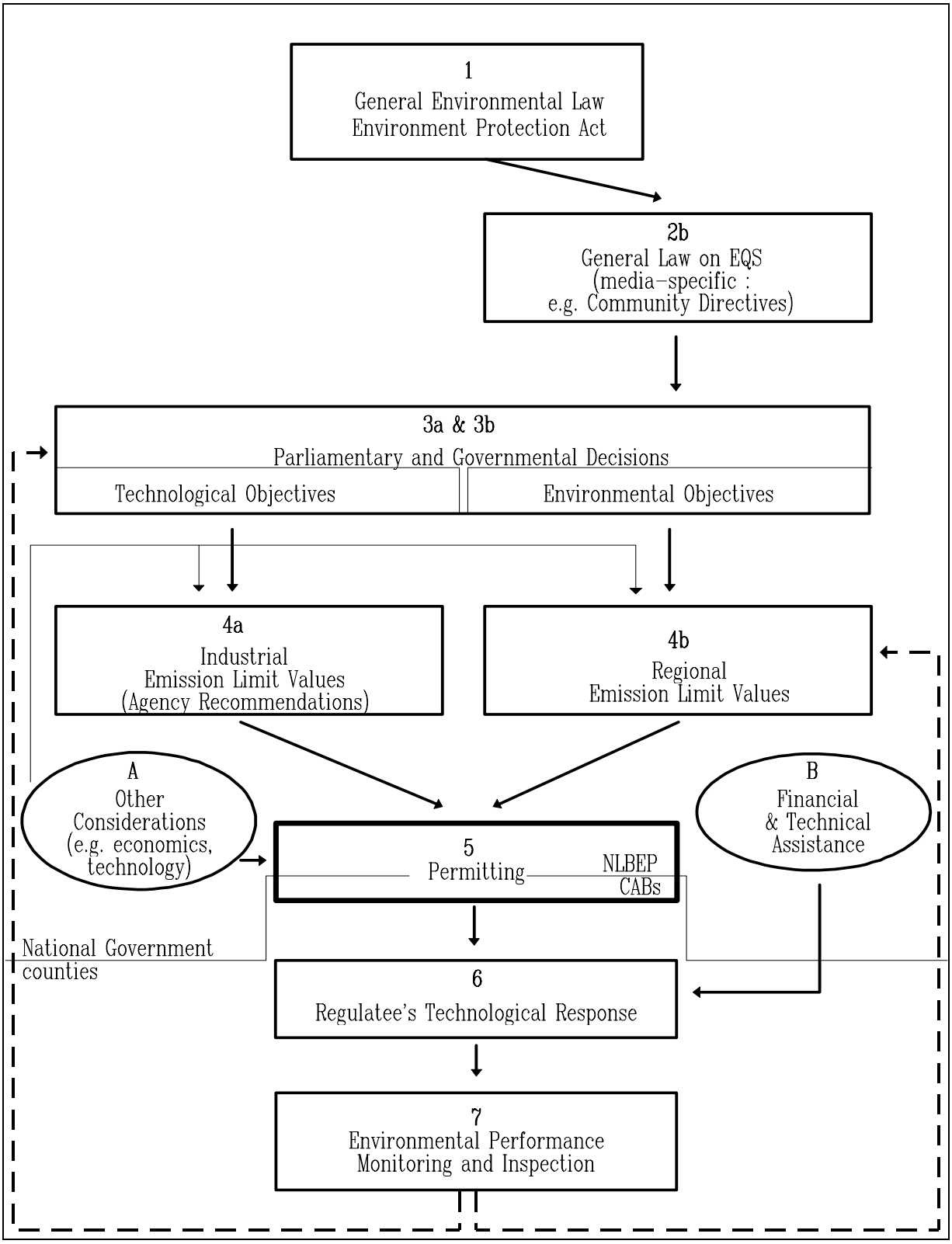


Figure 18 : Sweden

SWITZERLAND

Regulatory framework **Federal government/cantons**
Stage 1

Responsibility for environmental protection in Switzerland is shared between the federal and canton governments. The federal government makes laws and regulations dealing with the environment and the cantons are responsible for delivery at the local level, including mill permitting. The Swiss constitution stipulates that the cantons are responsible for the implementation of environmental laws "unless reserved by law to the Confederation" (article 24). Transboundary issues are of importance as relates to discharges to rivers, which cross borders, and emissions to air which give rise to transboundary air pollution.

The Federal Law for the Protection of the Environment designates the areas for which the Confederation has executive jurisdiction, e.g. regulation for fuel contents, independent monitoring, designation of hazardous waste sites, international agreements, information on substances (article 41). The cantons may participate in some of these areas and the Confederation may delegate some of its powers to the cantons (for instance in the field of dangerous substances). All the areas not mentioned in the law are reserved for the cantons to implement (article 36). Inversely, the Confederation must take into account the measures taken by the cantons for the protection of the environment. For the implementation of the federal laws, the cantons set up local environmental protection offices that mirror the work the Federal Office for Environment, Forests and Landscapes does at the federal level.

Article 24bis of the Swiss constitution grants to the Confederation authority to decree prescriptions for "the protection of man and his natural environment against harmful or inconvenient aggressions" (unofficial translation). Law-making bodies should be particularly concerned with air and noise pollution.

BAT **Stage 2a-3a**

The Swiss legislation does not provide a precise definition of Best Available Technology.

Air and Noise

The Federal Law on the Protection of the Environment (FLPE) provides the framework for the limitation of air and noise emissions from stationary and mobile sources.

Article 11 of the FLPE lays down a two-stage action plan to protect the quality of the air : in the first stage, emissions are to be reduced wherever this is economically bearable; in the second-

stage, restrictions on emissions will be tightened wherever this is necessary to reach the limits set in the Ordinance on the Protection of the Air of December 6, 1985.

> *Air pollution, noise, vibrations and radiation shall be limited at the source (limitation of emissions)* (FLPE, article 11.1, unofficial translation).
>
> *Regardless of existing nuisances, it is important from a prevention standpoint to limit emissions to the extent allowed by the state of the art (l'état de la technique) and the operation conditions, and as far as it is economically bearable* (FLPE, article 11.2, unofficial translation).

According to article 12 of the FLPE, emissions may be limited through, inter-alia, emission limit values (see ELVs), requirements in terms of construction or equipment and provisions on fuel quality.

The Ordinance on Air Protection (Opair) implements and provides an explanation of the BAT principles contained in the FLPE:

> […] *2. Are considered achievable, on technical and operational grounds, those emission-limiting measures :*
> *a. Whose performance has been proven in comparable installations in Switzerland or abroad, or*
> *b. Which have been successfully applied in experiments and which can technically be applied to other installations* (Opair, article 4, unofficial translation).

The Ordinance goes on to specify some general requirements for the recovery and release of emissions:

> *1. Emissions shall be recovered as fully and as close to their source as possible, and be released so as to avoid excessive immissions.*
> *2. Emissions will, in general, be released above the roofline through a stack or release duct* […] (Opair, article 6, unofficial translation).

The purpose of BAT is mainly to fulfil the precautionary principle set in the FLPE and to achieve the EQOs. The BAT requirements contained in the Opair are binding. They are set without specification on a pollutant-by-pollutant basis by the Swiss government after being submitted to a consultative procedure involving the cantons, industries and interested organisations.

According to the precautionary principle, the BAT requirements are enforced as well in the areas in compliance with the EQOs. Where BAT is insufficient to achieve the EQOs, emission limits are strengthened (see *ELVs*).

Water

In the Swiss legislation on the protection of waters, the concepts of Best Available Technique/Technology is not defined. Therefore, the requirements contained in the Federal Law on the Protection of Waters and in the Ordinance on Waste Water Discharge correspond to the "state-of-the-art" (*état de la technique*, *Stand der Technik*). Switzerland is a party to the Convention for the Protection of the Marine Environment of the North-East Atlantic and thus complies with definitions of Best Available Techniques contained in the convention.

According to the Federal Law on the Protection of Waters (FLPW) of 24 January 1991:

> *1. To introduce or infiltrate into a body of water any substances which may pollute such water, either directly or indirectly, shall be prohibited.*
> (FLPW, article 6).

The FLPW allows the Federal Council to issue regulations on the discharge of waste water into bodies of water, the infiltration of waste water and substances that may pollute waters or impair the operation of treatment installations (article 9). The procedure for the discharge of waste water is broadly defined:

> *Outside areas covered by public sewers waste water shall be discharged according to the latest technical methods.*
> (FLPW, article 13)

According to the Ordinance for Waste Water Discharge (OWWD), discharge qualifications may be relaxed:

> *1. For the treatment of waste waters from remote buildings with few inhabitants and no possibility to get connected to a public sewer system, the authorities of the Cantons may, for the discharge of such waste waters into a water body, apply less stringent effluent standards than prescribed in this decree. In such cases, the <u>best possible control technologies</u> shall be applied, taking into account the possible detrimental effects to surface and ground water, the safety for plant operation and the expenses*
> (OWWD, article 11, emphasis added).

<u>EQS</u> **Stage 2b-3b**

Air and Noise

The Federal Law on the Protection of the Environment (FLPE) indicates that:

> *The federal Council shall edict, by means of ordinances, immission limit values applicable to the evaluation of noxious or inconvenient releases*
> (FLPE, article 13, unofficial translation).

The Federal Office of the Environment, Forests and Landscapes, the Federal Commission on Air Hygiene and Federal Research Stations are involved in preparing the EQOs (ambient air quality standards) which are finally set in the Ordinance on Air Protection (Opair) by the Swiss government after being submitted to a consultative procedure involving the cantonal authorities, industries and interested organisations. Since the cantons are to a great extent responsible for the implementation of federal laws and ordinances (see *Distribution of Powers*), the Opair contains ambient air quality standards for those pollutants which can be managed at the local or subregional level. Problems of transboundary concern such as deposition of acidity, nutrient nitrogen, and to some extent also the photochemical oxidants are covered under the UN/ECE Convention on Long-Range Transboundary Air Pollution where the EQOs are referred to as critical levels/loads.

Based on the scientific state-of-the-art and experience, immission limit values are set to levels that do not threaten human, animal and plant life, impede the well being of the population, damage buildings or affects soil fertility or water quality. Particular attention is given to the health of sensitive subjects such as children, the sick, the elderly and pregnant women. Air and noise immission limit values must not be breached. Noise immission limit values (ILVs) are one of the three types of noise ambient quality standards. Alert levels are set higher than ILVs and are used for emergency response measures. Planning levels are set below ILVs and are used as target values for long-term development. This classification of levels may be pertinent for all types of environmental pollutants and nuisances.

All ambient air quality standards contained in the Opair apply to the entire territory of Switzerland. In the case of the critical loads developed within the UN/ECE Convention on Long-Range Transboundary Air Pollution there is a set of different critical loads reflecting the different sensitivities of subregions of Switzerland to the deposition of acidity and nutrient nitrogen.

Water

The purpose of environmental quality objectives is laid out in article 1 of the Federal Law on the Protection of Waters. The Ordinance for Waste Water Discharge provides the details of the objectives (e.g. sludge formation, turbidity, coloration, odour) regarding surface water flows and impounded river waters (article 1) and for still waters (article 2).

According to the Federal Law on the Protection of Waters (FLPW), the Federal Council is responsible for setting the quality requirements of surface and subterranean waters (FLPW, article 9). It is the responsibility of the cantons, however, to ensure that those water quality requirements are respected (see *Monitoring*).

The quality requirements for water are set in the Ordinance for Waste Water Discharge (OWWD) as “water quality objectives for surface and impounded river waters.” If the EQOs are not attained, the competent authorities shall demand supplementary measures.

The Ordinance for Waste Water Discharge (OWWD) sets the standards for emission limit values, immission limit values and quality criteria. The Ordinance fixes some general principles governing water quality objectives for surface water flows and impounded river waters as well as

still waters. In addition to these general principles (formation of sludge, turbidity, coloration or formation of foam, alteration of taste and odour as compared to natural state, algae proliferation, growth or visibility of bacteria, fungi or protozoons, disturbance of animal species through high levels of organic pollution, non compliance with the hygienic qualifications for drinking and bathing water) a series of quality criteria listed in the appendix to the Ordinance have to be complied with (OWWD, articles 1 & 2).

Emission Limit Values (ELVs) **Stages 2b-3b**

Air and Noise

Emission limit values are envisaged in the Federal Law for the Protection of the Environment (FLPE) but actually expounded in the Ordinance on Air Protection (Opair):

> *New stationary installations must be equipped and operated so as to be in compliance with [the attached] emission limit values* (Opair, article 3, unofficial translation).

Different ELVs apply to different pollutants and different industries. The authorities may impose more stringent limit values when the proposed emissions -even if they are in compliance with the applicable preventive ELVs- would induce excessive immissions.

The preventive emission limits also apply to existing installations. Existing facilities that do not meet the requirements have to be cleaned up. Supplementary measures and cleanup requirements may entail a reduction or a shutdown in the operations of the concerned facilities (Opair, articles 7-10). In particular, more stringent emission limit values apply to those stationary sources that generate more than 10 percent of the total pollutant load (Opair, article 32).

Water

The Ordinance on Waste Water Discharge (OWWD) sets the quality standards for effluents discharged into surface waters and, separately, for effluents discharged into public sewers. It is for the cantons to make sure that existing discharges are brought into compliance with these standards.

Stricter discharge qualifications apply when the quality standards are not met:

> *1. The authorities of the Cantons shall set stricter local qualifications for the discharge of waste water into a water body if the quality criteria and the concentration values* […] *are considerably in excess of standards and the quality criteria* […] *cannot be reached in spite of the fact that all qualifications* […] *are met* (OWWD, article 10).

Cantons may also set effluent standards for which no threshold values are listed or for substances that are not mentioned in the Ordinance.

However, in exceptional cases, the authorities of the Cantons may:

> *a. with agreement of the Federal Office for Environmental Protection set less stringent effluent standards than those listed […] for the discharge of waste waters into a water body, especially if this brings about a reduction of the pollution load and represents no risk to the said water bodies;*
>
> *b. set less stringent effluent standards for the discharge of waste waters into a public sewer system* […] *if all the sewer system, the plant operation conditions and the treatment and utilisation of the sludge allow for such procedure* (OWWD, article 11.2).

<u>Permitting</u> **Stage 5**

The cantonal offices are responsible for the delivery of requirements of federal laws and ordinances.

Air and Noise

The Ordinance on air protection (OPair) requires that:

> *1. Anyone operating or intending to build a facility that emits air pollutants must provide information to the authority on:*
> *a. the nature and the amount of emission;*
> *b. the site of emission, the height from ground at which it occurs and its fluctuations over time;*
> *c. any other characteristic of the emission necessary for its estimation.*
>
> *2. The declaration of emissions may be based on the measurement of the quantities of substances used*.
> (Opair, article 3, unofficial translation)

Water

The Federal Law for the Protection of Waters (FLPW) requires that:

> *1. Polluted waste water shall be treated. Its discharge or infiltration into any body of water shall be subject to cantonal authorisation* (FLPW, article 7).

The cantons may also require permits for the establishment, transformation or extension of installations that handle liquids that may pollute waters.

In order to obtain a permit, plants must file an application, providing detailed information on the process, the emission of pollutants from various sources and plans to abate and control the releases. The information is maintained as confidential. The cantonal permitting authority, may obtain advice from experts in the federal government or independent consultants, to assist in its review. Decisions of the permitting authority are based on environmental standards that have been issued by the government

In the case of appeals of decisions plants have recourse to appeal to the administrative court if:

- the regulatory authority demands more restrictive environmental standards than permitted by law; or

- abatement technology proposed by the plant is rejected by the regulatory authority.

Permits are normally issued for an indefinite period, although review is possible in the event of process change, deterioration in effluent quality, or changes in environmental laws.

Environmental Assessment is applied to new industrial operations prior to start-up or to a major change in the production process; this requirement is not extended to existing operations.

<u>Economic Considerations</u> **Factor A**

Air and Noise

Authorities may grant relief from cleanup requirements if the latter run counter to the proportionality principle. The Ordinance on Air Protection (Opair) stipulates a methodology for evaluating the economic feasibility of measures:

> […] *3. To gauge whether the limitation of emissions is economically bearable, an average-size, economically sound firm of the concerned sector will be used as a basis. When a sector is characterised by very different categories of firms, the evaluation shall be based on an average-size firm of the relevant category (Opair, article 4, unofficial translation).*

Economic considerations are not taken into account when setting ambient air quality standards or critical loads/levels. Economic considerations are taken into account when attempting to meet EQOs (Opair, articles 4 and 11). The precautionary principle is embodied in article 1 of the FLPE and realised in articles 3, 4, 7, 17 and 18 of the Opair.

The Opair has provisions for granting relief to firms and installations on the basis of economic and technological feasibility:

> 1.[…] *the authority shall grant relief to an installation's operator when a cleaning up* […] *would be disproportionate, in particular if the technique or the operation do not allow it or if it is not economically bearable.*

The relief granted may take the form of more flexible implementation deadlines or less stringent emission limit values. Economic considerations are considered within the permitting and standards development process. Economics is a primary consideration in determining the time when certain technology will be installed at existing plants, and the limits met. It is less a consideration for new plants.

<u>Financial and Technical Assistance</u> **Factor B**

The Confederation may distribute subsidies for the construction and equipment of monitoring and measuring installations and waste treatment plants when such installations are used by several cantons.

<u>Monitoring and Inspection</u> **Stage 7**

The Confederation has to ensure that the Federal Protection Laws are properly implemented and therefore co-ordinates the monitoring programs, decides upon the methodology for monitoring. The implementation of the monitoring programs is actually shared between the federal and cantonal authorities. The Federal Law for the Protection of the Environment, for instance, stipulates that

> *1. The Confederation monitors the implementation of this law.*
> *2. It co-ordinates the cantons' implementation measures and that of its own agencies and facilities.*
> *3. The federal Council sets the monitoring, measuring and calculation methodology*
> (FLPE, article 38, unofficial translation)

Air and Noise

The Ordinance on air protection (OPair) requires that:

> *1. The authority shall ensure that emission limits are complied with. It shall itself implement the monitoring and control measures or have them carried out by third parties.* […]
> (Opair, article 13, unofficial translation)

Additional monitoring requirements apply to the facilities that are the largest sources of pollution. Emissions from these sources must be monitored continuously. Combustion facilities

must be monitored at least every two years. Other facilities must be monitored at least every three years (Opair, article 13).

The cantons have the responsibility to monitor immissions and the state of the ambient quality within their respective territories. The federal office provides them with the appropriate monitoring techniques. In addition the permitting authority may impose requirements on the operator of a licensed facility to monitor immissions in the neighbouring area (Opair, article 29). At the national level, the federal office performs measurements of air pollution and its fluctuations.

Water

The Federal Law for the Protection of Waters (FLPW) provides for a shared responsibility of the federal and cantonal authorities. The federal authorities carry out the investigations applying to the entire Swiss territory with regard, inter alia, to the quality of surface and subterranean waters (FLPW, article 57). The cantons carry out supplementary investigations as needed by the enforcement of the FLPW. The results of these investigations has to be communicated to the federal authorities (FLPW, article 58).

The Ordinance for Waste Water Discharge (OWWD) lays out the rules for sampling and examination (OWWD, article 5).

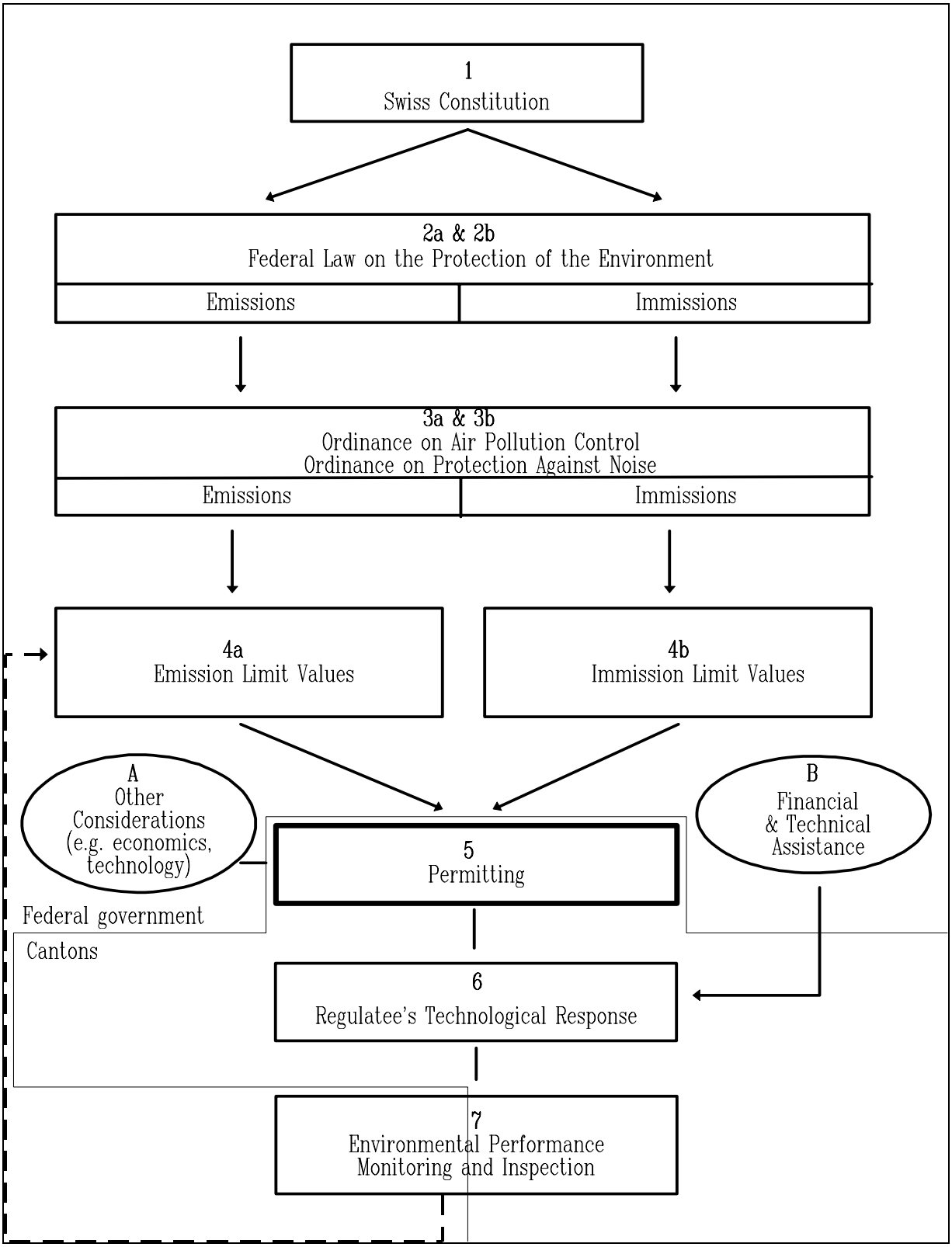


Figure 19 : Switzerland (air)

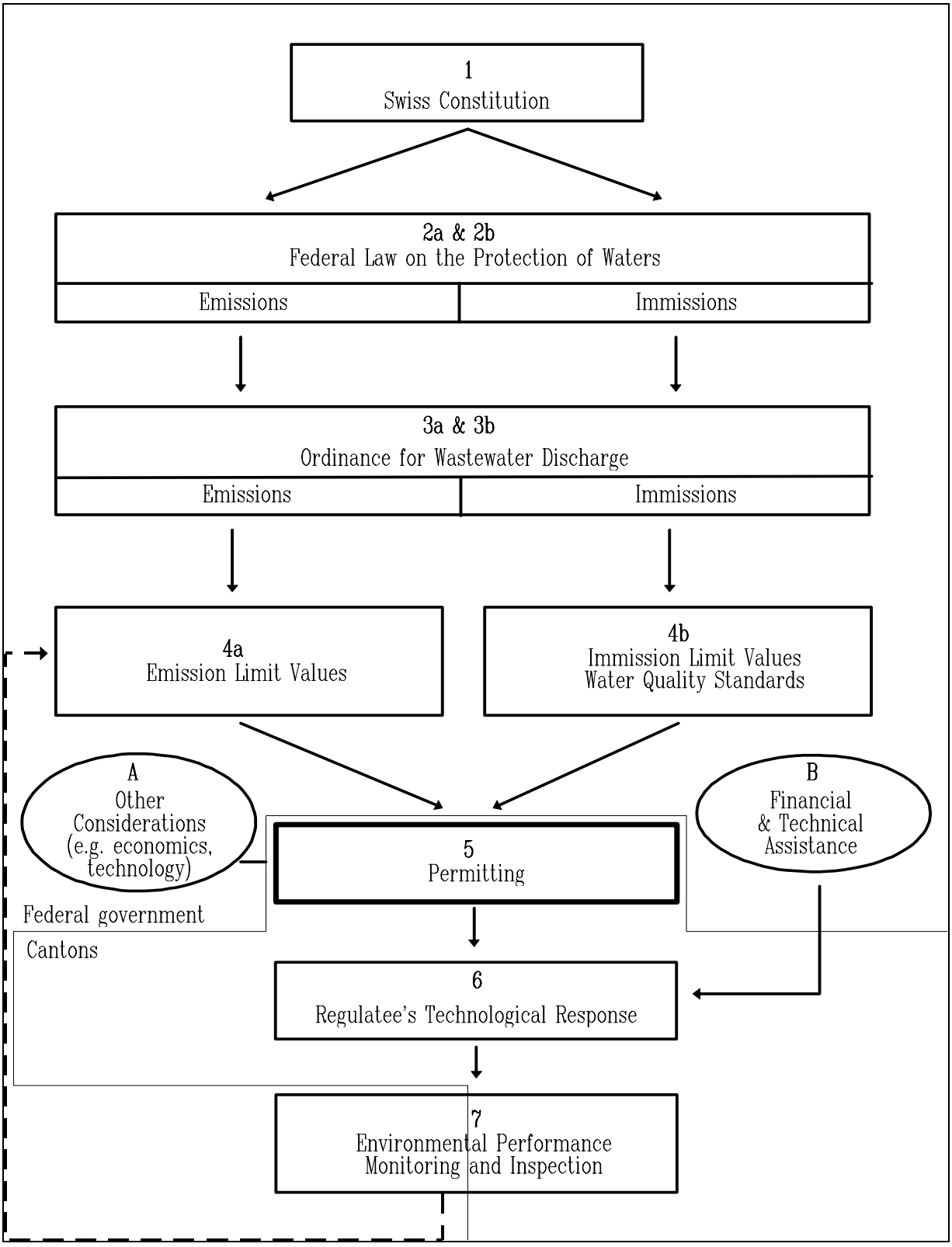


Figure 20 : Switzerland (water)

UNITED KINGDOM

Regulatory framework

Since 1970, environmental protection has primarily been the responsibility of the Department of the Environment (DOE), together with corresponding departments in the Welsh Office, the Scottish Office and the Northern Ireland Office. The Secretary of State for the Environment is supported, on environmental matters, by a Minister for the Environment and Countryside and a Junior Minister, both with their own areas of responsibility. The DOE has overall management responsibilities within England, which include developing the Government's policies, exerting financial control over executing agencies, including local authorities, and ruling on appeals against local authority and Agency decisions.

Under the system known as integrated pollution control (IPC), the Environment Agency is the enforcement agency responsible in England and Wales for regulating releases to air, water and land from the most polluting industrial processes. Control of a number of other, less polluting industrial processes not covered by IPC falls to the Environment Agency for release to water and land, and to local authorities for releases to air. In 1996, HMIP and the NRA were merged into the newly created Environment Agency.

As a member state of the European Union (EU), much of the legislation relating to environmental pollution control in the United Kingdom has been enacted following EU directives.

BAT **Stage 1-3a**

The 1990 Environmental Protection Act (EPA) introduced two regimes of pollution control:

• Integrated Pollution Control (IPC) for industrial processes with the most potential to pollute, enforced by the Environment Agency in England and Wales and the Scottish Environment Protection Agency (SEPA) in Scotland. Northern Ireland is in the process of introducing IPC.

• Local Authority Air Pollution Control (LAAPC), which focuses on air emissions and is enforced by the local authorities.

Under Part I of the Environmental Protection Act, an authorisation is required to carry on certain prescribed processes. Conditions are attached to authorisations issued under the Act. One of the objectives is the use of BATNEEC (Best Available Technique Not Entailing Excessive Cost):

> [...]
> *(2) Those objectives are-*

(a) ensuring that, in carrying on a prescribed process, the best available techniques not entailing excessive cost will be used-

(i) for preventing the release of substances prescribed for any environmental medium into that medium or, where that is not practicable by such means, for reducing the release of such substances to a minimum and for rendering harmless any such substances which are so released; and

(ii) for rendering harmless any other substances which cause harm if released into any environmental medium (Part I, Section 7(2), emphasis added).

The 1991 Environmental Protection (Prescribed Processes and Substances) Regulations, S.I. 1991/472, specifies the processes and substances which are prescribed for both the IPC and the LAAPC regimes.

However, there is no definition of BATNEEC in the 1990 Environmental Protection Act. Therefore, the Department of the Environment (and the Welsh Office) provide guidance on the operation of the IPC and LAAPC regimes for the implementing authorities.

1• The IPC regime is the subject of the separate guidance note entitled Integrated Pollution Control : A Practical Guide. In Chapter 7 of that document, the meaning of BATNEEC is clarified:

"Best" must be taken to mean most effective in preventing, minimising or rendering harmless polluting releases. There may be more than one set of techniques that achieves comparable effectiveness-that is, there may be more than one set of "best" techniques.

"Available" should be taken to mean procurable by the operator of the process in question. It does not imply that the technique has to be in general use, but it does require general accessibility. It includes a technique which has been developed (or proven) at pilot scale, provided this allows its implementation in the relevant industrial context with the necessary business confidence. It does not imply that sources outside the UK are "unavailable". Nor does it imply a competitive supply market. If there is a monopoly supplier the technique counts as being available provided the operator can procure it.

"Techniques" is defined in section 7(10) of the Environmental Protection Act. The term embraces both the plant in which the process is carried on and how the process is operated. It should be taken to mean the components of which it is made up and the manner in which they are connected together to make the whole. It also includes matters such as numbers and qualifications of staff, working methods, training and supervision and also the design, construction, lay-out and maintenance of buildings, and will affect the concept and design of the process.

2• The LAAPC regime is the subject of General Guidance Notes issued by the Department of the Environment. These notes explain the main controls and procedures. In General

Guidance Notes 1 (GG1), Introduction to Part I of the Act, a general explanation of BATNEEC identical to the one provided by the IPC Practical Guide is included.

EQS **Stage 1-3b**

The 1990 Environment Protection Act gives the Secretary of State the power to set environmental quality objectives or standards for any medium in any area:

> *Regulations [...] may establish for any environmental medium (in all areas or in specified areas) quality objectives or quality standards in relation to any substances which may be released into that or any other medium from any process* (Part I, Section 3(4), emphasis added).

Water

Water quality objectives could be set under the Environmental Protection Act. However, a water legislation exist: the Water Resources Act of 1991:

> *For the purpose of maintaining and improving the quality of controlled waters the Secretary of State may, by serving a notice on the Authority [...], establish the water quality objectives for any waters which are, or are included in, waters of a description prescribed for the purposes of that section* (Article 83, paragraph 1, emphasis added).

The Water Resources Act allows the Secretary of State by regulations to prescribe a system for classifying the quality of controlled waters. Water quality objectives may be set for any waters by means of such classifications (which may also transpose the directives of the European Union) and by serving a notice to the National Rivers Authority. The classification of waters will provide the framework for the establishment of statutory quality objectives to replace the administratively-set existing ones. The water quality objectives which have statutory force in the United Kingdom are those which are the result of requirements adopted in EU directives (e.g. the dangerous substances directive 76/464/EEC and its daughter directives or the bathing waters directive 76/160/EEC).

Air

Prior to the passage of the Environmental Protection Act, there were no specific powers for setting statutory air quality standards in the United Kingdom. No quality standards have yet been set under the EPA but a system of national air quality standards (AQSs) is being developed which will be implemented through this legislation. The AQSs will be based on the protection of health and the wider environment and based upon three threshold levels that will trigger graduate proportionate responses. The AQSs will apply throughout the territory of the United Kingdom although a supplementary set of controls could be added on the basis of local environmental information and critical loads.

The UK issued a draft National Air Quality Strategy for consultation in August 1996. The Strategy looks at all aspects of ambient air quality policy. It :

- describes the international and European framework within which the Strategy must operate;

- sets out the new national air quality objectives to be achieved by 2005. These are set with reference to air quality standards which represent no or minimal risk of health effects to the public. The pollutants covered are benzene, 1,3 butadiene, carbon monoxide, lead, nitrogen dioxide, ozone, particles, and sulphur dioxide;

- details how far towards these targets current policies will get us, and identifies the remaining areas to be tackled; and

- discusses the contribution that can be made at a national level and at local level in the key sectors - government, industry, transport;

- will be reviewed in 1999.

The air quality standards proposed represent concentrations of pollutants in the atmosphere at which there would be no or minimal effects on public health. They are taken from the best available consensual view of medical experts, either in the UK Expert Panel on Air Quality Standards or WHO. The standards will be used as benchmarks or reference points for setting objectives.

Air quality objectives provide the framework for determining the extent to which policies should aim to improve air quality. The general objectives give a broad indication of what government hopes will be achieved by the implementation of the Strategy and identifies the priority areas. These are complemented by specific objectives which are measurable targets against which progress can be assessed. Some of these are provisional at this stage, as there are considerable uncertainties associated with the levels of reduction required and the reductions that can be achieved through the measures currently available.

<u>Emission limit values (ELVs)</u> **Stage 4a**

BATNEEC is further defined for specific processes in a series of process guidances notes. The notes set out indicative ELVs.

1• For the IPC regime, the Environment Agency issues IPC Process Guidance Notes that set out emission limit values for the particular processes to air, water and land, as well as techniques for pollution abatement, requirements for compliance monitoring and any additional requirements. The IPC Practical Guide stipulates that

> *[t]he IPC Process Guidance Notes have no statutory force. They do, however, represent the view of HMIP on appropriate techniques for*

particular processes and are therefore a material consideration to be taken into account in every case. The Environment Agency must be prepared to give reasons for departing from the guidance in any particular case (IPC : A Practical Guide, 7.19).

2• Process Guidance Notes for local authorities on LAAPC are issued jointly by the Secretaries of State for the Environment, Scotland and Wales. LAAPC Process Guidance Notes tend to concentrate more on specifying emission limit values, monitoring requirements and operational controls and contain less detail on matters such as alternative process abatement. Because of the importance of securing consistency of enforcement among the 400+ local authorities responsible for enforcing LAAPC, the guidance notes have statutory force in that the authorities are required to have regard to them.

To reflect technological developments, Process Guidance Notes are reviewed regularly as BATNEEC evolves and revisions are issued as appropriate.

Permitting **Stage 5**

The Environmental Protection Act stipulates that an operator of a prescribed process will require an authorisation in order to carry it out (EPA, Part I, Section 6(1)).

The 1991 Environmental Protection (Applications, Appeals and Registers) Regulations, S.I. 1991/507 (as amended), procedure that has to be abided by in the application for, and the delivery of, an authorisation under the Environmental Protection Act.

Applicants are required to provide an environmental assessment of releases. This should take into account the characteristics of the receiving environment, including ambient levels of pollutants released and sensitive receptors. For IPC processes, the assessment should consider the concentration in air resulting from releases to air, the concentration on land resulting from deposition from the air, and the concentration in water from releases to water. For the purpose of comparing possible control options, account also needs to be taken of other factors, such as the contribution to global warming, the creation of photochemical ozone, and the hazardous nature of any waste produced which are not released to air or water.

The objectives of the conditions in an authorisations concerned with ensuring that releases to the environment are rendered harmless can only be addressed by taking account of site-specific pollution receptors, including any particularly sensitive pollution receptors in the receiving environment. The environmental assessment in support of the application for authorisation needs to include an assessment of the impact of proposed releases from the process on the sensitive ecosystem and needs to show that no harm would result. If necessary, further control options should be considered to ensure that releases are rendered harmless to the ecosystem. Statutory consultees include English Nature and the Countryside Council for Wales for processes operated close to sites of special scientific interest. These organisations may provide information on specific habitats during the consultation process, e.g. potential damage to lichen communities by acid gas deposition.

The guidance notes provide further insight on the delivery of authorisations:

IPC permitting

Guidelines on permitting requirements are laid out in the IPC Practical Guide. The following are required:

- the use of BATNEEC;
- the assurance that EU and international obligations as well as the relevant EQSs are not breached;
- the use of Best Practicable Environmental Option (BPEO) when releases are to several media.

The BPEO can be considered as "the outcome of a systematic consultative and decision-making procedure which emphasises the protection and conservation of the environment across land, air and water. The BPEO procedure establishes, for a given set of objectives, the option that provides the most benefit or least damage to the environment as a whole, at acceptable cost, in the long term as well as in the short term." No formal rule for selecting the BPEO option can be prescribed. Expert judgement is almost always necessary.

It is not possible, however, to cover every eventuality in an authorisation. The authorisation will therefore also place on the operator a residual duty to operate the process and carry out all the aspects of the process not specified in the authorisation using the principle of BATNEEC to ensure that such released substances are rendered harmless to the environment.

Authorisations granted under IPC must be reviewed at intervals no greater than four years. The enforcing authority may vary the authorisation at any time by issuing a variation notice. Discharge consents to water issued by the National Rivers Authority cannot be revised more frequently than four years under the Environment Act 1995 (formerly two years under the Water Resources Act). Similarly, discharge consents to sewer cannot be revised more frequently than two years. Whether a consent is revised will depend on the particular release and the potential for it to damage the environment.

LAAPC permitting

The General Guidance Note explaining Part I of the EPA (GG1) stipulates that "the Process Guidance Notes should be regarded by local authorities as their primary reference_document for determining BATNEEC in drawing authorisations". In addition, "Section 7(11) of the [Environmental Protection] Act obliges local authorities to have regard to any guidance issued to them by the Secretary of State when determining appropriate techniques in relation to the objectives in section 7(2) of the Act."

The local authorities have to decide on BATNEEC when they issue the authorisation for a specific process. In doing so, the inspector takes into consideration the variable factors such as

configuration, size and other individual characteristics of the process. For comparable processes, BATNEEC is expected to be similar.

Local pollution control authorities are not allowed to issue LAAPC authorisations if it may result in the breach of an air quality standard.

Discharges to sewer from LAAPC processes are covered by discharge consents from sewerage undertakers. Authorisations for IPC processes include their releases to sewer. Processes that only release trivial amounts of a substance to air, water or land or where the capacity to cause harm is insignificant may be excepted from regulation.

LAAPC covers processes with less potential to pollute than IPC processes. Thus, LAAPC processes tend to be smaller than those of IPC. However, many of the smallest industrial processes will be excluded from both LAAPC and IPC as they will not have enough potential to pollute to require such regulation. A few processes with particular potential to pollute have no minimum threshold specified in the regulations and are therefore included even if very small.

Economic considerations **Factor A**

The part of BATNEEC devoted to economic assessment ("not entailing excessive cost") is defined in the IPC Practical Guide:

> *"Not entailing excessive cost" (NEEC) needs to be taken in two contexts, depending on whether it applies to new processes or existing processes. Nevertheless, in all cases BAT can properly be modified by economic considerations where the costs of applying best available techniques would be excessive in relation to the nature of the industry and to the environmental protection to be achieved* (IPC : A Practical Guide, 7.7).

BATNEEC is explained further in the following paragraphs which state:

> *In many cases, for new processes, it is expected that BAT and BATNEEC will be synonymous. However, the following principles should apply:*

- *the cost of the best available techniques must be weighed against the environmental damage from the process; the greater the environmental damage, the greater the costs of BAT that can be required before costs are considered excessive;*

- *the objective is to prevent damaging releases so far as this can be done without imposing excessive costs; if after applying BATNEEC serious harm would still result, the application can be refused; and*

  as objective an approach as possible to the consideration of what is BATNEEC is required. The concern is with what costs in general are

excessive; the lack of profitability of a particular business should not affect the determination. (IPC : A Practical Guide, 7.8).

In relation to existing processes, the Environment Agency is concerned additionally with establishing timescales over which old processes will be upgraded to new standards, or as near to new standards as possible, or ultimately closed down.

Even though it relates to a single medium, the Secretary of State considers that the approach adopted in the EC Air Framework Directive is helpful in relation to the operation of IPC across all three media. Article 12 of the Directive, for example, which applies to all plants requiring an authorisation under the Directive, requires, where necessary, the imposition of appropriate conditions in authorisations, on the basis of developments as regards BAT and the environmental situation and also on the basis of the desirability of avoiding excessive costs for the plants in question, having regard to the economic circumstances of the industrial sector concerned.

Article 13, which applies only to processes existing prior to July 1987, requires certain factors to be taken into account:

In the light of an examination of developments as regards best available technology and the environmental situation, the Member States shall implement policies and strategies, including appropriate measures, for the gradual adaptation of specified existing plants to the best available technology, taking into account in particular:

- *the plant's technical characteristics;*
- *its rate of utilisation and length of its remaining life;*
- *the nature and volume of polluting emissions from it;*
- *the desirability of not entailing excessive costs for the plant concerned, having regard in particular to the economic situation of undertakings belonging to the category in question.*

According to General Guidance 1, the same holds true for the LAAPC regime : in the case of new processes, BATNEEC is required; in the case of existing processes, a timescale is specified according to which old processes should be upgraded (GG1, 28).

The IPC Practical Guide also indicates that, in developing the standards contained in the Environment Agency's guidance notes, techniques should be identified that are demonstrated to be "commercially viable" (7.17(a)).

In determining BATNEEC for an individual process regulated under the IPC regime, an Inspector will take account of the relevant guidance notes, but may also assess the cost of meeting requirements.

Monitoring and Inspection **Stage 7**

Requirements for monitoring by the operator are included as conditions in the authorisation. Methods to be used will often be specified. Monitoring is also carried out by the permitting authorities. The Environment Agency has a duty under Section 84(2) of the 1991 Water Resources Act to monitor the extent of pollution in controlled waters. This is to ensure, among other things, that the water quality standards are achieved at all times. The Department of the Environment has a programme of air quality monitoring, carried out by its own experts or by consultants.

Monitoring results do influence the establishment of standards and the negotiation of permits. In some cases, authorisation (Improvement Programme) sets a series of obligations to the operator in order to improve the monitoring of prescribed substances as well as other parameters that may be emitted by these processes (i.e. dioxins).

The results of operators' monitoring are placed on the public register. The results of authorities' monitoring are also published in an aggregated form.

In the case of the national water monitoring programme, rivers and lakes are routinely monitored. Since the early 1970s, surveys have been carried out every five years throughout the United Kingdom. Rivers are classified as "good", "fair" or "bad" according to the criteria based on dissolved oxygen (DO), biological oxygen demand (BOD) and ammonia. Water quality monitoring is also carried out in compliance with EC directives.

National ambient monitoring for smoke and SO_2 started in 1961 at several hundred sites. Networks have been created to monitor compliance with EC air quality standards for SO_2, and smoke (166 sites), NOx (7 sites) and lead (11 sites). Networks recently created include : the Enhanced Urban Network (12 sites for NO_2, CO, ozone and airborne particulates); the Hydrocarbon Network (6 sites for benzene, 1,3 butadiene and other hydrocarbons) and the Toxic Organic Micropollutants Network (4 sites for PAHs, PCBs and dioxins/furans). A network was established in 1993 to monitor NO2, in urban areas at over 1,100 sites, with the participation of local authorities.

Monitoring systems for ambient air quality and emission levels are well developed in the United Kingdom. Several monitoring networks are in operation and the DOE maintains a detailed inventory of sources of pollution. A major effort is made to ensure that the information collected is available to the public. The scientific base for understanding and analysing air pollution issues is strong.

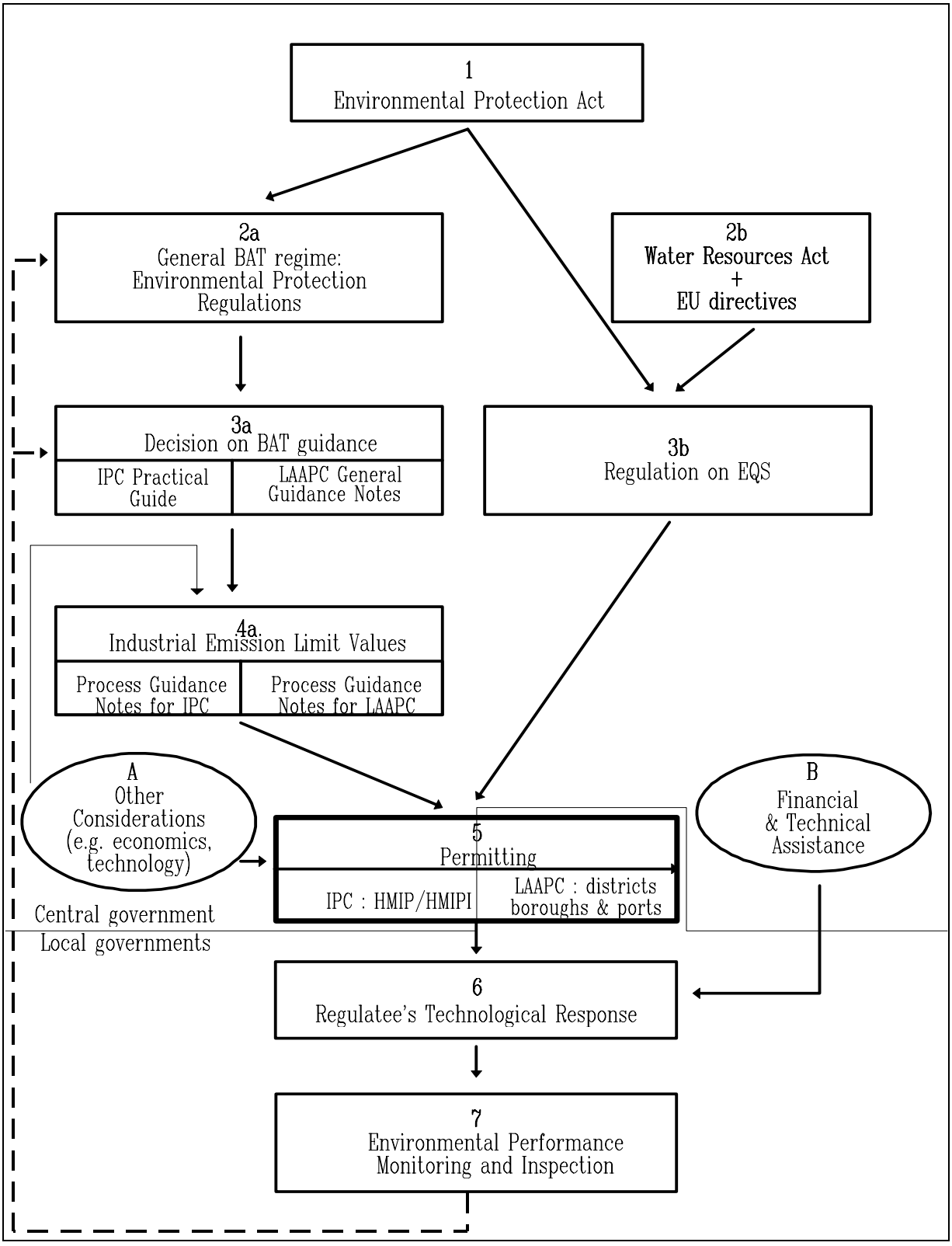


Figure 21 : United Kingdom

UNITED STATES

Regulatory framework **Federal/state/local**
Stage 1

The United States of America Congress enacts statutes, and the Executive Branch carries them out. Congress usually does not establish all the substantive or procedural details of the programmes it establishes in the laws it writes. In these cases Congress delegates the power to implement laws to Executive Branch agencies, giving agencies the power to fill in the gaps and impose specific requirements, in the form of rules. Congress may explicitly order agencies to make rules, leave rules to agencies' discretion, or set up procedures for citizens to initiate rules. The Administrative Procedure Act of 1946 defines a rule as: "...the whole or a part of an agency statement of general or particular applicability and future effect designed to implement, interpret, or prescribe law or policy or describing the organisation, procedure, or practice requirements of an agency..."

The U.S. relies on rulemaking by agencies for most of the technical, operational and legal details of all public programmes. This is especially true for regulatory programmes with large-scale goals and objectives such as those administered by the Environmental Protection Agency (EPA). The EPA decision-making process includes the following:

- Advanced Notice of Proposed Rulemaking - used to obtain general comment on issues before specific rule language is proposed;

- Proposed Rules - EPA proposed rules always contain actual rule language; EPA often provides for public hearings as an additional way to obtain public comment; often EPA provides 60 days or more for public comment;

- Final Rules - some final rules are made effective more than 30 days after publication.

Air

The U.S. air pollution control effort encompasses a joint effort between three levels of government: federal, state and local. The Federal government establishes national standards and then provides overall direction and guidance to the States and local government who develop control programmes, rules and regulations. The Federal government. approves, through formal rulemaking, State/Iocal control plans. Once enforceable rules/regulations are in place, State/local agencies have the primary responsibility for implementing and enforcing, with the Federal government providing technical support and "backup" enforcement authority as necessary.

Through this partnership, State/local agencies and the Federal government codify regulations which emitters are legally required to meet. This is a public process which allows for public comment and participation. Affected groups have the opportunity to submit their comments

to the regulatory agencies. Under a public rulemaking process, the government is obliged to respond to all comments. If their comments are not satisfactorily addressed, environmental groups and industry have the right to bring suit in the Federal courts to force action.

Water

The USEPA develops regulations, policy and guidance to assist the States and Indian tribes in the development and adoption of water quality standards regulations to meet the goals of the Clean Water Act (CWA). States have flexibility in setting and developing their water quality standards, provided that they will protect the uses of their water bodies and maintain the goals of the CWA. The USEPA also develops scientific information to assist the states and tribes, including recommended chemical specific water quality criteria for the protection of aquatic life and human health. These criteria are intended as guidance and are not binding unless a State, U.S. Territory, or tribe adopts them directly or if EPA formally promulgates them for a state or territory. Many states and tribes have adopted EPA's recommended criteria as part of their standards. Once formally adopted the criteria are no longer considered guidance but are called standards which are legally binding requirements. Standards are legally enforceable numerical endpoints which are applied within a designated water body. Discharge permits are written to comply with state standards.

Once water quality standards are adopted by the states or tribes, they must be submitted to EPA for review. In its review, EPA must ensure that the water quality standards meet the requirements of the CWA and that they do not interfere with the attainment of standards in the waters of another state or tribe. Industry, environmental groups and other stakeholders supply comments to all proposed criteria developed by EPA and when a state or tribe proposes to adopt a particular standard. States and tribes must hold public hearings for the purposes of reviewing and revising their water quality standards regulations. If EPA disapproves a state's or tribe's standards, it must propose and promulgate federal standards applicable to the state or tribal waters.

Waste

The Resource Conservation and Recovery Act (RCRA).is the primary federal law governing hazardous and municipal waste in the U.S.. Subtitle C is the section of RCRA governing hazardous waste management requirements. The EPA issues the regulations that implement RCRA and authorises state agencies to implement the RCRA programme within their jurisdiction. The issuing body for State regulations varies from one State to another. The States must issue regulations that are at least as stringent as the RCRA requirements. RCRA permits may be issued by the permitting authority of an individual authorised State or one of the ten U.S. EPA Regional Offices, with some permits issued jointly by the two agencies. RCRA requirements are enforced by authorised state agencies and the U.S. EPA. The discharge of waste into the waters of the United States is generally covered under US water laws. The emission from waste handling, including combustion and other forms of treatment, are covered through a combination of RCRA and the Clean Air Act.

In the United States, pollution control is governed by a series of medium-specific laws such as the Clean Air Act (CAA), the Clean Water Act (CWA) and the Resource Conservation and Recovery Act (RCRA).

Air

The Clean Air Act gives the USEPA the authority to set national ambient air quality standards for protecting public health and the environment from pollutants in the outside air.

Different types of Environmental Quality Standards have been used for air pollution depending on the nature of the pollutants to be regulated:

Criteria pollutants are subject to National Ambient Air Quality Standards (NAAQS). The Clean Air Act states that

> *National primary ambient air quality standards shall be ambient air quality standards the attainment and maintenance of which in the judgement of the Administrator, based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health. Any national secondary ambient air quality standard shall specify a level of air quality the attainment and maintenance of which in the judgement of the Administrator, based on such criteria, is requisite to protect public health from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air.*

Criteria pollutants (sometimes referred to as primary air pollutants) are those that may endanger public health or welfare. The Clean Air Act states that criteria pollutants are those

> *emissions of which, in the judgement of the EPA Administrator, cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare and the presence of which in the ambient air results from numerous or diverse mobile or stationary sources.*

The six criteria pollutants are carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}) and sulphur oxides (SOx). Primary standards set limits to protect public health, including the health of people particularly sensitive to air pollution such as young children, the elderly, an those with asthma. Secondary standards set limits to protect plants, wildlife, building materials, and cultural monuments. The Clean Air Act requires that primary standards be attained within prescribed deadlines. Secondary standards must be attained as expeditiously as practicable.

For hazardous air pollutants (HAPs), the applicable ambient quality standards are the National Emission Standards for Hazardous Air Pollutants (NESHAP). The Clean Air Act states that

> *The Administrator shall establish any such standard at the level which in his judgement provides an ample margin of safety to protect the public health from such hazardous air pollutant.*

Hazardous air pollutants (also referred to as air toxics) include chemicals that are known to cause, or that are suspected of causing, cancer and other serious health effects such as birth defects and gene mutations. The Clean Air Act provides the following definition :

> *An air pollutant to which no ambient air quality 'standard is applicable and which in the judgement of the Administrator causes , or contributes to, air pollution which may reasonably be anticipated to result in an increase in mortality or an increase in serious e, or incapacitating reversible illness*.

The 1990 amendments to the Clean Air Act include a list of 189 HAPs selected on the basis of potential health and/or environmental hazards. USEPA must regulate these listed air toxics. First, it establishes the best available technology standards (see *BAT*) and then establishes residual risk standards, as appropriate. The EQSs for HAPs now include protection from adverse environmental effects as well as protection of public health.

The NAAQS and NESHAPs apply the same to all areas of the United States. The Federal government sets standard and national regulations for controlling air pollution. The state governments manage most of the specific programs for achieving the standards. State implementation plans (SIPs) are legally enforceable documents that state governments develop to identify their sources of air pollution, and to determine what reductions they must make to meet the federal air quality standards. Measures are developed by the states on the basis of these SIPs. The SIPs must be approved by USEPA. If a SIP is not acceptable, the USEPA can enforce the Clean Air Act itself in that state.

The federal government notifies through a formal finding that an area has not achieved the NAAQS. Areas with measured violations of the NAAQS and areas which contribute to violations of the NAAQS are designated "non-attainment" areas (NAA) by federal rule. For some pollutants, the non-attainment urban areas are further divided into categories according to the severity of the pollution (five categories ranging from moderately to extremely polluted in the case of ozone). The more heavily polluted an area, the more stringent the controls that are required under the CAA. Federal law mandates attainment of each NAAQS by specific dates. All control requirements to meet NAAQS are directly related to an area's attainment or non-attainment designation (see *BAT*). For instance, the policies to control air pollution in attainment areas is based on the principle of prevention of significant (quality) deterioration (PSD). The USEPA's NAAQS are reviewed periodically, independently of special control circumstances, according to a fixed schedule prescribed in the Clean Air Act.

Water

According to the Clean Water Act, the states are responsible for establishing water quality standards. Standards consist of designated use of water bodies, e.g. aquatic life, recreation and water supply, criteria to protect the uses and antidegradation policies. The USEPA is responsible for the production of regulations, policy and guidance to assist the states in their development of water quality standards. The overarching purpose is to meet the goals of the Clean Water Act. These goals are referred to as the "fishable/swimmable" goals because the aim is to achieve water quality necessary to support fish, shellfish and wildlife. Provided that these CWA goals and requirements are, states and tribes have flexibility in setting their water quality standards.

The USEPA is also responsible for the development of specific national recommended criteria for the protection of aquatic life and human health. The criteria developed by EPA are considered by the states in developing their water quality standards. These criteria can be thought of as environmental quality objectives (EQOs) which also serve as guidance. These EQOs are not binding unless a state or US territory adopts them directly or if the USEPA promulgates them for a state or territory. In such a case, they become legally binding requirements. Most states elect to adopt the USEPA's water quality criteria guidance and implement them as legal EQOs called water quality standards.

The states' water quality standards must be submitted to the USEPA for review and approval. If the standards meet the quality requirements set forth in the CWA and water quality regulations, they will be upheld by the USEPA. Otherwise, and if no satisfactory changes are made, federal standards will be promulgated. A federal standard may also be promulgated for a state if the USEPA deems that a revised quality standard is needed. States may promulgate more stringent requirements than the federal standards.

Where necessary to achieve state water quality standards and to assure that point source discharge do not cause toxic effects in the nation's waters, water quality-based limits are imposed when they are more stringent than technology-based limits.

Waste

EQOs for solid waste (including municipal waste, hazardous waste, and other wastes such as from mining processes) are to protect public health and the environment from releases of hazardous constituents in the wastes. Very specific standards apply to hazardous waste. USEPA identifies which waste are hazardous, and sets standards covering the treatment, storage and disposal of the hazardous wastes. The standards include air emission limitations and standards (such as limits on leachable metals and limits on toxic organics) that must be met prior to land disposal.

BAT **Stage 2a-4a**

Air

(1) criteria pollutants : There are several types of sources under the Clean Air Act. For instance in the ozone classification scheme, "major sources" are those whose emissions of VOCs and NOx are in excess of 100 tons/year in the least polluted non-attainment areas and in excess of only 10 tons/year in the most severely polluted areas.

A source locating in a PSD area is subject to the Best Available Control Technology (BACT) to insure that new emissions are kept to a minimum by the application of the best technology and consequently provide for additional economic growth. The Clean Air Act defines BACT as:

> *An emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this Act emitted from or which results from any major emitting facility, which the permitting authority, on*

a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each pollutant.

A source located in an NAA is required to comply with the Lowest Achievable Emission Rate (LAER) to insure that the source achieves the lowest possible emission rate for the pollutant(s) emitted. The Clean Air Act defines LAER as:

For any source, that rate of emissions which reflects:
(A) the most stringent emission limitation which is contained in the implementation plan of any State for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable, or
(B) the most stringent emission limitation which is achieved in practice by such class or category of source, whichever is more stringent. In no event shall the application of this term permit a proposed new or modified source to emit any pollutant in excess of the amount allowable under the applicable new source standards of performance.

BACT and LAER are defined in sections 169 and 171, respectively, of title I of the Clean Air Act as well as in the New Source Review (NSR) Workshop Manual.

Reasonable Available Control Technology (RACT) is used to control specific major industrial sources of VOCs in ozone non-attainment areas. Based on control technique guidelines, RACT has been established to ensure some uniformity in emission reduction from one non-attainment area to another. Reasonably Available Control Measures (RACM) is a similar approach used in particulate matter non-attainment areas.

New Source Performance Standards (NSPS) are technology-based emission standards for criteria pollutants based on Best Demonstrated Technology (BDT) for a particular source category or process that is economically feasible. The purpose of the NSPS program is to reduce emissions from all industries through the control of new sources over the longer term as the industrial base of the country is replaced. The Clean Air Act defines NSPS as:

*a standard for emissions of air pollutants which reflects the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction **and** any non air quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated.*

(2) <u>hazardous air pollutants (HAPs)</u> : thousands of sources are regulated, either as "major sources" or smaller "area sources." Major sources are sources emitting 10 tons per year or more of a listed pollutant, or any combination of lesser quantity major sources defined by the USEPA. Area

sources are those that emit less than 10 tons at most per year of listed pollutants or 25 tons of any combination.

The 1990 amendments to the Clean Air Act have introduced new types of technology standards. Sources of HAPs must install the Maximum Achievable Control Technology (MACT) regardless of whether they are new or existing sources and regardless of the area. The Clean Air Act defines MACT as:

> *the maximum degree of reduction in emissions of the hazardous air pollutants subject to this section (including a prohibition on such emissions, where achievable) that the Administrator, taking into consideration the cost of achieving such emission reduction, and any non air quality health and environmental impacts and energy requirements, deter-mines is achievable for new or existing sources in the category or subcategory to which such emission standard applies, through application of measures, processes, methods, systems or techniques including, but not limited to, measures which:*
> *(A) reduce the volume of, or eliminate emissions of, such pollutants through process changes, substitution of materials or other modifications,*
> *(B) enclose systems or processes to eliminate emissions,*
> *(C) collect, capture or treat such pollutants when released from a process, stack, storage or fugitive emissions point, (D) are design, equipment, work practice, or operational standards (including requirements for operator training or certification) as provided in subsection (h), or*
> *(E) are a combination of the above.*

Controls for the smaller "area sources" may be as stringent as the MACT type controls for major sources but more flexible measures called Generally Available Control Technologies (GACT) is occasionally used. Maximum control technology is required for solid waste combustion.

For NSPS and MACT standards, technologies applicable across the entire range of an industrial source category are considered. NSPS and MACT standards are national standards that must be satisfied regardless of the attainment status of the area or of the need for additional BAT requirements. In addition, MACT "floor" requirements mandate that MACT standards be at least as stringent as that achieved in practice by the best single source in the case of new sources, and at least as stringent as the average top 12%, in terms of emission reduction, in the case of existing sources.

Control options are considered available when those air pollution control technologies or techniques have a practical potential for application to the emissions unit and the regulated pollutant under evaluation.

Water

The Clean Water Act gives the USEPA the authority to establish national technology-based limitations to control the discharge of pollutants to surface waters of the United States. Regulations are by industrial sectors (usually referred to as categories) and take the form of effluent limitations for specific pollutants. Once the final regulations are published in the Federal Register, these limitations

are used in the NPDES permit programme along with water quality standards. The effluent limitations and standards contain limits on substances (pollutants) that can be discharged directly into waters of the United States (direct discharge) or indirectly into public sewer systems (indirect discharge). Limits are based on treating and removing pollutants and are determined from the performance of technologies available. These limits are applied uniformly to every facility within the industrial category or subcategory. Under the CWA, the USEPA does not have the authority to mandate the technology to be used by industrial dischargers to meet the required effluent limitations. Although the regulations do not require plants any particular treatment technology, they do require to achieve effluent limits that reflect the proper operation of the model technologies from which the performance data were obtained to generate these limits.

Depending upon the different wastewater matrices, limitations established for a particular pollutant may vary among the industrial categories and subcategories. There are three groups (classes) of industrial pollutants for which effluent limitations, standards, and guidelines are established : conventional pollutants, toxic pollutants, and nonconventional pollutants.

(1) <u>conventional pollutants</u> are those which are found in domestic, commercial or industrial wastes such as total suspended solids (TSS), biochemical oxygen demand (BOD), fecal coliform (an indicator for pathogenic organisms), pH and oil & grease. There are only five (5). They are the most familiar group of pollutants and constitute parameters which are generic in character in that they are not specific compounds but measure classes of substances which have similar physical, chemical, or biological responses to empirical laboratory tests.

(2) <u>priority pollutants</u> are pollutants and classes of pollutants considered to be toxic. There are one hundred twenty six (126). As part of the amendments to the CWA in 1977, the US Congress issued a list of sixty-five (65) pollutants and classes of pollutants considered to be toxic (CWA Section 307 [a]). This list was expanded by the USEPA to 129 specific "priority pollutants." Subsequently, three of the priority pollutants were formally delisted in the Federal Register. During the development of the categorical effluent guidelines and standards, the wastewater from that category must be analysed to determine whether any of the "priority pollutants" are present. Implementation of the CWA toxic strategy required that categorical regulations and standards must be developed and issued for toxic pollutants (in this context that meant the 126 priority pollutants) that : are present in greater than trace concentrations; represent significant hazards to water quality or human health; are above treatability levels in raw wastewater streams; and pass through or interfere with the operation of publicly owned treatment works (POTWs).

(3) <u>nonconventional pollutants</u> are any pollutant or pollutant parameter that is not identified as either conventional or toxic. In this case, the count for nonconventional pollutants and nonconventional pollutant parameters could be in the hundreds of thousands. Examples of nonconventional pollutants and pollutant parameters are : metals and organic compounds not on the priority pollutant list; chemical oxygen demand (COD); ammonia; free available chlorine; total residual chlorine; phosphorus; temperature; surfactants; total organic carbon (TOC); total toxic organics (TTO); phenolic compounds (4AAP); settleable solids; colour; and radioactivity.

There are six different levels of control in water effluent standards:

Best Practicable Control Technology Currently Available (BPT) is a level of technology represented by the average of the best existing wastewater treatment performance levels for plants of various sizes, ages and unit processes within the industrial category. In terms of technology-based water standards BPT is the floor requirement for existing direct dischargers of conventional, toxic and nonconventional pollutants (see Figure 24). In establishing BPT effluent limitation guidelines, the USEPA considers the total cost of achieving effluent reductions in relation to the effluent benefits, the age of the equipment and facilities involved, the processes employed, process changes required, engineering aspects of the control technologies, non-water quality environmental impacts (including energy requirements) and other factors as appropriate.

Best Available Technology Economically Achievable (BAT) represents the best existing economically achievable performance of plants in the industrial subcategory or category. BAT is applicable to existing direct dischargers. According to the CWA, BAT is the principal means of controlling the direct discharge of toxic and non-conventional pollutants to navigable waters. In establishing BAT effluent limitation guidelines, the USEPA considers the age of the equipment and facilities involved, the process employed, potential process changes, and non-water quality environmental impacts (including energy requirements).

Best Conventional Pollutant Control Technology (BCT) replaces BAT for the control of conventional pollutants. In no case can BCT be less stringent than BPT. In establishing BCT effluent limitation guidelines, the USEPA considers the relationship between the cost of attaining a reduction in effluents and the effluent benefits attained at different levels of control within the industry, and a comparison of the cost and level of reduction of such pollutants by Publicly Owned Treatment Works (POTWs) and industrial sources.

New Source Performance Standards (NSPS) are based on the Best Available Demonstrated Control Technology (BDT). NSPS is used for new facilities directly discharging all types of pollutants. New plants have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent numerical values attainable through the application of the best available demonstrated control technology. In establishing the NSPS effluent limitation guidelines, the USEPA considers the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

Pre-treatment Standards for Existing Sources (PSES) are required by the CWA for pollutants that pass through POTWs or interfere with the POTWs' treatment processes or sludge disposal methods. The technology-based pre-treatment standards are meant to be similar to the BAT effluent limitations guidelines for the removal of toxic pollutants. In establishing the PSES, the USEPA considers whether there is pass-through of a pollutant. A need for categorical standards exists if the nation-wide average percent of a pollutant removed by well-operated POTWs achieving secondary treatment is less than the percent removed by the BAT model treatment system.

Pre-treatment Standards for New Sources (PSNS) are required by the CWA for the prevention of discharges of pollutants that pass through, interfere with, or are incompatible with the operation of POTWs. PSNS standards are to be issued at the same time as NSPS standards. Like new direct dischargers, new indirect dischargers have the opportunity to incorporate the Best Available Demonstrated Technologies. In establishing PSNS, the USEPA considers the same factors as in the establishment of NSPS.

When technology-based regulations are unavailable, it is highly probable that these dischargers would be regulated through local limits and the national pre-treatment regulations in the case of indirect dischargers. If technology-based regulations for direct dischargers are unavailable, permit writers (at the federal, state or local level) use best professional judgement (BPJ) in establishing pollutant effluent limits.

Waste

A major type of BAT under the Resource Conservation and Recovery Act (RCRA) are the land disposal restriction standards. Under RCRA, the USEPA is required to set

> *levels or methods of treatment, if any, which substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimised.*(RCRA section 3004(m)(1), 42 U.S.C. 6924(m)(1))

In practice, the USEPA has met this requirement by setting standards based on the Best Demonstrated Available Treatment (BDAT). Hazardous wastes must meet the requirements of the BDAT standards in order to be land disposed. BDAT can be a numerical standard or a standard requiring the use of a specific treatment technology.

BDAT standards are developed by the USEPA for specific RCRA listed wastes as well as RCRA characteristic wastes. Wastes to be regulated are divided into treatability groups based on similar physical and chemical properties, often along the lines of the industries or processes by which they have been generated.

BDAT is identified for each treatability group. During the development of standards proposals, several different technologies may be evaluated by the staff of the USEPA. A treatment technology is considered to be "demonstrated" primarily based on data from full-scale treatment operations that are currently being used to treat the waste (or a similar waste). To be "available" the technology itself or the services of the technology must be able to be purchased, and the technology must substantially diminish the toxicity of the waste or reduce the likelihood of migration of the waste's hazardous constituents. In addition, the USEPA favours the adoption of technologies that further the statutory goals of waste minimisation and recycling. The treatment performance of each technology is assessed. Once BDAT is identified, the USEPA establishes the treatment standard as maximum constituent-specific concentrations allowed in the waste, as a specific technology (or group of technologies), or as a combination of these. The USEPA has produced uniform treatment standards to consolidate its land disposal restriction performance standards.

The imposition of technology-based standards is unaffected by whether EQOs are attained.

Emission Limit Values (ELVs) **Stage 4a**

Air

BACT, LAER, NSPS and MACT limits are generally expressed as emission or discharge limits which the applicant/source has the option of meeting in any manner it chooses. If a numerical limitation is deemed not technically feasible, a BACT or LAER permit may specify a design, operational, or equipment standard. Such standards must be clearly enforceable.

Each determination on Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) is made on a case-by-case basis (see *Permitting*). To assist in the decisions, the USEPA manages the BACT/LAER Clearinghouse, a computer system that provides all the relevant data concerning determinations of BACT and LAER in all the states.

The NSPS and MACT standards are set for industrial source categories.

The 1990 amendments to the Clean Air Act include a list of 189 HAPs selected on the basis of potential health and/or environmental hazards. USEPA must regulate these listed air toxics. The USEPA has the authority to add to the list of air toxics to be regulated, as necessary.

New sources or sources that intend to increase their release of a criteria pollutant must obtain an offset (i.e. a reduction in the emission of the same pollutant by other existing stationary sources located in the area). Since the reductions must be greater than the allowed increases, the offset requirements provide for a net reduction in the total emissions within the area and ensure that it keeps moving toward attainment. An increase in a criteria pollutant can be offset with a reduction of the pollutant from some other stack at the same plant or at another plant owned by the same company in the NAA. The stringency of the offset criteria depends on the classification of the non-attainment area in which the sources are located. New source offset ratios vary from 1.1 to 1 in a marginally polluted NAA to 1.50 to 1 in an extremely polluted NAA. Offsets may also be used for emissions of air toxics.

Water

Technology-based requirements take the form of categorical effluent discharge limitations for specific pollutants.

Waste

When BDAT is expressed as a numerical level, the waste can be treated by any legitimate treatment appropriate for that waste so long as the treated waste does not exceed the numerical levels. In those cases where a technology is actually specified, a variance is available to allow alternative but equivalent technologies on a case-by-case basis.

Current legislative language does not allow for the trade-off of emissions into one medium against those into another. Experimental integrated media permits have been recommended by EPA for certain facilities. The State of New Jersey has recently implemented integrated permits at several facilities.

Air

The Clean Air Act Amendments of 1990 established a comprehensive operating permit program for air emissions modelled after the National Pollution Discharge Elimination System (NPDES -- see below) used to control water pollution from point sources. Under the program, all major sources of criteria and toxic pollutants (generally defined as emitting more than 100 tons per year of criteria pollutants or 25 tons per year of toxic air pollutants) must obtain a permit to operate (usually from a state or local government). The permit contains all of the relevant requirements (MACT, NSR, BACT, LAER, RACT, etc.) pertaining to the source and ensures that sources are not being subjected to conflicting requirements.

The Clean Air Act also requires that new major stationary sources of air pollution and major modifications to major stationary sources obtain an air pollution permit before commencing construction. This process is known as the new source review (NSR). It is required whether the major source or modification is planned in a an attainment or a non-attainment area. Permits for sources in attainment areas are designed to prevent significant deterioration of air quality and are referred to as PSD permits. Permits for sources located in non-attainment areas are referred to as non-attainment area (NAA) permits. Permits are generally issued and managed at the State or local government levels. However, if a State fails to establish a programme which meets the federal minimum requirements or fails to run such a programme properly, the federal EPA is required to run the permit programme in that State.

For BACT analysis, the reviewing authority evaluates the energy, environmental, economic and other costs associated with each alternative technology, and the benefit of reduced emissions that the technology would bring. In addition, an ambient air quality analysis must be conducted by the source. Analyses on the additional impacts on soils, vegetation, and visibility are also required. The LAER requirements do not consider economic, energy or other environmental factors.

The USEPA's top-down BACT determination process provides that all available control technologies be ranked in descending order of control effectiveness. The most effective technology is considered as BACT unless the applicant can demonstrate that it is not "achievable" in that case on grounds of technical considerations, energy, environmental or economic impacts. Since BACT determinations are made on a source-by-source basis, some negotiation is possible.

The LAER determination process is different in that no negotiation of alternative emission limitations is allowed. A LAER emission limitation is derived from the most stringent of either (1) the most stringent emission limitation contained in the implementation plan of any state for such class or category of source; or (2) the most stringent emission limitation achieved in practice by such class or category.

Technologies required under Lowest Achievable Emission Rate (LAER) determinations are available for BACT purposes and must also be included as control alternatives and usually represent the top alternative.

The NSPS and MACT standards are set for industrial source categories. The same permit covers any applicable NSPS and MACT requirements.

Air permits are required to be reissued at least every 5 years. When the air emission associated with modifications in the industrial process or in the plant layout result in a significant net emissions increase, such modifications are subject to New Source Review. Major sources of HAPs increasing their emissions above a certain threshold amount in certain industries need to be reviewed on a case-by-case basis.

A source is generally required to comply with the permit requirements (emission limits) upon start-up. Existing sources, that are covered by maximum achievable control technology (MACT) standards for hazardous air pollutants, have up to three years to comply.

Water

The Clean Water Act makes it illegal for any point source to discharge any pollutant into waters of the United States without a National Pollutant Discharge Elimination System (NPDES) permit. Discharge permits are written to ensure compliance with effluent guidelines for specific industrial sectors which provide the floor of the NPDES permits for many industries, with technology-based requirements such as secondary treatment and BAT, and with the relevant state water quality standards. All point source dischargers, industrial facilities or domestic sewerage plants, must have an NPDES permit before they may discharge their treated wastes into the navigable waters of the United States.

In addition, the Clean Water Act gives the USEPA the authority to develop and implement programs to control the flow of toxic pollutants into Publicly Owned Treatment Works (POTWs). Facilities discharging to such POTWs as sewerage systems are called indirect dischargers and are subject to the USEPA's pre-treatment standards, depending on the type of pollutants discharged. POTWs are required by the CWA to have secondary treatment of their effluent, unless they have a federally issued waiver. If an industry discharges directly in a POTW, that industry may be subject to pre-treatment standards which are developed by the POTW. If industries discharge directly to a POTW, the POTW is the holder of the NPDES permits since it discharges directly to the surface waters of the United States.

In the 1980s, many states and the USEPA discovered that even though most industries were in compliance with technology-based limits, many effluent discharges were still very toxic to aquatic life. As a result, the USEPA developed the water quality-based portion of the program which is based on state water quality standards for specific chemicals. Presently, NPDES permits are written to comply with technology standards, but must also comply with state water quality standards to protect aquatic life.

Protection against toxic releases is called for under Section 101(a)(3) of the CWA, which states that "it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited." In addition, CWA Section 303(c) requires states to develop water quality standards to protect the public health or welfare, enhance the quality of water, and serve the purposes of the CWA. The control of the discharge of toxics is a paramount objective of the National Pollutant Discharge Elimination System and water quality standards programmes. The CWA and the USEPA regulations authorise and require the use of the "integrated strategy" to achieve and maintain water quality standards. In addition, USEPA policy and guidance have long advocated this approach. For the protection of aquatic life, the integrated strategy involves the use of three control approaches : the chemical-specific control approach, the whole effluent toxicity control approach, and the biological criteria/bioassessment and biosurvey approach. However, for the protection of human health, technical constraints do not yet allow for full reliance on an integrated strategy, and thus primarily chemical-specific assessment and control techniques should be employed.

The integrated approach to water quality-based toxics control, including the use of toxicity testing and whole effluent toxicity limits, chemical-specific testing and limits, and biological criteria using bioassessments/biosurveys, relies on the water quality standards that each state has adopted. All states have water quality standards consisting of both chemical-specific numeric criteria for individual pollutants, and narrative "free from toxics in toxic amounts" criteria. Currently, a few states have incorporated biological criteria into water quality standards.

The narrative water quality criteria in all states generally require that the state waters be free from oil, scum, floating debris, materials that will cause odours, materials that are unsightly or deleterious, materials that will cause a nuisance, or substances in concentrations that are toxic to aquatic life, wildlife, or human health. The use of toxicity testing and whole effluent toxicity limits is based upon a state's narrative water quality criterion and/or in some cases, a state numeric criterion for toxicity.

Chemical-specific numeric criteria have been adopted by each state. In many cases, states have adopted USEPA recommended water quality criteria as part of their water quality standards. These state-adopted numeric chemicals criteria provide the basis upon which specific chemicals can be limited in permits. Where states have not developed chemical-specific numeric criteria, states may interpret their narrative standards for specific chemicals by using USEPA criteria updated with current quantitative risk values.

Biological criteria provide a direct measure of ambient aquatic life and overall biological integrity in a water body. Biological criteria constitute one basis for limits that will protect the biological integrity of a surface water.

The integrated approach must include the control of toxics through implementation of the narrative "no toxics" criterion and/or numeric criteria for the parameter toxicity, the control of individual pollutants for which specific chemical water quality criteria exist in a state standards, as well as use of biological criteria. Reliance solely on the chemical-specific numeric criteria or the narrative criterion or biological criteria would result in only a partially effective state toxics control program, because these different parameters allow for the measurement of different types of biological endpoints and indicators.

Waste

Owners or operators of facilities that treat, store or dispose of hazardous waste must obtain an operating permit under Subtitle C of RCRA. These permits define the conditions and requirements that apply to treatment, storage and disposal facilities to ensure that hazardous waste is treated, stored and disposed of safely and in a controlled manner. Permits are issued by EPA, by authorised states, or both. A permit is site-specific and can cover one or more units within a facility. Hazardous waste permits under the RCRA do not distribute "rights to pollute". Site-specific permit conditions are used to implement regulatory standards. These standards may be based on management practices, such as waste analysis, site security, inspections and monitoring, and personnel training, or technical criteria, such as material standards for land disposal liners and integrity measures for tanks and containers. The regulatory standards cannot be made less stringent when they are written into a permit. However, permit conditions beyond the regulations may be imposed as necessary to protect human health and the environment. In most cases, the permit does not allow any significant releases to be emitted from the regulated facility. One exception is for air emissions which are strictly controlled but not eliminated.

The general public can review and comment on permits before issuance, and specific forums for this purpose must be established. The permitted facility must comply with the permit conditions when the permit becomes effective. Any deviation from the permit conditions is a violation. Actions taken by the permittee to come back into compliance must be incorporated in a compliance schedule, which would include specific milestones. Appeals against permit decisions can be made to the Environmental Appeals Board, a panel of three senior environmental judges within EPA. After decision by the EAB, appeals may be made to federal courts.

Waste permits may be issued for a term no longer than 10 years. EPA can issue a permit for less than the allowable ten year term. EPA is required to review permits for land disposal facilities five years after the date of permit issuance or reissuance, and the permit can be modified at that time if necessary. A permittee may request a modification of any permit condition. Examples of modifications include the management of new wastes, new waste management units and changes in waste management practices.

Economic considerations **Factor A**

Air

(1) EQS: Costs and technological feasibility are not considered in setting NAAQS. To a limited degree, cost and technology can be taken into account when developing the implementation program. For HAPs under the Clean Air Act, by court order, the USEPA is to first select a safe level for a pollutant without considering cost or economic impacts. The EPA can then consider the cost and economic impacts in deciding which level provided an ample margin of safety.

(2) BAT: The establishment of technology-driven emission limit requirements is influenced by the cost and availability of control measures and equipment. Costs for controls range about $2000-5000/ton for RACT (reasonably available control technology) to greater than $5000/ton for new companies that must apply LAER.

In the BACT determination, average and incremental cost effectiveness (C/E) are taken into consideration. Cost effectiveness is expressed in terms of dollars per ton of pollutant emissions reduced. The marginal cost effectiveness is the difference between an emission reduction alternative and the next less stringent option. Average cost effectiveness refers to the incremental difference in cost per ton between the current or baseline conditions and the alternative under consideration. In the LAER determination, economics are not considered. In both BACT and LAER, primary consideration is given to quantify the cost of control and not the economic situation of the individual source. The USEPA offers guidance for determining control equipment cost (e.g. in the Environmental Protection Agency, Office of Air Quality Planning and Standards Control Cost Manual).

In the case of NSPS and MACT standards, cost effectiveness and economic viability/impact are considered (e.g. size cut-offs for sources subject to some NSPS regulations, economic impact analyses). The resultant rate of return on investments after considering different control alternative is estimated and considered in decision-making. For MACT, negative economic impacts may not be held as a reason to set the standards below the floors (see *BAT*).

Water

(1) EQS: No consideration to economic affordability is given to what the impact of the aquatic life criteria would be.

The designated use of the regulated waters may be revised on grounds of economic feasibility. The state or discharger must show that attaining the designated use would result in "substantial and widespread" economic and social impacts or would interfere with important social and economic development. Only the economic impact resulting from treatment beyond the required technology-based standards are considered. The technology-based limits applied to direct and indirect dischargers are considered the baseline. Only the incremental cost of meeting the water quality standards are considered. It is up to the state to determine in which cases "substantial and widespread" economic and social costs will ensue. The determination must demonstrate that

(a) the pollution source, whether privately or publicly owned, will not be able to afford the necessary pollution controls ("substantial impact");

(b) the affected community will bear significant adverse impacts if the source is required to meet the water quality standards ("widespread impact").

(2) BAT: The economic impact is measured for each industry (e.g. what percentage of companies will fail as a result of a particular regulatory option). Economic considerations are taken into account at various levels and to different degrees depending on the type of technology-based requirements warranted (see *BAT*). The major factors taken into consideration are contained in a publication called a "development document." Economic considerations are compiled in a special publication called an "economic impact analysis."

Waste

Economic considerations are taken into account when setting standards under the RCRA. Economic considerations are input to the decision making process as regulations are developed. A thorough Regulatory Impact Analysis (RIA) should be performed for all "significant" regulations. RIAs should account for all direct and indirect costs home by the regulated community and effects "downstream". For regulations not deemed "significant" a less intensive cost or economic impact analysis should be performed. In addition, there are requirements to assess the impact of a regulation on small entities (e.g. small businesses) and the "burden" for regulated entities.
.

Financial and technical assistance **Factor B**

Air

The federal government, through the USEPA, assists the states by providing scientific research, expert studies, engineering designs and money to support clean air programs. In particular, the federal government provides technical support and backup enforcement authority as necessary to achieve the objectives of the State Implementation Program.

Water

Section 106 of the Clean Water Act provides federal assistance to States (including territories, the District of Columbia and Indian tribes).

Waste

Under RCRA, no economic assistance is provided to enhance introduction of BAT. There are non-regulatory efforts to push for the adoption of "innovative" technology across the USEPA.

Monitoring and Inspection **Stage 7**

Air

Air permits include self-monitoring requirements which depend on the regulatory requirements to which the source is subject. The 1990 amendments to the Clean Air Act also include "periodic monitoring" in addition to monitoring required by the underlying standards. In addition, the USEPA and the states review monitoring, record-keeping and reporting and they carry out on-site inspections. Through the enhanced monitoring and operating permit programs, source owners are required to certify their compliance status for the year.

Water

NPDES permits contain monitoring requirements that facilities must comply with. While requirements and monitoring techniques vary by program, in general, the permittee must sample and report performance through a self-monitoring system.

Waste

Most monitoring under RCRA is conducted by the regulated community. The types of self-monitoring a permittee is required to conduct vary with the type of regulated device. They range from reports of self-inspections, to groundwater monitoring samples, to monitoring of certain emission parameters from a combustion device. Waste generators often test their wastes to determine whether they are hazardous, while waste treatment and disposal facilities test hazardous waste to determine whether they comply with treatment standards. In addition, facilities often conduct site monitoring as part of their "corrective action" (clean-up) programmes. The monitoring results are, placed in an administrative file and are subject to public review, unless they are claimed to be confidential business information. Permittees are required to report instances of non-compliance with permit conditions. Regulatory agencies conduct compliance and enforcement monitoring and periodically conduct inspections of permitted facilities, including any documents the facility may have developed. The agency may also take samples of, for example, groundwater from a land disposal facility. Any violations uncovered by the government agency are also subject to public disclosure. EPA also conducts waste monitoring to determine whether wastes should be listed as hazardous and to develop appropriate treatment standards.

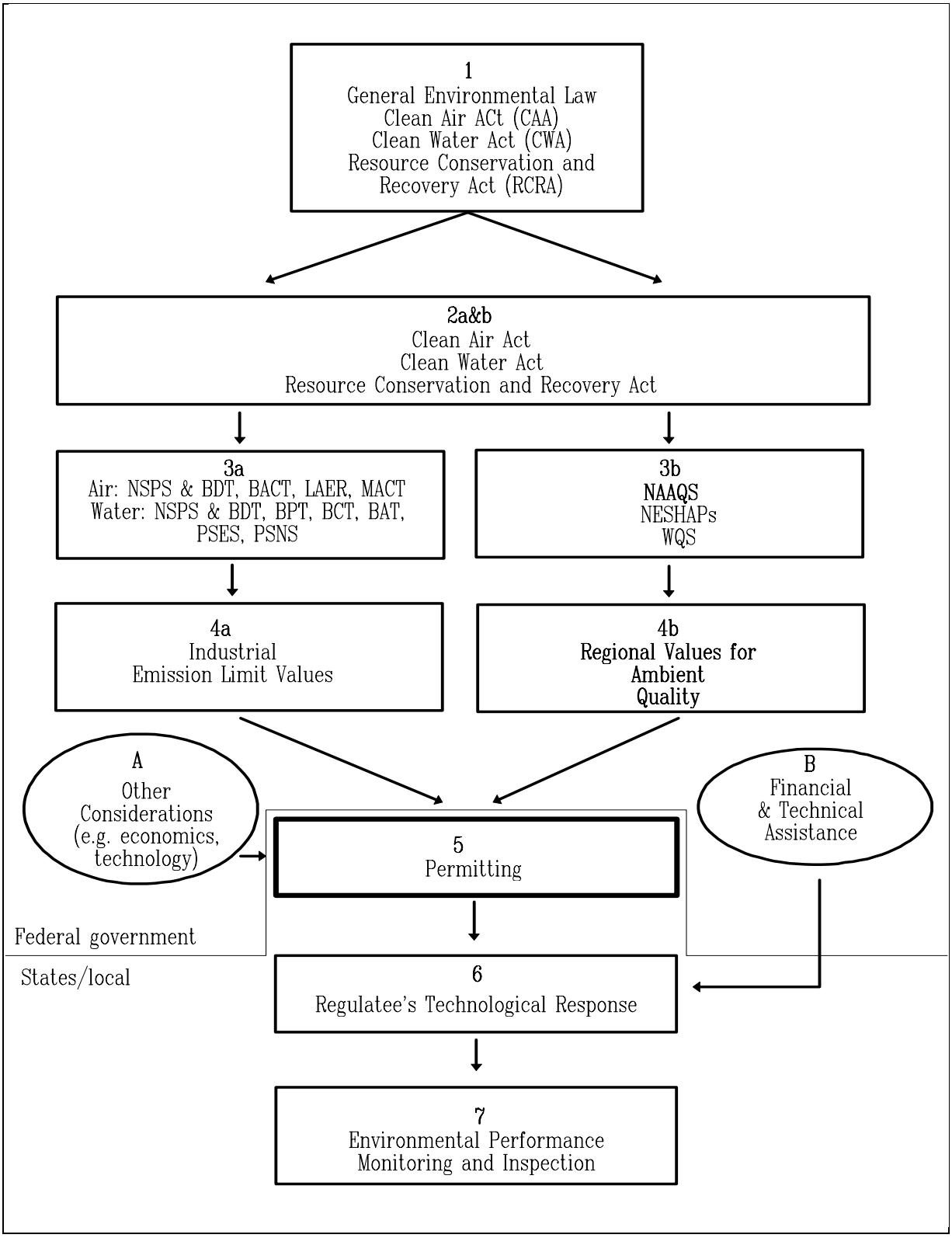


Figure 22 : United States

pollutants & sources \ areas		attainment areas (AA)	non-attainment areas (NAA)
criteria	new (specific source categories only)	NSPS: New Source Performance Standards based on Best Demonstrated Technology (BDT)	NSPS: New Source Performance Standards based on Best Demonstrated Technology (BDT)
	new or modified major sources	BACT : Best Available Control Technology	LAER: Lowest Achievable Emission Rate
HAPs	new	MACT : Maximum Achievable Control Technology ≥ top single performer	MACT : Maximum Achievable Control Technology ≥ top single performer
	existing	MACT : Maximum Available Control Technology ≥ average of 12% top performers	MACT : Maximum Available Control Technology ≥ average of 12% top performers

Figure 23 : United States (air requirements)

pollutants, dischargers & sources			technology standards set by the USEPA
conventional	direct	new	NSPS: New Source Performance Standards based on Best Available Demonstrated Control Technology
		existing	BCT: Best Conventional Pollutant Control Technology*
	indirect	new	PSNS: Pretreatment Standards for New Sources (similar to BAT for toxics)
		existing	PSES: Pretreatment Standards for Existing Sources
toxic and non-conventional	direct	new	NSPS: New Source Performance Standards based on Best Available Demonstrated Control Technology
		existing	BAT: Best Available Technology Economically Achievable*
	indirect	new	PSNS: Pretreatment Standards for New Sources (similar to BAT for toxics)
		existing	PSES: Pretreatment Standards for Exisiting Sources

* : floor requirement : Best Practicable Control Technology Currently Available (BPT), with BCT more stringent than BPT

Figure 24 : United States (water requirements)

EUROPEAN UNION

The text of the EU Directive on Integrated Pollution Prevention and Control, as adopted by the Council on 27 November 1995 provides the following definitions:

BAT

The concept of BAT is developed in a certain number of EC Directives. It was first introduced by Council Directive 76/464/EEC on the release of dangerous substances into the aquatic environment, which makes reference to "Best Technical Measures Available."

This concept was then further developed in the context of the Air Framework directive 84/360/EEC, which introduces the concept of BATNEEC (Best Available Technologies Not Entailing Excessive Costs), thus making a clear link to cost/benefit considerations.

The latest and most complete definition of BAT is laid down in the proposal for the Directive on Integrated Pollution Prevention and Control (IPPC). This definition is bound to become the reference for EU policy. BAT is defined as follows in the IPPC Directive:

> *"Best available techniques" (BAT) shall mean the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole.*
>
> *-"techniques" include both the technology used and the way in which the installation is designed, built, maintained, operated an decommissioned.*
>
> *-"available" techniques shall mean 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" shall mean most effective in achieving a high general level of protection of the environment as a whole.*
> (IPPC Directive, article 2)

In determining what constitutes BAT, some factors have to be taken into consideration:

1. the use of low-waste technology;
2. the use of less hazardous substances;
3. the furthering of recovery and recycling of substances generated and used in the process and of waste, where appropriate;
4. comparable processes, facilities or methods of operation which have been tried with success on an industrial scale;
5. technological advances and changes in scientific knowledge and understanding;
6. the nature, effects and volume of the emissions concerned;
7. the commissioning dates for new or existing installations;
8. the length of time needed to introduce the best available technique;
9. the consumption and nature of raw materials (including water) used in the process and their energy efficiency;
10. the need to prevent or reduce to a minimum the overall impact of the emissions on the environment and the risks to it;
11. the need to prevent accidents and to minimise the consequences for the environment;
12. the information published by the Commission pursuant to Article 16(2) or by international organisations.
(IPPC directive, Annex IV)

In order to facilitate the use of BAT, the IPPC Directive provides for an exchange of information between EU Member States and Industry on BAT, associated monitoring and developments in them.

The European Commission will publish every three years the results of these exchange of information by means of sectoral BAT notes. These notes will be accessible to any interested party.

EQS

European Community-wide EQOs are set in a number of EC Directives. These include several water Directives (among which 76/464/EEC is one), as well as the proposal for a framework Directive on Ambient air quality assessment and management. In general, all these Directives set Quality Objectives for certain specified, "priority" pollutants. The Commission has also recently announced its intention to cover all water EQOs by means of one single water management Directive.

The IPPC Directive creates a very important relationship between BAT-based ELVs and existing EQOs, by imposing a complementary use of these two elements. Article 10 of the current text states that

Where an environmental quality standards requires stricter conditions than those achievable by the use of the best available techniques, additional measures shall in particular be required in the permit, without prejudice to other measures which might be taken to comply with environmental quality standards.

(IPPC Directive, article 10)

Emission Limit Values (ELVs)

Two broad types of ELVs can be identified: those set at Community level and those set at national level, by competent authorities in Member States.

Community-wide ELVs are set by a number of Directives, mainly the "daughter Directives" of Directive 76/464/EEC, the Directive on Large Combustion Plants and the Directives on incineration of municipal and hazardous waste. These Directives set, for the industrial plants under their scope of application, limit values for emissions of specific pollutants into a specified media (air or water).

The proposed IPPC Directive sets a procedure to be used by competent authorities in Member States for the setting up of integrated permits, which would include Emission Limit values for the principal pollutants emitted by the permit holder. These ELVs are to be set on the basis of BAT, but taking into account the technical characteristics of the installations concerned, its geographical location and the local environmental conditions.

Finally, according to IPPC, the European Council could approve Community-wide ELVs, based on proposals by the Commission.

Permitting

> *"permit" shall mean that part or the whole of a written decision (or several such decisions) granting authorisation to operate all or part of an installation, subject to certain conditions which guarantee that the installation complies with the requirements of this Directive. A permit may cover one or more installations or parts of installations on the same site operated by the same operator.* (IPPC directive, article 2)

The IPPC imposes conditions for the delivery of permits:

> […]
>
> 7. *The permit may contain such other specific conditions for the purpose of this Directive as the Member State or competent authority may think fit.*
>
> 8. […] *Member States may prescribe certain requirements for certain categories of installations in general binding rules instead of including them in individual permit conditions, provided that an integrated approach and an equivalent high level of environmental protection as a whole are ensured.* (IPPC directive, article 9)

The IPPC Directive imposes the delivery of integrated permits, containing ELVs based on BAT and general conditions. These conditions are set in Article 3 on the general principles governing the basic obligations of the operator:

> *Member States shall take the necessary measures to provide that the competent authorities ensure that installations are operated in such a way that:*
>
> *(a) all the appropriate preventive measures are taken against pollution, in particular through application of the best available techniques;*
>
> *(b) no significant pollution is caused;*
>
> *(c) waste production is avoided in accordance with Council Directive 75/442/EEC of 15 July 1975 on waste; where waste is produced, it is recovered or, where that is technically and economically impossible, it is disposed of while avoiding or reducing any impact on the environment;*
>
> *(d) energy is used efficiently;*
>
> *(e) the necessary measures are taken to prevent accidents and limit their consequences;*
>
> *(f) the necessary measure are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state.*
>
> *For the purposes of compliance with this Article, it shall be sufficient if Member States ensure that the competent authorities take account of the general principles set out in this Article when they determine the conditions of the permit.*
> (IPPC Directive, article 3)

The permitting requirements under IPPC will only apply to certain industrial installations, generally the larger ones. The permitting requirements for smaller industrial installations are, at present, covered by Directives 76/464/EEC and the air framework Directive.

INTERNATIONAL AGREEMENTS

CONVENTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT OF THE NORTH-EAST ATLANTIC (OSPAR)

BAT

> *3.(a) In implementing the Convention, Contracting Parties shall adopt programmes and measures which contain, where appropriate, time-limits for their completion and which take full account of the use of the latest technological developments and practices designed to prevent and eliminate pollution fully.*
> *(b) To this end they shall:*
> *(i) taking into account the criteria set forth in Appendix 1, define with respect to programmes and measures the application of, inter alia,*
> *- best available techniques*
> *- best environmental practice*
> *including, where appropriate, clean technology;*
> *(ii) in carrying out such programmes and measures, ensure the application of best available techniques and best environmental practice as so defined, including, where appropriate, clean technology.*
> (OSPAR, article 3)

The concepts of BAT and BEP are defined in Appendix 1 to the Convention:

> *Best Available Techniques*
>
> *1. The use of the best available techniques shall emphasise the use of non-waste technology, if available.*
>
> *2. The term "best available techniques" 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. In determining whether a set of processes, facilities and methods of operation constitute the best available techniques in general or individual cases, special consideration shall be given to:*
> *(a) comparable processes, facilities or methods of operation which have recently been successfully tried out;*
> *(b) technological advances and changes in scientific knowledge and understanding;*
> *(c) the economic feasibility of such techniques;*

(d) time limits for installation in both new and existing plants;
(e) the nature and volume of the discharge and emissions concerned.

3. It therefore follows that what is "best available techniques" for a particular process will change with time in the light of technological advances, economic and social factors, as well as changes in scientific knowledge and understanding.

4. If the reduction of discharges and emissions resulting from the use of best available techniques does not lead to environmentally acceptable results, additional measures have to be applied.

5. "Techniques" include both the technology used and the way in which the installation is designed, built, maintained, operated and dismantled.

The use of BAT is part of a broader concept termed "best environmental practice" which encompasses policies and measures of various nature and is designed as follows in Appendix 1 to the Convention:

6. The term "best environmental practice" means the application of the most appropriate combination of environmental control measures and strategies. In making a selection for individual cases, at least the following graduated range of measures should be considered:
(a) the provision of information and education to the public and to users about the environmental consequences of choice of particular activities and choice of products, their use and ultimate disposal;
(b) the development and application of codes of good environmental practice which covers all aspects of the activity in the product's life;
(c) the mandatory application of labels informing users of environmental risks related to a product, its use and ultimate disposal;
(d) saving resources, including energy;
(e) making collection and disposal systems available to the public;
(f) avoiding the use of hazardous substances, products or groups of products;
(g) recycling, recovery and re-use;
(h) the application of economic instruments to activities, products or groups of products;
(i) establishing a system of licensing, involving a range of restrictions or a ban.

7. In determining what combination of measures constitute best environmental practice, in general or individual cases, particular consideration should be given to:

(a) the environmental hazard of the product and its production, use and ultimate disposal;
(b) the substitution by less polluting activities or substances;
(c) the scale of use;

(d) the potential environmental benefit or penalty of substitute materials or activities;
(e) advances and changes in scientific knowledge and understanding;
(f) time limits for implementation;
(g) social and economic implications.

8. It therefore follows that the best environmental practice 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.

9. If the reduction of inputs resulting from the use of best environmental practice does not lead to environmentally acceptable results, additional measures have to be applied and best environmental practice redefined.

CONVENTION ON THE PROTECTION AND USE OF TRANSBOUNDARY WATERCOURSES AND INTERNATIONAL LAKES

BAT

In Annex I to the Convention, a definition of the term "best available technology" is provided:

1. The term "best available technology" is taken to mean the latest stage of development of processes, facilities or methods of operation which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste; In determining whether a set of processes, facilities and methods of operation constitute the best available technology in general or individual cases, special consideration is given to:
(a) Comparable processes, facilities or methods of operation which have recently been successfully tried out;
(b) Technological advances and changes in scientific knowledge and understanding;
(c) The economic feasibility of such technology;
(d) Time limits for installation in both new and existing plants;
(e) The nature and volume of the discharges and effluents concerned;
(f) Low- and non-waste technology.

2. It therefore follows that what is "best available technology" for a particular process will change with time in the light of technological advances, economic and social factors, as well as in the light of changes in scientific knowledge and understanding.

Annex II to the Convention provides guidelines for the development of environmental practices:

> *1. In selecting for individual cases the most appropriate combination of measures which may constitute the best environmental practice, the following graduated range of measures should be considered:*
> *(a) Provision of information and education to the public and to users about the environmental consequences of the choice of particular activities and products, their use and ultimate disposal;*
> *(b) The development and application of codes of good environmental practice which cover all aspects of the product's life;*
> *(c) Labels informing users of environmental risks related to a product, its use and ultimate disposal;*
> *(d) Collection and disposal systems available to the public;*
> *(e) Recycling, recovery and reuse;*
> *(f) Application of economic instruments to activities, products or groups of products;*
> *(g) A system of licensing, which involves a range of restrictions or a ban.*
>
> *2. In determining what combination of measures constitute best environmental practices, in general or in individual cases, particular consideration should be given to:*
> *(a) The environmental hazard of:*
> *(i) The product;*
> *(ii) The product's production;*
> *(iii) The product's use;*
> *(iv) The product's ultimate disposal;*
> *(b) Substitution by less polluting processes or substances;*
> *(c) Scale of use;*
> *(d) Potential environmental benefit or penalty of substitute materials or activities;*
> *(e) Advances and changes in scientific knowledge and understanding;*
> *(f) Time limits for implementation;*
> *(g) Social and economic implications.*
>
> *3. It therefore follows that best environmental practices for a particular source will change with time in the light of technological advances, economic and social factors, as well as in the light of changes in scientific knowledge and understanding.*

<u>EQS</u>

In Annex III to the Convention, guidelines for the development of water-quality objectives and criteria are provided:

> *Water-quality objectives and criteria shall:*

(a) Take into account the aim of maintaining and, where necessary, improving the existing water quality;
(b) Aim at the reduction of average pollution loads (in particular hazardous substances) to a certain degree within a certain period of time;
(c) Take into account specific water-quality requirements (raw water for drinking water purposes, irrigation, etc.);
(d) Take into account specific requirements regarding sensitive and specially protected waters and their environment, e.g. lakes and groundwater resources;
(e) Be based on the application of ecological classification methods and chemical indices for the medium- and long-term review of water-quality maintenance and improvement;
(f) Take into account the degree to which objectives are reached and the additional protective measures, based on emission limits, which may be required in individual cases.

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE : LONG-RANGE TRANSBOUNDARY AIR POLLUTION

BAT

The fundamental principles of the Convention stipulate that the Contracting Party shall endeavour to limit and, as far as possible, gradually reduce and prevent air pollution. For that purpose control techniques are crucial.

According to article 6 of the Convention, each Contracting Party undertakes to develop "control measures compatible with balanced development, in particular by using the best available technology which is economically feasible and low- and non-waste technology."

Under article 7, the Contracting Parties initiate and co-operate in the conduct of research into and/or development of "existing and proposed technologies for reducing emissions of sulphur compounds and other major pollutants, including technical and economic feasibility and environmental consequences."

Pursuant to article 8, the Parties also exchange available information on "control technologies for reducing air pollution relevant to long-range transboundary air pollution, and the projected cost of the emission control of sulphur compounds and other major air pollutants on a national scale."

The protocols (two on sulphur, one on NO_x and one on VOCs) have developed further the technology component, firstly in terms of using BAT, and secondly in terms of facilitating the exchange of BAT among parties.

In general, Parties to protocols shall apply appropriate national or international emission standards to new or existing stationary or mobile sources, where appropriate, based on best available technologies which are economically feasible, taking into consideration guidance contained in technical annexes to protocols. Moreover, specific articles of the 1988 Sofia Protocol on NOx , of the 1991 Geneva Protocol on VOCs and of the draft Oslo Protocol on further reduction of sulphur emissions, deal with the exchange of technology.

Application of best available technology (BAT) is crucial to the effective implementation of basic obligations of the Convention and its Protocols. BAT, although not explicitly defined, incorporates here the wide range of techniques involved in an industrial process from "cradle to grave," such as plant construction, design and layout, choice of raw materials, by-product utilisation and waste management, operation of the process and training and qualifications of personnel.

In keeping with relevant technology-oriented articles of the Convention and its Protocols, the Executive Body continuously monitors state-of-the-art pollution control technology and prepares updated technical annexes to the protocols. They contain different control techniques for main stationary and mobile emission source categories of SO_x, NO_x and VOCs that are considered to be well established on the basis of operational experience. Their actual performance is often considered as emission standards and as such widely recognised in the ECE region. Because of accumulating experience with new plants and new engines incorporating low-emission technology as well as with retrofitting existing plants, regular updating of the annexes are necessary. One of the best forums for technology assessment is provided by five-yearly ECE seminars on control technology for emissions from stationary sources.

If the use of BAT seems to be enough to meet the objectives of the SOx, NOx (first step) and VOC (first step) protocols certainly this is not the case as regards the second sulphur protocol. The latter has been negotiated on the basis of the critical load approach, the best available technologies for sulphur emission abatement and other measures. The result reflects this approach: (1) Emission ceilings were set for each Party that joins the protocol which are in the range of 30% to 87% of 1980 emission levels; this differentiated schedule, covering the years 2000, 2005 and 2010, was drawn up on the basis of scenario analysis using integrated assessment models, taking into account, also the possibilities of Parties to reduce emissions; while the long-term goal is to reach critical loads, the models had calculated the least costly way to reduce the gap between critical loads and sulphur deposition in 1990 by at least 60% for the whole of Europe; (2) Requirements were set for certain stationary combustion sources and for the sulphur content of gas oils; this will mean that cleaning technologies will have to be applied for a number of activities; in addition, the application of further technologies and techniques to reduce emissions are recommended by the Protocol. Furthermore, the Protocol includes provisions to enable Parties to jointly implement the emission reduction obligations after procedures have been established, to enhance the exchange of technologies and techniques, including those to raise energy efficiency, the use of renewable energy and the processing of low-sulphur fuels and to further international co-operation in a number of fields relevant for the objectives of the Protocol. A new feature is a strong regime to review the implementation of the Protocol and the compliance by Parties with their obligations.

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE: RECOMMENDATIONS TO ECE GOVERNMENTS ON WATER-QUALITY CRITERIA AND OBJECTIVES

as adopted by the Senior Advisers to ECE Governments on Environmental and Water Problems at their sixth session in March 1993

EQS

Many chemical substances emitted into the environment from anthropogenic sources pose a threat to the functioning of aquatic ecosystems and the utilisation of water for various purposes. The need for strengthened measures to prevent and control the release of hazardous substances into the aquatic environment, and to abate the deterioration of water quality owing to these substances, as well as to an excessive release of nutrients and other conventional water pollutants, has led many countries to develop and implement water management strategies on the basis of, inter alia, water-quality criteria and objectives, taking into account water-quality requirements for water uses in the relevant catchment area.

Guidelines for developing water-quality objectives and criteria are given in annex III to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Helsinki, 1992). With a view to providing further guidance in the elaboration of water-quality criteria and the formulation and setting-up of water-quality objectives for inland surface waters, and in order to strengthen international co-operation,

it is recommended that.

1. Water-quality requirements for different water uses, such as drinking-water, irrigation, livestock watering, fisheries, leisure activities, amenities, and maintenance of riverine flora and fauna should be clearly defined, taking into account in particular the adverse impact of the use of substances that are toxic, persistent, bio-accumulative, carcinogenic, mutagenic and teratogenic, or which cause eutrophication and acidification of aquatic ecosystems.

2. Special attention should be given to acquiring more information on the substance's behaviour in water, as well as to the fate and interaction of different substances and their mixtures (for example, synergistic effects) on both the biotic and abiotic components of aquatic ecosystems.

3. A methodology for the selection of water-quality parameters, including physical properties, chemical constituents and microbiological parameters of water, which are of relevance to water uses for various purposes, should be developed and harmonised, if possible, at an international level. Particular attention should be given to the development and harmonisation, at the international level, of methodological approaches for the selection of biological indicators relating to the conservation of flora and fauna and to other parameters suitable for characterising the structural and/or functional integrity of aquatic ecosystems.

4. The precautionary principle should be applied when selecting water-quality parameters and establishing water-quality criteria to protect and maintain individual uses of waters. Water-quality criteria should be established as follows:

(a) Raw-water quality criteria for drinking-water supply should strive for attainment, as appropriate, of drinking-water criteria;

(b) Water-quality criteria for aquatic life should be aimed at the protection and maintenance of riverine flora and fauna in all its forms and life stages, taking into account, in particular, the protection of the functional integrity of aquatic ecosystems;

(c) Water-quality criteria for surface waters used for irrigation should not lead to any significant adverse effects on soil properties, salinisation or accumulation of toxic substances or to the subsequent transfer of pollution from soil to surface water and groundwater;

(d) Quality criteria for sediment and suspended particulate matter should be aimed at the protection of aquatic organisms living in or on sediment, at the protection of aquatic ecosystems, and at the protection of soils and terrestrial ecosystems, if dredged sediment is to be disposed of.

5. Particular attention should be paid to the protection of the integrity of aquatic ecosystems and to specific requirements regarding sensitive and specially protected waters and their environment, such as wetland areas, and the surrounding areas of surface waters which serve as source of food and habitats for various species of flora and fauna. Special-use categories should be defined for that purpose. Quality criteria for these categories should be established on the basis of indicators relating to the conservation of flora and fauna and other information that characterises the structural and/or functional integrity of aquatic ecosystems.

6. In setting water-quality criteria, particular attention should be paid to substances that cause acute and chronic toxic effects at low concentrations, as well as to substances that cause (or are suspected of causing) carcinogenic, mutagenic and teratogenic effects.

7. Water-quality criteria should be used as a reference base for the assessment of the current water quality in water bodies and its suitability for different purposes.

8. In order to improve knowledge about the adverse impact of pollution on aquatic ecosystems, research should be continued on sensitive indicators and/or criteria that are capable of diagnosing early stages of stress to aquatic ecosystems. Particular attention should be paid to the further development and improvement of systems for water-quality assessment and classification that rely on biological information, as well as the combination of physicochemical and biological assessment and classification systems. Efforts should be made by riparian countries to jointly develop and agree on water-quality assessment and classification systems for transboundary waters.

9. Water-management authorities in consultation, inter alia, with industries, municipalities, farmers' associations and the general public should agree on the water uses in a catchment area that are to be protected. Use categories, such as drinking-water supply, irrigation, livestock watering, fisheries, leisure activities, amenities, maintenance of aquatic life, and protection of the integrity of aquatic ecosystems, should be considered, if applicable.

10. In setting water-quality objectives for a given water body, both the water-quality requirements for water uses of the relevant water body, as well as downstream uses, should be taken into account. In transboundary waters, water-quality objectives should be set taking into account water-quality

requirements in the relevant catchment area; as far as possible, water-quality requirements for water uses in the whole catchment area should be considered.

11. Water-quality objectives should be set, taking into account specific physicochemical, biological and other characteristics of water bodies and their catchment area. Expert judgement should be sought for adjusting water-quality objectives to site-specific natural conditions, particularly natural excessive occurrence of some substances, such as heavy metals. Under no circumstances should the setting of water-quality objectives (or modification thereof to account for site-specific factors) lead to the deterioration of existing water quality.

12. Water-quality objectives for multipurpose uses of water should be set at a level that provides for the protection of the most sensitive use of a water body. Among all identified water uses, the most stringent water-quality criterion for a given water-quality parameter should be adopted as a water-quality objective.

13. Water-management authorities should be required to take appropriate advice from health authorities in order to ensure that water-quality objectives are appropriate to protect human health.

14. Water-quality objectives established should be considered as the ultimate goal, that is, as a target value which indicates a negligible risk of adverse effects on water uses and the ecological functions of waters.

15. The setting of water-quality objectives should be accompanied by the development of a time schedule for compliance with the objectives, taking into account action which is technically and financially feasible and legally implementable.

16. Where necessary, there should be a step-by-step approach to attain water-quality objectives, taking into account, inter alia, the current water quality, current and potential new water uses in the catchment area, available technical and financial means for pollution prevention, control and reduction, as well as the urgency of control measures. These objectives, which represent the result of a balance between what is desirable from an environmental point of view and what is feasible from a technical and economic point of view, should be regarded as a policy goal to be attained within a certain period of time.

17. The setting of emission limits on the basis of best available technology, the use of best environmental practices and water-quality objectives as integral instruments of prevention, control and reduction of water pollution, should be applied in an action-oriented way. Action plans covering both point and diffuse pollution sources should be designed, which permit a step-by-step approach and are both technically and financially feasible. In addition to action plans and measures implementing strategies and standards for emission limits, measures based on water-quality criteria and objectives should also be considered, where appropriate; the relative priorities of all these measures should also be considered. Preparatory and complementary administrative measures to these action plans should include, inter alia:

(a) Taking steps, such as emission inventories and catchment inventories, in order to ascertain where substances that are hazardous or otherwise likely to adversely affect water uses and aquatic ecosystems are manufactured, used, stored, disposed of or discharged into inland waters;

(b) Phasing out or prohibiting the use of hazardous substances when they pose a particular risk to sensitive or specially protected waters.

18. Monitoring programmes, including programmes for laboratory analyses, should be adapted to the water-quality objectives, particularly with regard to measurement parameters, range of concentrations and frequency of measurement, and should provide reliable information on whether water-quality objectives are met and what further reduction in emissions from both point and nonpoint sources in the catchment area is required to meet the objectives.

19. Both the water-quality objectives and the timetable for compliance should be subject to revision at appropriate time intervals in order to adjust them, inter alia, to new scientific knowledge on water-quality criteria, changes in water use in the catchment area, best available technology for point-source control, the establishment and implementation of rules of good agricultural practice for the control of agricultural sources, as well as environmentally sound practices for the control of other non-point sources, which are technical and financially feasible, in addition to other factors that may have a bearing on the implementation of measures to prevent, or reduce water pollution. The public should be kept informed about water-quality objectives that have been established, and about measures taken to attain these objectives.

REFERENCES

The vast majority of the information contained in this guide was collected through personal communications with government officials in the environment protection agencies and ministries of the countries and regions surveyed. Most of this information was obtained in response to the questionnaires developed during phase I (analysis of regulations, policies and practices) and phase II (industrial case studies) of the OECD's industrial permitting project. However, the publications listed below provided useful supplementary information.

A Guide to the Environmental Protection Act 1990, Department of the Environment, United Kingdom, 1991.

Austria's National Environmental Plan

Bjällås, Ulf, *Environmental Legislation in Sweden*.

Enckell-Sarkola, E., *Control and Surveillance of Industrial Wastewaters in Finland*, paper prepared for the UNECE Seminar on Waste-water management, Munich, Germany, 21-25 May 1990.

Environmental Performance Review of Austria, OECD, 1995.

Environmental Performance Review of Canada, OECD, 1996.

Environmental Performance Review of France, OECD, 1996.

Environmental Performance Review of Germany, OECD, 1993.

Environmental Performance Review of Italy, OECD, 1994.

Environmental Performance Review of Japan, OECD, 1994.

Environmental Performance Review of the Netherlands, OECD, 1995.

Environmental Performance Review of the United Kingdom, OECD, 1994.

Environmental Performance Review of the United States, OECD, 1996.

Environmental Protection in Korea, Ministry of Environment, Republic of Korea, 1994.

Environmental, Economic and BPEO Assessment Principles for Integrated Pollution Control : Consultation Document, Her Majesty's Inspectorate of Pollution, United Kingdom, 1994.

Eskild Holm Nielsen & Per Christensen, *Integrated Pollution Prevention and Control : The new EC draft and some Danish experiences with IPC*, paper prepared for the European Environmental Conference, Bristol 20-21 September 1993.

Heinonen, P. & Herve, S., Water quality classification of inland waters in Finland, *Aqua Fennica* 17,2 (1987) : 147-156.

Industrial Air Pollution Control Guidelines, Ministry of the Environment, Denmark & Danish Environmental Protection Agency, 1992.

Industry and the Environment, Swedish Environmental Protection Agency, background report for the action programme.

Integrated Pollution Control : A Practical Guide, Department of the Environment, United Kingdom.

Kjærgård, Bente, Jesper Holm, Henning Schroll and Per Homann Jespersen, "Environmental Regulation of Trades by Fixed Standards : The Danish Experience," *The Environmentalist*, Volume 14, Number 4, 243-251 (1994).

Korea's Green Vision 21, Ministry of Environment, Republic of Korea, 1995.

La Prévention des Pollutions et des Risques des Activités Economiques : Les Installations Classées, Ministère de l'Environnement, France, 1989.

La Signification des Valeurs Limites d'Immission de l'Ordonnance sur la Protection de l'Air, Cahier de l'Environnement n°180, Office Fédéral de l'Environnement, Suisse, 1992.

Les Agences de l'Eau, Ministère de l'Environnement, France, 1992.

Mäkelä, Markku, *Municipal Waste Water Treatment in Finland - Demands and Background*, paper presented at the Water Treatment Technology Seminars in Vilnius, Riga and Tallinn, April 6-10, 1992.

OECD, *Control of Hazardous Air Pollutants in OECD countries*, Paris, 1995.

OECD, *Hazardous Air Pollutants - The London Workshop*, OECD Documents, Paris, 1995.

Profile of the Fabricated Metal Products Industry, USEPA, September 1995.

Profile of the Iron and Steel Industry, USEPA, September 1995.

Profile of the Petroleum Refining Industry, USEPA, September 1995.

Profile of the Pulp and Paper Industry, USEPA, September 1995.

Report on the State of the Environment in Italy, Ministry of the Environment, Italy, 1993.

Swedish Environmental Legislation, Booklet 1 : Environmentally hazardous activities and liability for environmental damage, Ministry of the Environment and Natural Resources, Sweden, 1993.

Technical Support Document For Water Quality-Based Toxics Control, USEPA, March 1991.

The Development of Korean Environmental Policy, Ministry of Environment, Republic of Korea, 1995.

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 1999 03 1 P) ISBN 92-64-16193-7 – No. 50529 1999

OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 1999 03 1 P) ISBN 92-64-16193-7 – No. 50527 1999