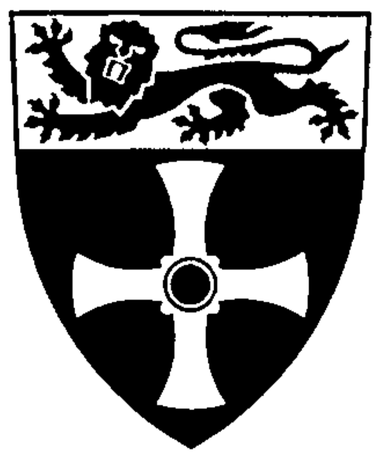

Harmonising Policy and Technology: Environmental Regulation of Mine Waters in the United Kingdom and European Union.

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ABSTRACT

Amongst its many aims, the Research, Technology and Development (RTD) Programmes of the European Commission seek to achieve harmony between RTD projects and policy development. Serving this laudable aspiration, a programme of "action research" has been conducted with the aim of demonstrating that a European RTD project can be designed and implemented so that it effectively functions as a platform for significantly influencing European policy-making. The research takes as its technical topic the management of mine waters, an activity which has great importance to achieving adequate environmental protection in many EU countries. The research centred around the management of the European project 'ERMITE' (Environmental Regulation of Mine Waters in the European Union). Investigations were developed on three levels. Firstly, the United Kingdom was examined as a paradigmatic case study for mine water management, on the grounds that the UK is at the forefront of recent developments in Europe concerning mine water management. Secondly, building upon the UK case study, and taking into account findings from other elements of the broader ERMITE project, a platform was created from which to attempt to influence EU policy-making. An analysis of the existing regulation of mining in European environmental policies led to a critique of the highly preferential treatment which the mining sector has hitherto enjoyed within the EU regulatory framework. The most important outcome of this analysis was the identification of a range of key issues which must be taken into account if management of mine waters is to be properly incorporated into future EU policies. The third element of the research presented here is the analysis of the nature and efficacy of the various practice / policy-making interfaces developed by the ERMITE project, notably six national-level stakeholder groups, and EU-level interfaces with the European Commission, the European policy office of a major environmental NGO (WWF), and the European Parliament. The success of these interfaces in directly influencing the development of the proposed European Directive on the management of waste from the extractive industries is demonstrated, and wider implications for other interfaces between RTD and policy in the context of the European Union environmental policies are explored

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ABBREVIATIONS AND ACRONYMS

AWB	Artificial Water Bodies
BAT	Best Available Techniques
BEP	Best Environmental Practice
BiH	Bosnia and Herzegovina
BRAP	Bridging Research and Policy
BREF	BAT Reference Document
CA	Coal Authority
CCC	Coalfield Communities Campaign
CEC	Commission of the European Communities
CIS-WFD	Common Implementation Strategy for the Water Framework Directive
COPA	Control of Pollution Act
DFID	Department for International Development
DG	Directorate General (European Commission)
DG ENV	DG Environment
DG RTD	DG Research, Technology and Development
DG TREN	DG Transport and Energy
DTI	Department of Trade and Industry
DTLR	Department for Transport, Local Government and the Regions
EA	Environment Agency of England and Wales
EAP	Environmental Action Programme
EC	European Commission
ECJ	European Court of Justice
ECSC	European Coal and Steel Community
EDD	The Europe of Democracies and Diversities Group (European Parliament)
EEB	European Environmental Bureau
EIA	Environmental Impact Assessment
ELDR	European Liberal, Democratic and Reformist Group (European Parliament)
EMS	Environmental Management System
ENVI	Committee on the Environment, Public Health and Consumer Policy (European Parliament)
EP	European Parliament
EPs	English Partnerships
ERMITE	Environmental Regulation of Mine Waters in the EU (an EC FP5 research project)
ESRC	Economic and Social Research Council
EU	European Union
Euromines	European Association of Mining Industries, Metal Ores and Industrial Minerals.
FP5	5th Framework Programme
FP6	6th Framework Programme
GDN	Global Development Network
GUE/NGL	Confederal Group of the European United Left/Nordic Green Left (European Parliament)
HEI	Hydro-Engineering Institute of the Civil Engineering Faculty, University of Sarajevo
HERO	Hydrogeochemical Engineering Research and Outreach
HMWB	Heavily Modified Water Bodies

HoU	Head of Unit (in the European Commission)
IAD	Institutional Analysis and Development
IDA	Institutional Decomposition and Analysis
IGME	Instituto Geológico y Minero de España
IMWA	International Mine Water Association
IP	Integrated Projects
IPPC	Integrated Pollution Prevention and Control
IRGO	Institute for Mining, Technology and Environment, Slovenia
ITRE	Committee on Industry, External Trade, Research and Energy (European Parliament)
IWMI	International Water Management Institute
JRC-IPTS	Institute for Prospective Technological Studies, Joint Research Centre
KTH	Water Resources Engineering, Royal Institute of Technology, Sweden
MEP	Member of the European Parliament
MMSD	Mining, Minerals and Sustainable Development
MoU	Memorandum of Understanding
MPA	Mining Planning Authority
MPG	Mining Planning Guidance Note
MWD	Mining Waste Directive
NAS	National Academy of Science of the USA
NCC	National Co-ordination Group
NETL/EST	National Energy Technology Laboratory USA, Environmental Science and Technology Division
NGO	Non- Governmental Organisation
NIOO	Netherlands Institute of Ecology
NRA	National Rivers Authority
NSG	National Stakeholder Group
ODI	Overseas Development Institute
ODPM	Office of the Deputy Prime Minister
PIRAMID	Passive In-situ Remediation of Acidic Mine/Industrial Drainage (an EC FP5 research project)
PPE	European People's Party (European Parliament)
PSE	Party of European Socialists (European Parliament)
RAPID	Research and Policy in Development
RDA	Regional Development Agency
RTD	Research, Technology and Development
RWG	Regional Working Group
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SG	Stakeholder Group
STREP	Specific Targeted Research Project
SUAS	Natural Resources and Environmental Economics, Swedish University of Agricultural Sciences
TWG	Technical Working Group (in IPPC Directive)
UEPG	European Aggregates Association
UF	Technical University and Mining Academy Freiberg
UK	United Kingdom
UNEP	United Nations Environment Programme
UNEW	University of Newcastle
UNEX	University of Exeter
UNIOVI	School of Mines, University of Oviedo
WFD	Water Framework Directive

WP	Workpackage
WRA	Water Resources Act
WWF	WorldWide Fund for Nature

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1 INTRODUCTION

1.1 Harmonising policy and technology within European RTD programmes

This thesis is an exploration of the harmonisation of policy and technology within the particular framework of the European Research, Technology and Development (RTD) Programmes. It came about as the result of the endeavours of the Newcastle University mine water research team (HERO) to prove that an European RTD project could, indeed, function as a platform to support European policy-making as just the guidelines of the European RTD programmes request. The particular case study relates to the management of mine waters, a technological area critical for the European environment.

The definitions of technology in a standard English dictionary (Davison et al. 1988) include "*the practice of any or all of the applied sciences that have practical value and/or industrial use*" and "*technical method(s) in a particular field of industry or art*". Abbott (1991, p. 5) provides a thorough discussion of the essence of technology in his exploration of the concept of hydroinformatics, based on the ideas presented by Heidegger in "*The Question Concerning Technology and Other Essays*" (Heidegger 1977). According to Heidegger, technology stems from the Greek word *technē* which refers not only to the activities and skills of the craftsman but also to the arts of the mind and the fine arts. Abbott (1991) distinguishes between technology, which has to do with creativity in the material world, and science, which has to do with understanding the world. Science contributes to technology, but so do business, aesthetics (eg industrial design) and many other activities. In the context of this thesis, technology will be used in the broad sense of all types of applied knowledge and skills that can contribute to the attainment of a particular technical objective (in this case management of waters in the mining sector). The emphasis is on the applied, and not speculative or theoretical, nature of this knowledge, and on the need for it to inform policy.

The construction of a common research, technology and development policy is an essential element of the overall "project" of European integration. The development of a common RTD policy within the European Union (EU) has been closely linked conceptually to the common industrial and energy policies (Moussis 2002). However, as

the "*environment*" and "*sustainability*" have become more central to the wider European "project" (see Section 1.3.2) they have received increasing attention within the RTD programmes. Every five years (in current practice), the EU adopts a multiannual RTD "Framework Programme", which specifies the scientific and technological objectives and identifies the broad lines of research activity. The Framework Programmes are implemented through specific sub-programmes that address diverse areas of activity. Energy, environment and sustainable development are now key components of European RTD and formed one of the Thematic Programmes of the 5th Framework Programme (1998-2002).

The mining sector is a good example of this evolution towards environmental concerns. Mining interests have traditionally fallen with the remit of two different policy areas within the EU: energy policy for the energy extractive industries and industrial policy for the non-energy extractive industries. The relatively recent involvement of environmental policy with the mining sector at European level is discussed thoroughly in Chapter 6. The review of European research on mining undertaken for this dissertation shows a similar pattern, with increasing attention to the environment (Kroll et al. 2002): while research on mining has a long pedigree within the EU, until recently most projects focused on mining exploitation technology; inclusion of environmental concerns related to mining practices in the funding streams is a relatively recent development. The research programmes of the European Coal and Steel Community (ECSC), managed by the former Directorate General V (Energy) and Directorate General XVII (Employment, Social Affairs and Education), formerly constituted the most important body of European research on mining issues. Within the ECSC umbrella, there have been several generations of mine safety (ECSC-WORKSAFE and MINESAFE), hygiene (ECSC-MINEHYG) and technical guidelines (ECSC-COALRES) programmes, which were very active in the 1970s and 80s. Particularly relevant are the 7 five-year programmes on medium-term guidelines for technical coal research covering mining operations, mine infrastructure and management. ECSC-COALRES 7C (1994-99) introduced a section on Environment Protection, including the abatement of water pollution.

Mining and mine pollution have also been present in the mainstream research programmes managed by DG Research within the larger Framework Programmes. The 2nd Framework Programme (FP) included the MATREC C programme (1990-92) on

raw materials and recycling, with a section on mining technology. This work was continued in the BRITE/EURAM 2 and 3 programmes of the 3rd (1990-94) and 4th Framework Programmes (1994-99), with projects such as "Novel methods for controlling zinc in mine effluents". The 3rd FP also had the ENV1 programme, focused on Technologies for the Environment, which supported some projects on acid mine drainage and removal of cadmium. Within the ENV2 in the 4th FP, the TOROS project on the biogeochemistry of an acidic, metal-rich river-estuary system was funded. With the 5th Framework came an array of projects dealing with metal pollution and mining, as part of the Energy, Environment and Sustainable Development Thematic Programme, most notably the projects PIRAMID, PEREBAR, METAL: BIOREDUCTION, DIMDESMOTOM, IMAGE-TRAIN and ERMITE. PIRAMID developed guidelines on passive mine water treatment for general diffusion and uptake in Europe. IMAGE-TRAIN was a programme linking groundwater pollution projects which (inter alia) paid particular attention to mining related problems. The aim of ERMITE was to support the development of European legislation and practice relating to water management in the mining sector, exploiting the accumulated knowledge of European and national technological research in this area. This thesis is effectively an output of the ERMITE project (see Chapter 2).

The 5th Framework Programme philosophy had three main stated objectives: using a problem solving approach, actively involving stakeholders and end-users and, in particular, underpinning (development and implementation of) European policies. One of the expected objectives of projects under Key Action 1 "Sustainable Management and Quality of Water" (which funded ERMITE) was to "*support the implementation of various policies related to the sustainable management of water resources*". However, the RTD Programmes provide no guidance whatsoever on **how projects could interface with EU policies**; and the Directorate General (DG) Research, which manages the Framework Programmes, has no mechanisms to transfer research findings so they support policies administered by other DGs. This is still an unresolved issue between DG Research and DG Environment, in relation to all of the (substantial) European RTD effort on environmental issues. ERMITE was specifically designed to address this challenge. This thesis is a demonstration of how a 5th Framework Programme RTD project could indeed be used as a platform to support European policy-making.

The following sections will provide the background to the key themes covered in the thesis: regulation of the environmental impact of mine waters; European policy-making and European environmental policy; and the interface between RTD and policy.

1.2 Regulation of the environmental impact of mine waters

1.2.1 Environmental impact of mining: mine waters and waste

There are many thorough reviews of the environmental impacts of mining (e.g. Azcue 1999). A recent update of the challenges and perspectives of mining and sustainable development (UNEP 2000), lists the following potential impacts (Table 1-1):

Table 1-1 Potential impacts of mining

Environmental Impacts	Pollution Impacts
• Destruction of natural habitat at the mining site and at waste disposal sites	• Drainage from mining sites, inc. acid mine drainage and pumped mine water
• Destruction of adjacent habitats as result of emissions and discharges	• Sediment run-off from mining sites
• Destruction of adjacent habitats arising from the influx of settlers	• Pollution from mining operations in river beds
• Changes in river regime and ecology due to siltation and flow modification	• Effluent from mineral processing operations
• Alteration of water tables	• Sewage effluent from the site
• Changes in landform	• Oil and fuel spills
• Land degradation due to inadequate rehabilitation after closure	• Spoil contamination from treated residues and spillage of chemicals
• Land instability	• Leaching of pollutants from tailings and disposal areas of contaminated soils
• Danger from failure of structures and dams	• Air emissions from mineral processing operations
• Abandoned equipment, plant and buildings	• Dust emissions from sites
	• Release of methane from mines

Air pollution by the dust produced by the working of open pits and by crushing and grinding operations is a major concern during the active phases of mining. Contaminated dust from dried tailings dams is the worst air-borne hazard in the long term. However, looking at the whole life-cycle of a mine, **water** pollution is the main impact on the environment, as will be seen in detail later in this introduction.

Due to the substantial amount of **waste** generated by the mining industry, especially since surface mining became the predominant practice (waste being 70% of all the material excavated, of which 99% is generated by surface mines; Younger et al. 2002), there is a general tendency to perceive mining environmental problems exclusively as waste problems, overlooking the fact that water is undoubtedly the single greatest pathway and receptor of mining-related contamination. For example, the recent Mining, Minerals and Sustainable Development project (MMSD 2002) (a global review of the mining sector commissioned by the Global Mining Initiative through the World Business Council for Sustainable Development) devoted most of its coverage of environmental issues to "large-volume wastes". Water issues were reduced solely to acid drainage from waste, even though pollution from mined void's is volumetrically more important (Younger 2003). The same reductionist thinking has permeated the recent development of European environmental mining legislation.

In countries with a long mining history, the impact of the past mining activities is frequently the main source of pollution. **Abandoned and orphan mine sites** are no longer operational, not actively managed and frequently lack any responsible party accountable for site remediation and rehabilitation. The problem of how to deal with such sites is a major global policy issue.

This thesis is centred on the **regulation of mine water** defined as "*water in mined ground including waste rock/tailing depositories and/or draining into an adjoining body of water including streams, lakes, aquifers, wetlands, and oceans.*" (ERMITE D7, Amezaga and Alvarez 2004). For the purpose of this work, the recent synthesis on mine water of Younger et al. (2002) was adopted as the general technical reference source in the early stages of the project. The technical and managerial guidelines for catchment scale management (ERMITE Consortium 2004) produced by the ERMITE project, and the guidelines for the design of passive treatment of the related PIRAMID project (PIRAMID Consortium 2003), were the main technical reference materials used in the later phases of the research.

Younger et al. (2002) give an in-depth presentation of the impacts of mining and mine waters on the water environment and infrastructure. According to their classification mining impacts on the water environment arise at six distinct phases of the mining life-cycle:

1. The mining process itself
2. Mineral processing operations
3. The dewatering that is undertaken to make mining possible
4. Seepage of contaminated leachate from waste rock and tailings dams
5. Flooding of workings after extraction has ceased
6. Discharge of untreated waters after flooding is complete

If mining operations are undertaken responsibly the first phase is the least important, and the last one the most critical in the long term.

The **mining process** causes disruptions of existing hydrological pathways. Usually, the direct impacts tend to be localised and of limited magnitude as mining engineers have a vested interest in avoiding the direct interaction of mine voids with water resources, in order to facilitate mining. Underground mining normally has subtle impacts on the surface environment, but subsidence and propagation of fractures can alter surface flow patterns. For groundwater systems there could be locally pronounced declines in the water table within shallow aquifers. On the other hand, the excavation of open-pit surface mines causes an inevitable alteration of subsurface pathways. It is not uncommon for surface streams to be temporarily diverted to allow exploitation to proceed.

Water pollution from **mineral processing** operations, and the disposal of tailings in particular, have been historically the main sources of nuisance. This is still the case in unregulated environments. Proper application of tailings dams technology and effluent treatment have seriously diminished this danger. However, mineral separation processes that make use of dangerous and toxic substances such as sulphuric acid, cyanide (leaching) and organic reagents (flotation) can be serious sources of contamination if appropriate control systems are not in place.

Mine dewatering impacts can vary from negligible in small mines to major in large connected underground systems. For instance, the dewatering of large coalfields has been shown to depress regional water tables over areas of up to several thousands of km^2. This can decrease flows in surface water bodies in hydraulic continuity with the dewatered area; lower water tables in water supply wells; cause land subsidence; and lead to surface and groundwater pollution if the pumped water is of poor quality and is

discharged without treatment. In spite of all these potential problems there are few well-documented cases of negative impacts of dewatering.

Seepage of contaminated leachate from waste rock piles and tailings dams is a very important source of surface water pollution in most mining districts. Unreclaimed spoil can produce highly polluted run-off during storms. In some cases, leachate from waste rock piles has continued to pollute several decades after re-vegetation from perched systems within the spoil. Drainage of leachate from old tailing dams can also pollute surface and groundwater systems. The particular geotechnical characteristics of fine grained tailings and the great quantity of water in tailings dams can provoke catastrophic failures. Globally, the stability of the estimated 3500 tailings storage facilities in active use and many thousands already closed is a major concern (MMSD 2002; ICOLD 2001).

The **flooding of abandoned mine workings** is usually referred to as water table rebound or groundwater rebound. It usually implies a deterioration of the water quality due to the dissolution of acid-generating salts formed by the weathering of sulphide minerals above the water table. This commonly results in a ten-fold increase in the concentration of contaminants within the mine waters. Flooding can also prompt physical changes in the mined system such as: subsidence as open voids are eroded; fault re-activation; rising ground levels; development of high pressure gas pockets and acceleration of mine gas emissions.

The **discharge of untreated waters after flooding is complete** is the most significant impact in the long term. Problems associated with mine water discharge from abandoned working are of the two types: surface flooding and aquatic contamination. Surface flooding cases are relatively scarce. Water pollution by abandoned mine discharges is one of the most widely documented forms of aquatic pollution. Acidity, metal ions and iron oxyhydroxide precipitates (ochre) from these waters represent significant hazards for surface waters. Most of the literature concentrates on acid mine drainage, with acidity primarily released by the weathering of pyrite in solutions with dissolved oxygen. However, there are also alkaline mine waters with sufficient iron content to be highly contaminated. Pollution of over-lying aquifers by upward migration has been recorded much less frequently (Younger 2002).

In summary, mining can have impacts on both water availability and quality (ERMITE Consortium 2004), and there are three main modes of impact on water quality:

- liberation of sediment
- mobilisation of pre-existing waters of poor quality (usually naturally saline waters)
- weathering of previously stable minerals which release ecotoxic metals and other solutes.

Modern mining has achieved a high degree of control on the release of polluted waters. However, the uncontrolled release of excessive sediment loads is still an occasional problem in certain mining operations. In spite of the inert character of many types of sediment, they have a heavy impact on the biota of the receiving streams, simply due to blocking out light and burying benthic organisms.

1.2.2 Mine waters in environmental policy: Europe and the UK

The focus of attention of this thesis is the regulation of mine waters at European level and its interaction with UK regulations. Chapters 3, 4 and 5 will look in-depth at the mine water regulation in the UK. Chapter 6 will review the coverage of the mining sector in EU environmental policy. However, it is necessary to establish two crucial points at this stage of the dissertation:

First, the study of EU environmental legislation will show that the mining industry has had a favoured status compared to other industries (Hámor 2002). Traditionally there has been a gap in the environmental regulation of the extractive industry at this level. Some Member States do have a comprehensive body of mining environmental legislation, but this is by no means universal within the EU and is even less common amongst new Member States and accession countries (ERMITE D2, Wolkersdorfer 2002). The Aznalcóllar (1998) and Baia Mare (2000) disasters (see Chapter 6) gave clear dramatic examples of this situation. After Baia Mare the Commission established an expert group which provided the guidelines for a round of policy development by Directorate General Environment (CEC 2000c). This is the policy process to which this thesis has contributed.

Second, the United Kingdom which is at the forefront of Europe in mine water management and has some of the best-documented cases of mine water pollution is, accordingly, the most appropriate case study to support European policy development

on this issue (Younger and Robins 2002). Mining was once one of the most important economic activities in Britain. Now metal mining has nearly disappeared and coal mining is reduced to less than 30 opencast mines and only 8 significant underground mines. The regulation of the impact on the water environment from these remaining active mines now follows well-established procedures. The combination of one of the strictest legislations on tip stability (developed after the Aberfan disaster in 1966) and comprehensive water legislation, including coverage of the abandonment of mine voids, has proven to be very robust. The key issues in mine water management in the UK presently centre around dealing with the legacy of abandoned mines. The country is one of the few Member States of the EU with a fully developed remediation programme for abandoned coal mine waters. The success of this programme provides important lessons in a European context, given the widespread closures of coalfields on the horizon in Spain, Germany and Poland, and the recent abandonment of coalfields in France, Belgium and the Netherlands.

1.3 European policy-making and environmental policy

1.3.1 European institutions and processes

European Institutions

In order to ascertain how to harmonise mine water technology and environmental policy at European level, it is necessary to obtain an understanding of general structures and processes involved in the development of environmental policy in the EU.

The Maastricht Treaty (1992) created the European Union with the intention of realising the wider political aspirations of the Member States. Article G of the Maastricht Treaty modified the previous Treaty on the European Economic Community, which was renamed "Treaty establishing the European Community". The European Union encompasses the European Community together with broader mechanisms for policy development in other areas such as judicial, foreign and security policy. The legal basis for environmental legislation is in the European Community Treaty. Only within the European Community may legislation be passed which binds Member States (CEC 1998).

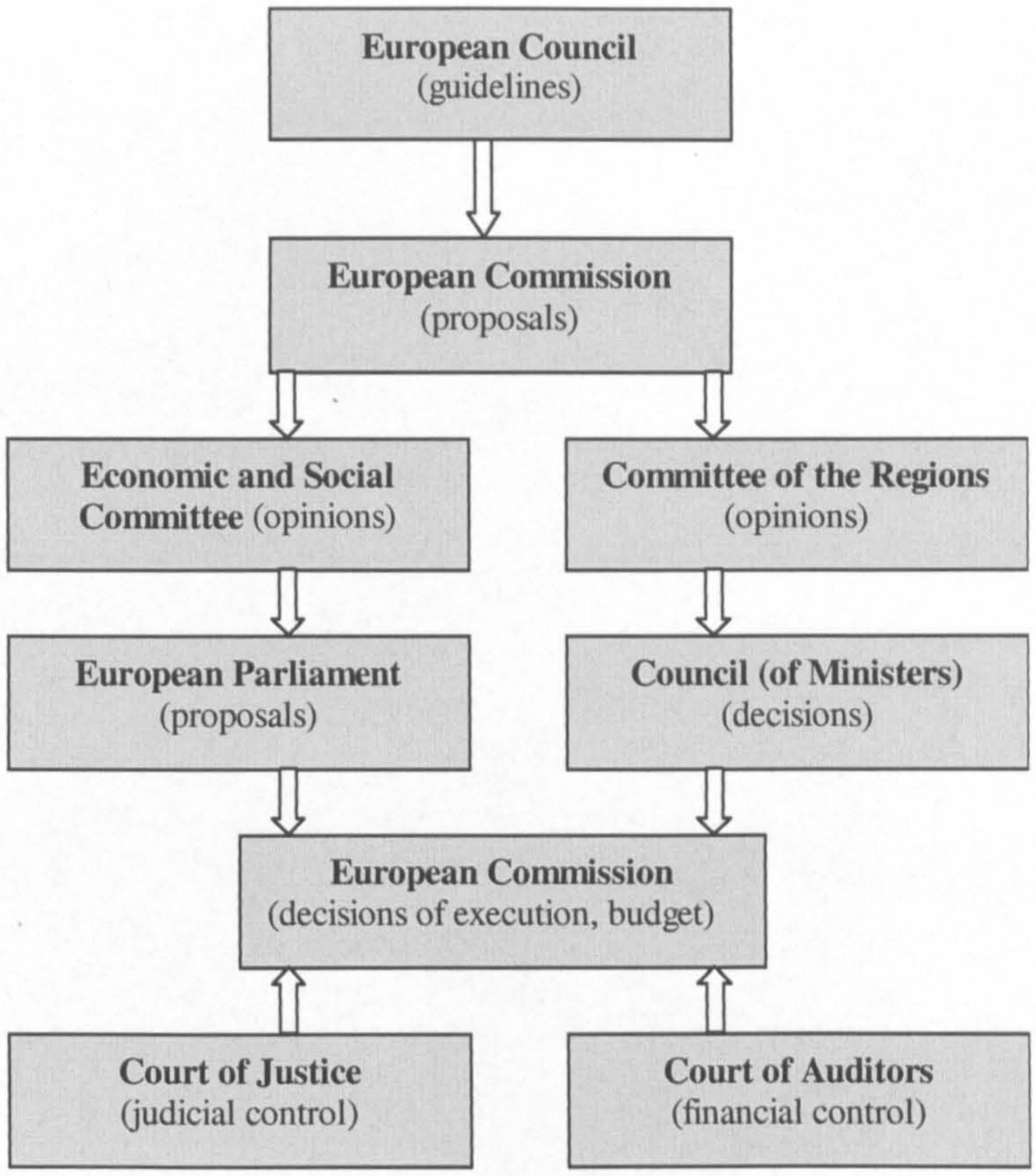

Figure 1-1 The European institutions (Moussis 2002)

The development of European policies results from the combined efforts of the European institutions (the Council of Ministers, the European Parliament and the European Commission) depicted in Figure 1-1 and the Member States. The Community has several unique characteristics, as it has legislative, executive and judicial organs of government and a transfer of competence from the Member States to the Community according to the Treaty. Also, there is supremacy of Community law over national law, which is subject to exclusive review by the Community's Court of Justice.

European Commission

The European Commission has a central role as the originator of all European legislation. Its work is based on the requirements of the Treaty, international obligations and the further development of existing policies. Nugent (2001) provides a thorough introduction to the structure and work of the Commission. The following review is based on Nugent's work and the knowledge acquired by direct interaction with EC officers. The Commission has two distinctive levels: the College and the services. The

College is formed by a number of Commissioners proposed by the President of the Commission. Commissioners have a *cabinet* working directly for them. The Commission is supported by a number of services organised into departments equivalent to the national ministries. Most of the departments are Directorates General (DGs). These are the places where most policy issues are handled. From 9 DGs in the first Commission, the number has grown steadily to more than twenty as the EU acquired.more responsibilities. Table 1-2 shows the structure of the Commission after Romano Prodi's reorganisation at the end of 1999. Most DGs vary in size according to their workloads but the majority have a total permanent staff of between 150 and 500. In many DGs this is supplemented with as many as one-quarter of temporary staff.

Table 1-2 Directorates General of the European Commission (March 2000)

Directorates General after Romano Prodi's reorganisation	
Agriculture	**Financial Control**
Budget	**Fisheries**
Competition	**Health and Consumer Protection**
Development	**Information Society**
Economic and Financial Affairs	**Internal Market**
Education and Culture	**Justice and Home Affairs**
Employment and Social Affairs	**Personnel and Administration**
Energy and Transport	**Regional Policy**
Enlargement	**Research**
Enterprise	**Taxation and Customs Union**
Environment	**Trade**
External Relations	

The dispersion between the Commission services has caused a high degree of compartmentalisation and fragmentation. Stevens (2000) describes three types of inter-service conflicts:

- Territorial conflict for influence over policy areas, with many issues cutting across internal organisational boundaries.

- Ideological conflicts over policy approaches and solutions. The classical example are the disputes between DG Environment and the DGs that are more concerned with promoting business.
- Conflict over resources.

There are several mechanisms within the Commission to promote inter-service coordination. These include:

- The requirement that all services with a potential interest in an initiative or proposal be given the opportunity to make observations before the proposal is referred to the College of Commissioners.
- Inter-service meetings which may be *ad hoc* or be based on standing inter-service committees. (These inter-service meetings played an important role in the development of this thesis, as presented in Chapter 7).

The Figure 1-3 in Section 1.3.2 shows the structure of DG Environment. The key components of a typical DG are:

- DGs are headed by Directors General. They belong to the most senior administrative grade within the Commission (A1). Their responsibilities include the good running of the DG, representation in dealings with other agencies inside and outside the Commission, and communication with the Commissioner.
- DGs are typically divided into 3 to 6 Directorates headed by Directors (normally level A2).
- Directorates are divided into 3 to 6 Units headed by Heads of Unit (usually A3s). They normally contain between 3 and 7 A-grade officials plus administrative staff.

So, the basic organisational entity is the Unit and there is a hierarchical structure in which each level reports upwards to the next level. The officials within the Units undertake a number of tasks such as:

- Preparing policy papers
- Drafting legislative proposals
- Drawing up action and work programmes
- Implementing EU legislation
- Assessing the impacts of EU policies and legislation
- Gathering information and writing reports

Making EU legislation

The responsibility to prepare a legislative proposal belongs to the DGs under whose policy remit the proposal falls. Within the DGs a senior to middle ranking official known as the *desk or policy officer*, normally a Head of Unit or an official with the appropriate expertise, is responsible for the file. This involves preparation of the text and steering it through the long decision-making stages. The work of this policy officer determines a great deal of what will later be approved as legislation.

The flexibility with which the officials, and their line managers, work varies according to the circumstances. This includes the nature and extent of the consultation with external interest and the stage at which the Commissioner's *cabinet* is informed of the procedures. Regarding the content, there is more freedom of manoeuvre when the proposal is for a new policy area. However, there are some compulsory stages that have to be fulfilled:

- Lead DGs consult with other interested DGs: If there is little overlap this will consist solely of the circulation of the file to the other DGs. If there is considerable interest there will be extensive informal contacts between officials and one or more inter-service meeting. (Chapter 7 shows how critical this interface is as a mechanism for influencing policy-making within the Commission).
- Advisory Committees are consulted: There are two main types of these committees chaired and serviced by the Commission, the *expert committees* and the *consultative committees. Expert committees* consist of national officials and experts. They are not normally viewed as official spokesmen, so the committees can work on an informal basis. Some of these committees are set up *ad hoc* to discuss an early draft of a proposal and only meet one or two times. *Consultative committees* comprise representatives of sectoral interests without reference to the national governments. They are convened by the Commission and members are typically full-time employees of associations and special interest groups. Usually, the expert committees are more influential than the consultative committees because they function as sounding boards for Member States positions. The same experts will usually staff the working parties when the proposal is sent to the Council.

- External policy actors are consulted: Those networked with or considered important by the Commission are frequently invited to express their opinion. They may include consultancies and research institutes with contracted reports.

On the basis of this extensive internal and external consultation, the policy officer writes the first drafts of a proposal. Head of Units keep the Directors informed about progress. Director Generals see advance drafts but are unlikely to intervene unless the proposal is controversial. The "board of management" of the DG, usually involving all the Directors, is kept in touch with developments and may become involved at any stage of the process. The moment at which the Commissioner, via the *cabinet*, becomes involved depends on a number of factors. Since the reforms of Romano Prodi, Commissioner and *cabinet* are based in the same building with their DGs. This has improved communications. Once a draft has been approved by the lead Commissioner, it is formally adopted by the College. This whole process may take several years.

The co-decision procedure

After the College adopts a proposal it follows one of the four main legislative procedures of the EU: consultation, cooperation, co-decision or assent. The co-decision procedure of the Council with the European Parliament was created by the Maastricht Treaty. Its application was extended by the Amsterdam Treaty and now covers most of the existent Treaty provisions, including the majority in the field of environmental policy (Krämer 1998).

In the most common pathway of the co-decision procedure, the first reading of the Parliament will produce a number of amendments to the original proposal from the Commission. The Council will then adopt by qualified majority voting (some times it must be by unanimity) a "common position" (Nugent 2001) that may differ from both the text of the Commission and the amendments of the Parliament. The proposal goes back to the Parliament for a second reading. If the Council doesn't agree with the amendments introduced during the second reading of the Parliament, a "conciliation committee" will be formed with equal numbers of representatives from both sides. If they fail to agree a joint text the proposal cannot be adopted. If they agree, the proposal must be approved by qualified majority in the Council and by the majority of cast votes in the Parliament.

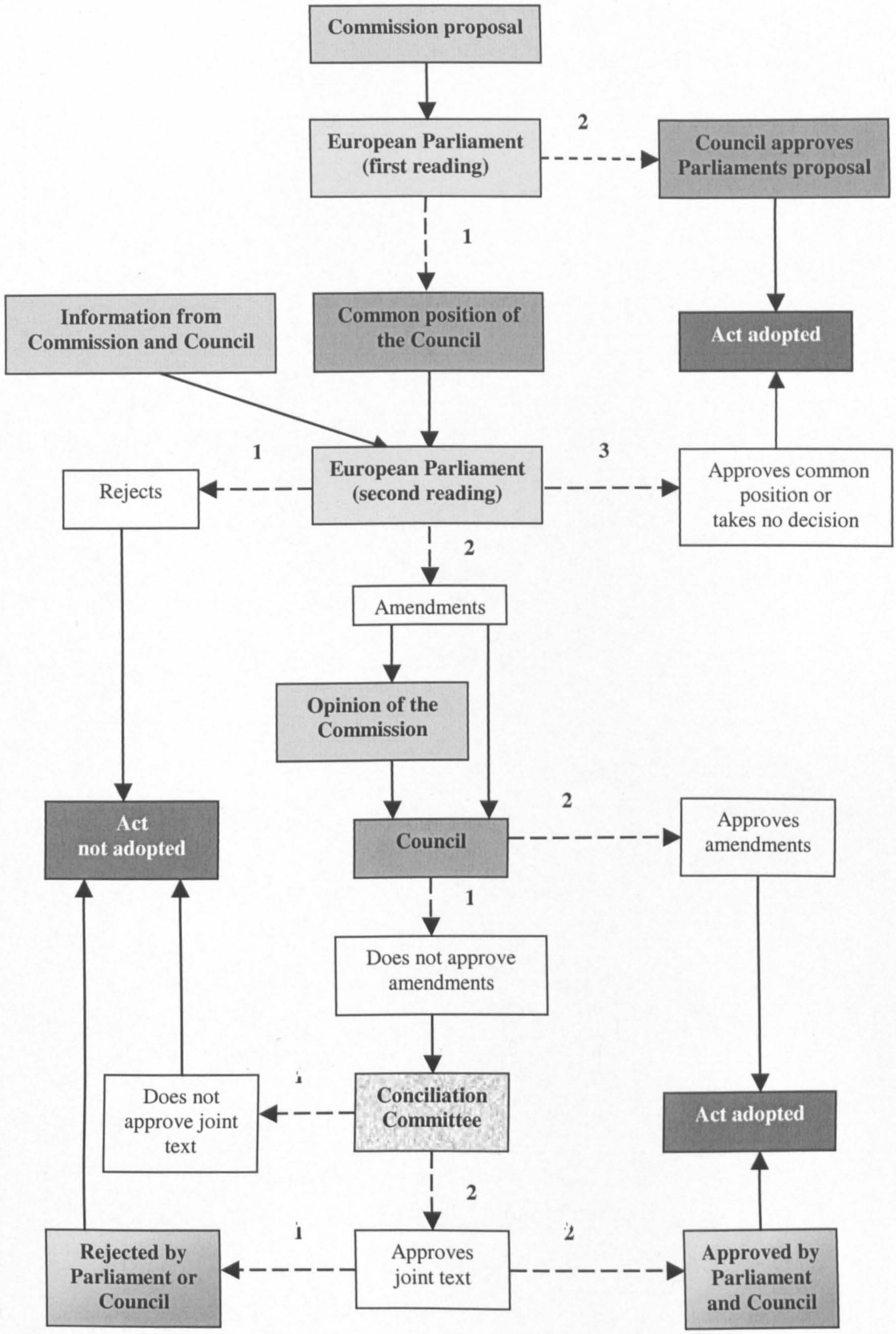

Figure 1-2 Diagram illustrating the co-decision procedure

So, once the text enters this process it has a life of its own out of the control of the Commission. However, the Commission (as the only party present in all the steps of the procedure) is always able to influence the outcome to certain extent. For instance, if the proposal reaches the conciliation step, the Commission will attend all the meetings and often invited to contribute to the discussion and suggest a way forward (Nugent 2001).

The importance of the Parliament has increased with the increasing use of this co-decision procedure. In the Parliament the key actor is the *rapporteur* appointed by the relevant committee (which in the context of this study is the Environmental Committee) to follow the procedures. One role traditionally performed by the Environment Committee has been the promotion of environmentalism within EC policy and institutions (Judge 2002). The other Committees of the Parliament, more influenced by industrial interests, do not always share the ethos of the Environment Committee. However, the trans-party and trans-national consensus which typifies the Environment Committee frequently results in successful amendments that push the Commission proposal towards more 'environmental' positions. Meanwhile the Council usually has the opposite effect. Member States that had argued during the Commission's consultations against particular measures will now use all their power to negotiate with the other Member States a "common position" according to their interests. The final outcome depends on the work of the Conciliation Committee. Member States with a strong interest in a proposal will usually find a way to get their points across. However, the final outcome may change with the particular politics of each legislative process.

1.3.2 European environmental policy

Environment and sustainability in European policy

Concepts such as "environmental protection", "environmental policy", or "sustainable development", which are mainstream today, were not mentioned in the original Treaty of Rome signed in 1957 (Krämer 1998 and Wolf et al. 2002). Article 2 of the Treaty however sets out criteria for the improvement of standards of living in the Member States. On this basis, the first "environmental" European Directive was adopted in 1967 on the classification, packaging and labelling of dangerous substances (Council 1967). In 1970, the European Commission (EC) submitted a memorandum to the Council to draw up a Community Action Programme on the environment. The communication (Commission 1971) gave rise to vigorous debates between Member States and the EC.

In October 1972, following the United Nations Stockholm Conference, the then 9 Member States accepted the proposal of the EC, backed up by the European Parliament, favouring Community provisions for environmental matters (Wolf et al. 2002). Since then, six successive Environmental Action Programmes (EAP) have been adopted. Although these programmes were political declarations of intent, they did not initially constitute a legal basis for Community environment measures (Krämer 1998). The process by which environmental policy gradually became a central competence of the European Union has been called policy development "by stealth" (Weale 2002).

The coming into force of the Single European Act (SEA) in 1987 provided for the first time a legal underpinning for the Community to develop environmental policies (Articles 130r, 130s and 130t under Title VII "Environment"). The creation of the Single European Market was accompanied by Article 130r(2) of the SEA, which specified that "*environmental protection requirements shall be a component of the community's other policies*". Naturally, the Fourth EAP of 1987 gave prominence to environmental integration. It was during the 1990 Intergovernmental Conference (IGC) that the word "sustainable" was first used in a Community context, when it was added to the pre-existing objective of political and monetary union. In 1992, the Maastricht Treaty on the European Union introduced the word "sustainable" (Art B) and amended Article 2 of the Treaty of Rome by replacing the objective of "continuous expansion" with that of "*sustainable and non-inflationary growth respecting the environment*". Article 130r(2) was also amended to strengthen the integration principle, now making it imperative: "*environmental protection requirements must be integrated into the definition and implementation of other Community policies*". Note that since the Maastricht Treaty the EAPs have acquired a new legal status (Article 130s(3)) under the co-decision procedure with the European Parliament. Prepared in parallel with the principal 1992 Rio agreements and sharing the principles of the Agenda 21 strategies, the Fifth EAP (1992-2000) marked an important change of direction for the Community's environmental policy.

The 1997 Amsterdam Treaty introduced a much stronger mandate for the incorporation of sustainability in all fields of EU activity (Art.6 of the Treaty). Each DG now has the duty to examine the sustainability of its policies and DG Environment has reorganised its structure to include wider issues of sustainability and environmental governance. The Helsinki European Council in December 1999 invited the European Commission to

"*prepare a proposal for a long-term strategy dovetailing policies for economically, socially and ecologically sustainable development*" in time for the Gothenburg European Council in June 2001. The resulting document of the Commission includes objectives, measures and timetables for policy review (CEC 2001a). The Sixth EAP (2001-2010) (CEC 2001b) establishes the objectives for the next 10 years of environmental action by the EU. It includes four main priority areas: climate change, nature and biodiversity, health and environment, and natural resources and waste, this last area specifically including the topic of water. The Sixth EAP for the first time introduces policy action in the mining sector to take place at EU level.

Environmental *acquis* and DG Environment

After years of development there is a substantial amount of environmental legislation within the *acquis communautaire*, i.e. the body of directives, regulations and decisions adopted on the basis of the various Treaties which together make up the primary law of the European Union. Currently, it comprises more that 300 legal acts (Wolf et al. 2002). The key pieces of legislation are less than 100 directives and their accompanying regulations. They include horizontal legislation covering general environmental management issues (eg. environmental impact assessment), air quality, waste management, water quality, nature protection, industrial pollution control and risk management, chemicals and genetically modified organisms, noise, nuclear safety and radiation protection (CEC 1998).

The genesis of all the above legislation is the work of the different units of DG Environment. Figure 1-3 depicts the structure of DG Environment in 2002 after the appointment of Catherine Day as DG. As explained in Section 1.3.1, policy officers within a particular Unit develop each piece of legislation. Although there are mechanisms for communication between Units, they essentially work completely independently from each other. Hence the choice of which Unit is in charge of a particular directive will greatly influence the outcome of a policy initiative. The viewpoints, interests and composition of consultation committees will be totally different from one Unit to another. In this particular case, the definition of the policy issue as a waste problem (Unit A.2) fixed the agenda of the process. The Unit dealing with water (Unit B.1) felt completely detached from it.

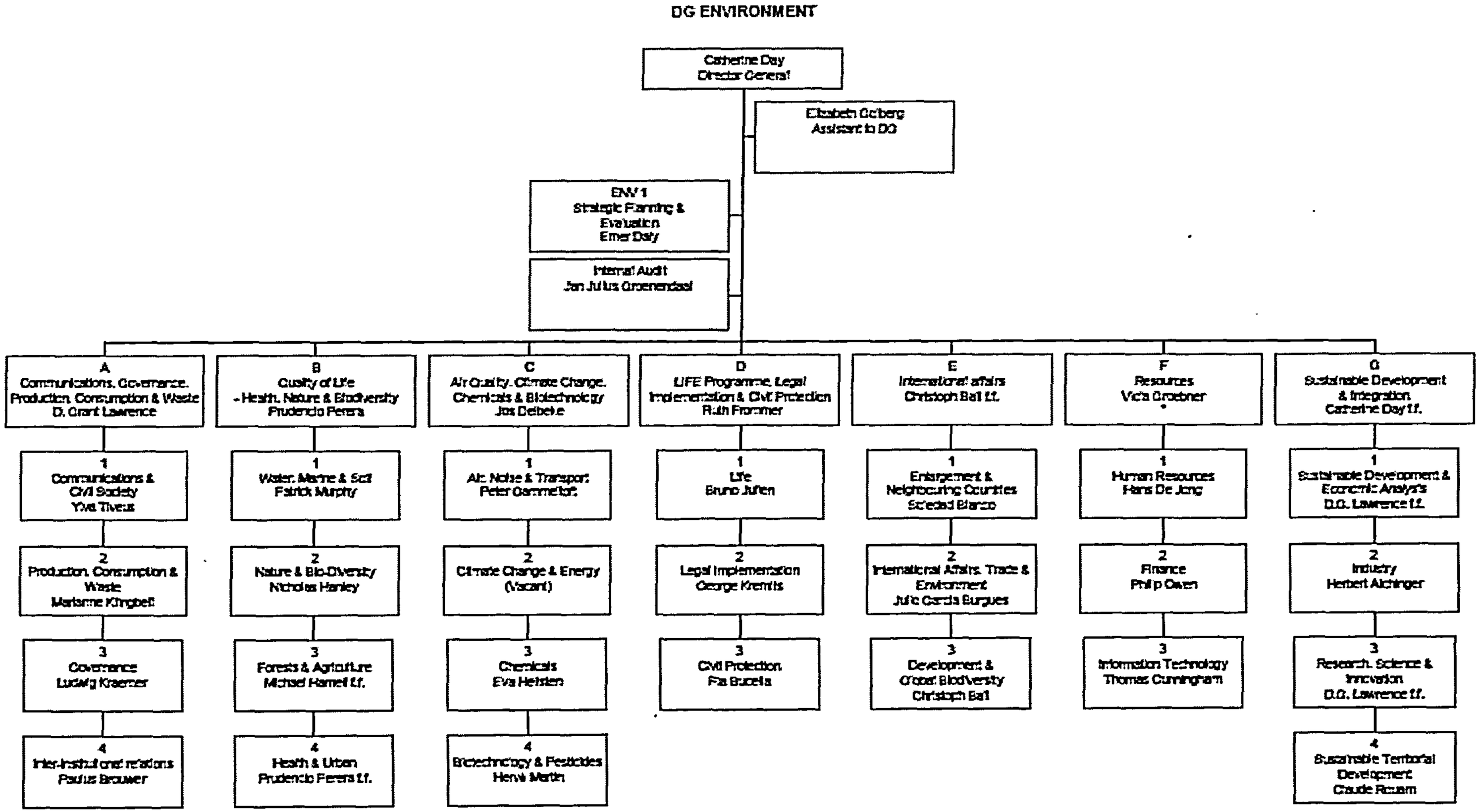

Figure 1-3 Diagram of DG Environment

1.4 Interface RTD/policy

1.4.1 The policy process and institutional analysis

This thesis deals with the very specific policy process involved in the generation of legislation by the European Union, which has been described in detail in the previous sections. This policy process is characterised by intensive interaction amongst European institutions, Member States and large number of external actors. There is a wealth of literature devoted to the policy process in general (Sabatier 1999; Hill 1997; Anderson 2003; Birkland 2001) and to European general (Jordan 2002; Lowe and Ward 1998) and environmental (Keeley and Scoones 1999; Carter 2001; Connelly and Smith 2003) policy processes in particular. It is beyond the purpose of this study to provide a thorough review of all this literature. However, some of the key concepts arising from it which are relevant to this thesis need to be introduced. (The specific body of literature dealing with the interface between research and policy, which is the precise topic of this thesis, is examined in the next Section).

Sabatier (1999) presents reviews of the main theoretical frameworks currently utilized to understand policy processes, written by leading proponents of these theories. These are some of the key frameworks:

- The Stages Heuristic Framework: Until recently the most influential framework, this divides the policy process into a series of stages, usually listed as: *agenda setting, policy formulation and legitimation, implementation and evaluation.* This is the framework presented in most of the standard text books (Anderson 2003).
- Institutional Rational Choice: This is a family of frameworks focusing on how institutional rules alter the behaviour of intendedly rational individuals motivated by self-interest. The Institutional Analysis and Development (IAD) framework, which has been developed by E. Ostrom and colleagues at the Workshop in Political Theory and Policy Analysis at Indiana University, is one of the most popular of these approaches. IAD distinguishes three main tiers of nested decision-making: operational, collective choice and constitutional decisions. It concentrates on the analysis of institutions defined as "*the shared concepts used by humans in repetitive situations organized by rules, norms and strategies*".
- The Multiple-Streams Framework: This views the policy process as being composed of three streams of actors and processes; a problem stream consisting of data about various problems and the proponents of various problem definitions; a policy stream

involving the proponents of solutions to policy problems; and a politics stream consisting of elections and elected officials. The streams normally operate independently of each other, except when a *window of opportunity* permits *policy entrepreneurs* to couple the various streams. The corollary is that to understand and influence policy, one must understand the *agenda-setting* process.

- The Advocacy Coalition Framework: This focuses on the interaction of advocacy coalitions, each consisting of actors from a variety of institutions who share a set of policy beliefs, within a policy subsystem. Policy change is a function of both competition within subsystems and events outside the subsystem. A central claim of this framework is that an understanding of policy change requires a focus on elite belief systems over a long period of time (Carter 2001). Belief systems are organised into a three-level hierarchy: *deep core beliefs* are the broad philosophical values that apply to all policy subsystems; *policy core beliefs* are the fundamental values and strategies applied throughout specific policy subsystems (e.g. the seriousness of the problem and the best policy instrument to deal with it); *secondary aspects* are the narrower beliefs about specific aspects of the problem and policy implementation.

Saleth and Dinar (1999, 2000), working at the International Water Management Institute (IWMI) and the Rural Development Department of the World Bank, have developed concepts and methods for institutional analysis specific to the water sector, and have applied them in a comprehensive evaluation of water institutions and water sector performance. They subsequently proposed a research paradigm for the strategic analysis of water institutions based on two complementary analytical and theoretical components: the "Institutional Decomposition and Analysis" (IDA) framework and the "Institutional Transaction Cost" theory (Saleth and Dinar 2004 and Saleth 2004). The theoretical basis for this paradigm lies in institutional economics and has analytical similarities to the IAD framework. It sees institutions as entities defined by a configuration of legal, policy and organizational rules, conventions and practices that are structurally linked and operationally embedded within a very specific environment. IAD distinguishes the institutional structure (or governance structure) from its institutional environment (or governance framework). While the *institutional environment* is characterized by the overall physical, cultural, historic, socio-economic and political milieu of a country or region, the *institutional structure* is defined by the interactive effects of the legal, policy, and organizational or administrative components

and their constituent aspects. The institutional structure is embedded within the institutional environment and both elements influence each other.

The water institutional structure can be broadly resolved into three interrelated components: water *law*, water *policy* and water *administration*. The formal and informal institutional components can be resolved further to highlight some institutional aspects: Water law could be separated into inter-governmental issues, water rights and accountability provisions; water policy could distinguish between policy principles, project selection criteria, pricing and cost recovery, and user and private sector participations; and in relation to water administration one could highlight organizational structures, roles of different layers of government, financing and management, regulatory mechanisms and conflict resolution arrangements.

The variety of theoretical approaches to the policy process is quite puzzling. However, each of the theoretical frameworks illuminates different perspectives of the question that resonate with the practitioner. Chapter 7 and 9 show how these concepts can be utilised to make sense of a policy intervention. The IDA framework of Saleth and Dinar (2004) is still a model under construction but it provides accessible categories to structure a discussion on institutional frameworks which have been tested at a global level.

1.4.2 Bridging research and policy

The evidence of a poor interface between RTD and policy has led to a recent interest on this topic. This has seen the emergence of several research initiatives specifically exploring how to improve it. Stone (quoted in Crewe and Young 2002) has suggested a number of reasons why research is often ignored in policy-making, which are listed in Table 1-3.

This Section will review some research initiatives that have tried to address the question of how to link research and policy, concentrating on the particular model (Context, Evidence, Links), which has provided the theoretical framework for this thesis.

Table 1-3 Why is research ignored?

- Inadequate supply of, and access to, relevant information
- Researchers' poor comprehension of the policy process and unrealistic recommendations
- Ineffective communication of research
- Ignorance or anti-intellectualism of politicians and bureaucrats
- Inadequate capacity for absorbing research findings among policymakers
- Politicisation of research, using it selectively to legitimise decisions
- Gaps in understanding between researchers, policymakers and the public
- Time lag between dissemination of research and impact on policy
- Research is deemed unimportant, censored or controlled by policymakers
- Some "ways of knowing" are seen as more valid than others

At the start of the 1990s, the Centre for Comparative Studies of River Basin Administration at Delft University of Technology undertook a review of policy, management and research in Integrated Water Management in The Netherlands (Grijns and Wisserhof 1992). Within this work, a PhD thesis called "*Matching Research and Policy in Integrated Water Management*" (Wisserhof 1994) provided an analysis of the RTD efforts in the water sector in The Netherlands and its degree of utilisation for integrated water policy, in particular in policy formulation. The main cases studies were the Second (1985) and Third (1989) National Policy Documents on Water Management. The main conclusion of the study was that interdisciplinary policy analysis can serve as an integrative intermediary between policy research and policy formulation for integrated water management, provided that a networking process among policymakers, policy researchers and policy analysts is maintained. Although the strict applicability of this study is confined to the very well structured Dutch policy process and the requirements of the complexity of integrated water management in a low-lying area, it provides two key concepts:

(i) The need for active interfacing between researchers and policymakers, with the definition of the role of policy analyst, as being specifically in charge of keeping the links between researchers, policymakers, target groups and implementers. As we have seen, the European policy process leaves the burden of the whole process to a reduced team of policy officers in the DGs.

(ii) Policy-making in reality is incremental rather than synoptic. In order to increase the degree of utilisation of policy research, then besides keeping an eye on what policy is made (substantive observation), the analyst should have a (procedural) eye for how policy is made.

From an administrative perspective, the UK has recently experienced an increased interest by Government in the development of evidenced-based policies (Scott 2003). This has been fuelled by the election of the Labour government in 1997 and 2001, which set forth a modernising program on the premise that "*what counts is what works*" (Nutley 2003). Within this context, the National Audit Office (NAO 2003) has recently issued a report examining how government departments commission research, and how well research is being used to improve service delivery and develop policies. The key findings of the report were that, with the support of the Office of Science and Technology, Departments need to:

- Be clear about their strategic research aims, and establish coherent systems for procuring research, including commissioning, quality assurance and use.
- Be proactive and innovative in the way they disseminate and use research findings.
- Identify and share best practice, and thus improve the effectiveness of commissioning, managing and using research.

Another important initiative is the ESRC Evidence Network looking at the use of research in social-policy related activities. Nutley (2003) provides a summary of reflections and lessons on bridging the policy/research divide from the perspective of this network and the existing body of literature on the topic. Critics of the evidence-based policy movement consider it a dual folly to assume that research can provide objective answers to policy questions and that policy-making can become a more rational process. The position maintained by Nutley (2003) is that there is potential for policy decisions to be better informed by available evidence than has usually been the case hitherto.

There are three types of factors that hinder or facilitate the use of research evidence in policy making:

- Issues relating to research
- Issues relating to the policy-making process
- Issues arising from the interactions between these two worlds.

The main limitation of research is that, in general, research-based knowledge is insufficient to inform many areas of policy. The response to this problem in the UK has been three fold: establishing mechanisms for identifying and plugging key gaps in research knowledge; improving research and evaluation methods; and promoting the use of systematic review methods to assist the process of knowledge synthesis and accumulation.

Attempts to improve the inherent messiness of the policy process, so that it might be more receptive to research evidence, tend to focus on introducing more instrumental rationality in the process. This could entail measures to increase the pull for evidence and facilitate better evidence use. These attempts tend to treat utilisation as something which is direct and instrumental, which means that application depends on a decision. However, there are many ways in which research enters the policy-making process and the instrumental (or problem solving) model of utilisation is in fact quite rare. It is most likely to happen where research findings are non-controversial, require only limited change and will be implemented within a supportive environment. One possible response to this limitation is to work with the political grain of the policy process, looking beyond formal government in order to consider *policy networks,* the patterns of formal and informal relationships that shape policy agendas and decision-making. As the Advocacy Coalition Framework (Sabatier and Jenkins-Smith 1999) has identified, *advocacy* is one of the main ways in which research evidence becomes known within policy networks. Another possible response is to "democratise" the policy process by making research evidence available to all the policy actors, for instance with the establishment of *intermediary bodies* to digest existing research evidence, or widening the membership of the policy networks involved in consultations.

Perhaps the principal problem is the limited interaction between the research and policy worlds. They have different priorities, use different languages, operate over different time-scales and are subjected to very different reward systems. The response to this has been two fold: attempts to improve communications between researchers and policymakers, and moves to establish better institutional mechanisms to bridge the research/policy divide. The conclusion of all the literature is that mechanisms should be found to sustain ongoing interactions between researchers and research users, in what has been called *sustained interactivity.* This should span the entire process of research, from the definition of the problem to the application of the findings, with the aim of

fostering better cross-boundary understanding. However, this degree of integrated working over prolonged periods raises serious concerns about the independence and impartiality of research

A variety of approaches have been suggested in the UK to institutionalise sustained interaction within the policy process:

- Use of policy-making guidelines to encourage early involvement of in-house researchers and policymakers.
- Re-arrange working locations to institutionalise the desired interactions between in-house researchers and policymakers.
- Involve civil servants specialised in the substance of the policy domain in policy-making, and not only the generalists.
- Use of secondments to encourage the exchange of staff between government departments and universities.

Finally, a very important conclusion of the UK experience is that *grandiose policy/research bridge strategies seem unlikely to be the best way forward.* Multiple interactions, involving personal contacts, throughout the process would be a better strategy to improve the communications between both worlds. In the cases in which more permanent links are necessary, intermediary bodies able to intelligently co-ordinate interactions between policy and research networks seem to be the best approach.

Another arena where there has been considerable activity to improve the interface between research, technology and development efforts and policy-making is international development. Thus, the Global Development Network (GDN), a network of organisations working on development issues, was established in 1998 with the goals of supporting and linking research and policy institutes whose work is predicated on the belief that ideas matter (http://www.gdnet.org). GDN has initiated projects such as "Bridging Research and Policy" (BRAP), which is gathering experiences on this issue from all around the world. Several national development organisations supporting GDN also run local projects on the same topic. In the UK, the Overseas Development Institute (ODI), which played a major role in the BRAP project, has established with DFID support its own programme of research: Research and Policy in Development (RAPID). Since its first contributions to the GDN project in 1998, RAPID has been building up a

considerable amount of publicly available material (http://www.odi.org.uk/RAPID) covering both theoretical and practical aspects of how to utilize evidence from research in development policy and practice. RAPID has also produced a number of working papers presenting the results of ODI research (e.g. Crewe and Young 2002; Vibe et. al. 2002; Court and Young 2003).

Particularly interesting is the presentation of over 30 theoretical models gathered from a review of the literature, and preliminary and detailed case studies. The first four are cross-cutting general models or frameworks applicable to the research-policy interface, while the others are a collection of concepts from different fields applicable to particular aspects of this interface. The cross-cutting models are:

- **Linear model**: This is based on the Stage Heuristic framework, and assumes a rational and objective policy process. According to this model, researchers need to present their findings in a convincing manner when policy decisions are being made, and if they are convincing enough their findings will be taken into account.
- **Percolation model**: This model was developed by C. Weiss in the 1970s (De Vibe et al. 2002) to explain the influence of social research in policy. Weiss argues that research exerts its influence by introducing new concepts and frameworks of understanding, and incrementally altering the language used in policy circles. Weiss calls this the *enlightenment function* of research. She sees the role of research as clarifying, accelerating and legitimising gradual shifts in opinion, thus indirectly contributing to policy change.
- **Tipping point model**: M. Gladwell (2001) suggests that the best way to understand the emergence of trends is to see them as social epidemics. Ideas and products spread through exposure until they reach a *tipping point* when they become predominant. Small features can make a big difference in this process. In particular, three types of actors seem to have a critical role: *connectors*, i.e. networkers who know who to pass information to; *mavens*, information specialist who acquire information and educate others; and *salesmen*, persuasive individuals who are listened to where others would be ignored.
- **Context, Evidence, Links**: ODI's own model resulted from an analysis of the factors that influence why some of the ideas that circulate in the research/policy networks are picked up and acted on, while others are ignored. The answer is a combination of the *political context*, the *evidence* and how it is communicated, and the *links* with the actors involved.

Crewe and Young (2002) provide an introduction to the Context, Evidence and Links model. The categories of this model are quite similar to those proposed in Nutley et al. (2002) to explain research utilisation for policy-making in the UK. They are broad enough to articulate a discussion on the active interfacing between RTD and policy proposed by this thesis.

The category **Context** is related to politics and institutions. This is the most critical variable in affecting the uptake of research into policy (Court and Cotterrell 2004). Several dimensions of the political context should be taken into account:

- *Macro-political context*: This refers to the political characteristics, including issues of democracy and good governance (accountability, transparency and responsiveness) and their relevance to the interface between research and policy. Democratic contexts imply the existence of more entry points into the policy-making process. Research is more likely to influence policy in contexts with strong academic and civil society institutions, free media and good information systems.
- *Specific context of policy formulation*: This is determined by the nature of the policy process. Here the key question is to ascertain to what extent a given issue is a priority and is on decision-makers' agendas. The degree of demand from policymakers is one of the main factors that distinguish cases of research uptake from those which have little impact on policy. Another important issue is that the degree of political contestation matters greatly. The source of resistance could be, amongst others, special interests, ideological reasons, or the costs of reform.
- *Decisive moments in the policy process*: The decision modes in the policy process provide different contexts for exerting influence. Routine decision-making gives little scope for new ideas. Incremental processes, where policymakers deal selectively with issues as they arise, may involve some new thinking. Meanwhile, fundamental and emergent decisions provide greater scope for research impact as they involve a comprehensive review of associated issues.
- *The way policymakers think*: Policymakers cannot handle simultaneously all the issues facing them; they engage in selective problem definition and agenda setting on the basis of the perceived salience of an issue, which is determined by a combination of preferences and the political context. Some key issues that influence choices taken by individual policymakers include power (position, autonomy, access to policymaking process, room for manoeuvre); interests, both individual (value preference) and organisational (response to lobbying, institutional incentives);

norms, also individual (socially constructed) and organisational (accountability, consensus, dissention); values and belief-systems; and history and path dependence of research-policy linkages of the organisational/institutional structures.

In a practical sense, researchers need to get to know policymakers, their agendas and the constraints they operate under. They need to identify potential supporters and opponents. They have to keep an eye on the horizon and prepare for opportunities in regular policy processes; and they have to look out for, and react to, unexpected policy windows.

The category **Evidence** refers to the relevance and credibility of the research and how it is communicated. This is linked to the ways in which policymakers think and handle information. Some ideas seem to be so widely accepted that they form a *framework of possible thought* (Chomsky quoted in Court and Cotterrell 2004) outside which new ideas are instantly dismissed. The *relevance* of research to policy, not only in terms of substance, but also in its operational use for policymakers, is often critical. The acceptability of research has been linked to the various variables that individuals use to determine *credibility*. In general, the *source of information*, and who conveys it, are probably as important as the content. People accept information more readily from those they trust; and a good reputation enhances credibility. A record of excellence in research would support the legitimacy of the evidence. The quality of the research does not guarantee success but poor quality research is easily dismissed. High consensus in a research community can enhance credibility, but conflicting views can enhance visibility.

Marketing studies have show that *the way the message is communicated* matters. Often there needs to be substantial pressure to challenge the habitual frameworks of thought amongst policymakers. The RAPID programme has identified two key issues: providing solutions as a way to increase interest; and the importance of packaging and targeting messages. Gladwell (2001) uses the term *stickiness factor* to explain why some ideas stick in our minds while others are quickly forgotten. Surprising and simple stories can be very effective, but they can also be manipulated by policymakers to gloss over the complexity of the issues; presenters make a bigger impression if they outline no more than three points; and different presentations stick for different audiences.

So, in order to improve the weight of their evidence, researchers need to establish credibility over the long term and establish legitimacy. They have to provide practical solutions to problems. They have to build a convincing case and present clear policy options; and they have to communicate effectively.

The category **Links** refers to the relationships between researchers and policymakers. When researchers and policymakers forge close personal links, with appropriate chains of legitimacy to those they represent, researchers should have more influence and policymakers could make better use of research. Actor-oriented approaches to policy change have stressed the importance of *policy networks* for the promotion and establishment of particular policy discourses. *Policy communities* include a wide range of actors with access to privileged information inside and outside government who are highly integrated with the policy-making process in specific fields. *Epistemic communities* are networks of experts who share beliefs and engagement with a policy enterprise. *Advocacy coalitions* include a wide range of actors who share beliefs, rather than interests, and work together to lobby key figures. Effective *policy entrepreneurs* will make the most of networks but will also use connections or negotiations skills, be persistent, develop ideas and proposals, and anticipate *policy windows*. Finally, while some form of negotiation through *official networks* is a frequent part of any policy process, other discussions through *shadow networks* may be more influential.

So, in order to improve their links, researchers need to get to know the other stakeholders and establish a presence in existing networks. They have to build coalitions with like-minded stakeholders and new policy networks. Actions that can be taken include forming partnerships between researchers and policymakers; identify key networkers and salesmen; and use informal contacts.

Summarising, ODI's work indicates that RTD efforts are more likely to contribute to evidence-based policy if:

1. It fits with the political and institutional limits and pressures of policymakers, and the topic resonates with their ideological assumptions (or sufficient pressure is exerted to challenge those limits).
2. The evidence is credible and convincing, provides practical solutions to current policy problems, and is packaged to attract policymakers interests.

3. Researchers and policymakers share common networks, trust each other, honestly and openly represent the interests of all stakeholders and communicate effectively.

There are no sources of scholarship on the interface between RTD and policy at the EU level that could be compared to the UK Evidence Network or the GDN BRAP effort. This is in spite of the emphasis given in the last RTD Framework programmes to research underpinning European policies. However, the European Commission does have an intermediary body in the Joint Research Centres that could fulfil an important role in this interface, as this thesis will demonstrate. There are also recent movements within DG Environment to improve the way in which research is utilized to support environmental policy. Chapter 9 will discuss some of the ideas proposed by EC officers in the context of water policy.

1.5 Overview of dissertation

Chapter 1 of this thesis has reviewed the areas of interest covered by its scope:

- the problem of harmonising technology and policy in general and within the EC RTD programmes in particular,
- the environmental impact of mining on the water environment,
- the EU policy development process and EU environmental policy,
- the interface between RTD and policy.

Chapter 2 presents the methodological approach. This thesis has been developed in parallel with the EC project ERMITE which must be introduced first in order to understand the methodological framework. That is the reason why the exact aim and objectives cannot logically be presented until the end of Chapter 2.

Chapter 3 gives an overview of the institutional environment of mine water management in the UK based on the classification of mine water problems presented in Section 1.2.1 and an analysis of its social, technical, economic and political aspects.

Chapter 4 provides an in-depth review of the institutional structures for mine water management in the UK and a discussion of open questions regarding issues, institutions and policies.

Chapter 5 summarizes the findings in the UK with conclusions and policy recommendations.

Chapter 6 presents the context for European policy-making relating to the regulation of mine water. It includes a thorough review of European legislation and analysis of key mine water issues that should be covered by European policy.

Chapter 7 presents and discusses the various interfaces used in this thesis to connect the activities of the European RTD project on the environmental regulation of mine waters with European policy-making.

Chapter 8 presents the conclusions and policy recommendations relating to the EU level.

Chapter 9 provides an analysis of the difficulties and success factors in interfacing between RTD and policy in the light of the experience of this thesis. It also provides recommendations for improvements of this connection in the EU.

Chapter 10 is the conclusion of the thesis, with a final review of aim and objectives and the achievements of the dissertation.

2 METHODOLOGY

2.1 Introduction

As explained in Section 1.1, the idea for this thesis arose from the desire to take on the challenge posed by the EC Fifth Framework Key Action 1 of "*supporting the implementation of various EU polices related to the sustainable management of water resources*", in particular by applying it to an area where it was felt that there was a serious gap in the European environmental policy framework: the *regulation of the impact of mining on the water environment.* With this purpose in mind the author, in collaboration with his supervisor, designed a three-year multidisciplinary project submitted to an open call of the Commission. The RTD project "Environmental Regulation of Mine Waters in the European Union" (**ERMITE**) was subsequently approved and ran from 01.02.01 to 31.01.04. The author acted as principal architect and project manager of the whole project, steering the interaction of the administrative and technical coordination tasks with engagement in the policy process. This thesis is one of several outcomes of the ERMITE project.

In order to clarify how the author innovated in the production of this thesis, the next two sections will first present the structure and rationale of the ERMITE project as a whole and then identify the particular aspects of ERMITE which constitute this thesis. ERMITE has been a real team effort that wouldn't have achieved its aims without a high degree of collaboration amongst its members. So, although the responsibility for the general design and management of the project rests with the author, the implementation and application of particular areas of expertise has been a joint endeavour. This thesis concentrates on the aspects undertaken personally by the author. Elements shared with other team members will be clearly identified.

2.2 The ERMITE project

Goal and objectives of ERMITE

The stated goal of the ERMITE project was *to provide integrated policy guidelines for developing European legislation and practice in relation to water management in the mining sector.* These guidelines needed to be coherent with the catchment management

approach defined by the Water Framework Directive and the sustainability principles enshrined in the current governing Treaty of the European Union.

To this end, ERMITE had the following objectives:

1. Analyse the different environmental, social, technical, economic, institutional and legal issues involved in the regulation of mine waters in several representative case studies.
2. Provide an overview of these issues for the whole of the EU and the enlargement countries in Eastern Europe.
3. Establish a network for stakeholder dialogue and evaluation of institutional arrangements and policies.
4. Assess different technical and managerial options for mine water management in a catchment context, including methods for economic evaluation.
5. Propose avenues for the integration of the European policies which influence mine water management, taking into account the existing ecological and legal principles of EU environmental legislation.
6. Develop a coherent set of policy guidelines for use by the European Commission.

ERMITE workprogramme

The workprogramme of the ERMITE project was organised in six workpackages corresponding to the six forgoing objectives:

WP1. National case studies

WP2. Development of an overview of mine water issues in the EU and Eastern Europe

WP3. Institutional research and development of a stakeholder network

WP4. Derivation of technical guidelines and economic evaluation

WP5. European policy guidelines

WP6. Reporting to the European Commission

Figure 2.1 shows the interconnection of the different workpackages.

WP1 consisted of an in-depth analysis of the conditions in characteristic countries representing different climatic, historical and political situations. The analyses focused on social, technical, economic, political and sustainability issues. There were four case studies of EU-Member States representing North (Sweden), West (UK), South (Spain), and Central Europe (Germany). The German case study also showed the experience of a

recently incorporated territory (Eastern Germany). The other two case studies represented the two types of Eastern European countries where mine waters are an important issue, countries that had at the time already been accepted as candidates for EU membership (represented by Slovenia) and future candidate countries (e.g. Bosnia-Herzegovina).

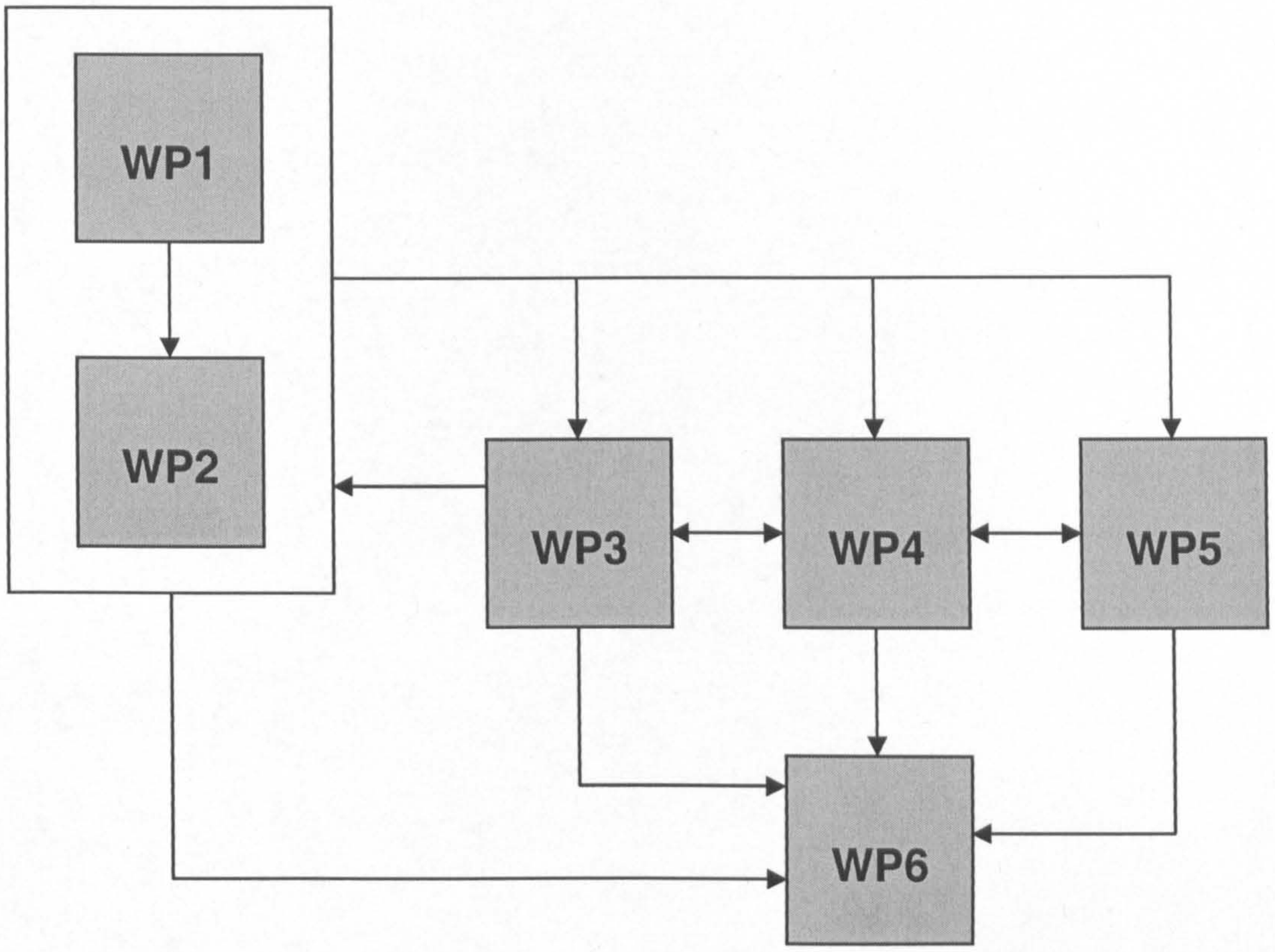

Figure 2-1 ERMITE workprogramme interconnection diagram

In **WP2** the in-depth analysis was complemented by a more concise overview of the key issues affecting the regulation of mine waters throughout the EU and in potential accession states (mainly countries of Eastern Europe). Together, both WPs provided a map of pressures and barriers that a European approach will have to face.

In **WP3** the project involved a network of representative stakeholders at national and European levels. National Stakeholder Groups, which met at least three times during the lifetime of the project, were established in each of the six case study countries. The European Stakeholder Group was mainly formed by EC officers and met two times, at the beginning and the end of the project. Complementing the stakeholder meetings the project sustained an active programme of promotion and dissemination. The stakeholder

network provided an input to most of the WPs and actively represented the different perspectives of the main actors at regional, national and European level. In particular, the National Stakeholder Groups facilitated the analysis of the institutions and policies related to mine water management in the case study countries and provided different perspectives on the impact of European policies. A final report was produced with a global analysis of the findings of WP1, the institutional analysis and the stakeholder networks. The report included recommendations for institutional improvements in each of the countries, together with an analysis of the implications for European policy-making.

WP4 entailed the production of technical and managerial guidelines intended to assist those involved with the implementation of catchment management strategies in understanding and dealing with the peculiarities of the effects of mining on the water environment. The guidelines (ERMITE Consortium 2004) provide an overview of the key issues associated with mining in the catchment management context and specific advice on technical and managerial measures. They are based on existing good practice but also include significant innovations with the catchment management perspective in mind. The coverage includes exploration and working phase, closure and post-closure. Within this workpackage, one of the teams produced a methodology for economic analysis of mine water pollution abatement programmes at catchment level, optimising interventions to ensure cost effectiveness of measures required to comply with the Water Framework Directive (Annex III).

WP5 consisted of a multidisciplinary analysis of the overall EU policy framework and, in particular, the ecological and legal principles of existing EU environmental legislation, again with clear emphasis on the Water Framework Directive. It included a survey of the existing EU policies which influence mine water; an exploration of the legal incentives affecting mine operators, in particular with the review of the concept of environmental liability and its application in and outside Europe in relation to mining activities; and a critical analysis of the ecological concepts used in the European environmental legislation, and their applicability to mine water management activities.

WP6 was specifically devoted to the integration of the findings of the project into an executive report for direct use by the stakeholder departments in the European Commission. This took the form of 9 concise policy briefs for free use by the European

Commission and any other interested parties. Each policy brief addresses a particular policy area within DG Environment.

Consortium and project management

A key element of the ERMITE project was the composition of the Consortium. In order to maximise the potential for linking research with policy a Consortium was formed with the following characteristics:

- Strong links with previous and current mine water research at national, European (e.g. FP 5 PIRAMID) and international levels (e.g. MMSD, Mining Minerals and Sustainable Development)
- Multidisciplinary team: water resources, mining, ecology, law, economy, policy and institutions.
- Interface with the Commission through the JRC-IPTS

The partners of the project and their individual roles were:

UNEW (University of Newcastle upon Tyne) Technical Co-ordination Team and leader of WP1, WP3, WP4 and WP6; UK case study.

UNIOVI (School of Mines, University of Oviedo) Administrative Co-ordinator; Spain case study, expert in WP4 and WP6.

JRC-IPTS (Institute for Prospective Technological Studies, Joint Research Centre, Seville) Interface with EC; leader of WP5 and co-leader of WP6.

NIOO (Netherlands Institute of Ecology) Ecology in WP4, WP5 and WP6.

UNEX (University of Exeter) Environmental liability in WP5 and WP6

KTH/SUAS (Water Resources Engineering, Royal Institute of Technology, Sweden and Natural Resources and Environmental Economics at Swedish University of Agricultural Sciences) Swedish case study; Economy and expert in WP4 and WP6

UF (Technical University and Mining Academy Freiberg) German case study; leader of WP2, expert in WP4 and WP6, interface with International Mine Water Association.

IRGO (Institute for Mining, Technology and Environment, Slovenia) Slovenian case study, expert in WP2 and WP4.

HEI (Hydro-Engineering Institute of the Civil Engineering Faculty, University of Sarajevo) Bosnia-Herzegovina case study, expert in WP2 and WP6.

UNEW kept the overall responsibility for the management of the project and specifically of the technical outputs. The author co-ordinated the workflows amongst all the workpackages and personally led WP1 (National case studies), WP3 (Institutional research and stakeholder networks) and WP6 (Reporting to the Commission). Prof. Paul Younger at UNEW, was the appointed Technical Co-ordinator overseeing all technical aspects related to water resources and mining. Prof. Jorge Loredo of UNIOVI maintained the administrative links with DG Research in close contact with the management unit at UNEW.

A key component of the management of the project was the steering of the Consortium towards policy impact and not merely the production of project deliverables. The collaboration with Ms. Adeline Kroll of IPTS-JRC was a critical factor in the design and implementation of the project in all aspects related to the European Commission. The IPTS-JRC is one of the European Commission's "Joint Research Centres". Its mandate is "*to collect information about technological and scientific developments and their impact in Europe and world–wide, to analyse this impact and transmit it in distilled form to European decision-makers*". As an integral component of the European Commission, IPTS-JRC staff members can interact directly with other EC officers. The management of this interaction was a joint effort of IPTS-JRC and UNEW. The role played by the IPTS-JRC interface is analysed in detail in Chapter 9.

Rationale of ERMITE

The design of ERMITE was a compromise between two requirements:

- the need to be approved by a FP5 independent evaluation committee
- the wish to go beyond the average European project and achieve measurable policy impacts.

In order to fulfil the first requirement, careful attention was given to the rules established by the evaluation process. The first constraint was the need to follow very closely the guidelines of the RTD Priority "Socio-economic aspects of sustainable use of water" within the Theme "Integrated Management and Sustainable Use of Water Resources at Catchment Scale", which itself formed part of Key Action "Sustainable Management and Quality of Water". These guidelines determine very clearly the types of activities and the anticipated deliverables acceptable in a project. As such, ERMITE was structured to produce only deliverables of the expected kind. Secondly, evaluators

only accept realistic goals and objectives. That is precisely why the goal of the project did not go beyond an ambition to "*provide integrated policy guidelines*".

Informally, it was always the aspiration of the ERMITE team to try and transcend the limitations of the guidelines and follow verbatim the more ambitious objective of the Key Action to "*support the implementation of various EU policies related to the sustainable management of water resources*". This is the viewpoint of this dissertation: the "real" ERMITE focused on harmonising the technology of mine water management, understood in the broad sense proposed in Chapter1, within the European environmental policy framework.

The workpackages of ERMITE can be presented with the policy impact logic in mind as belonging to three categories:

A. Compendium of the variety of conditions in Europe for policy development

Determination of the different conditions over the EU and Eastern Europe as a framework for policy development:

- Six national case studies analysing social, technical, economic, political and sustainability conditions of mine water problems (Spain, UK, Sweden, Germany, Slovenia, Bosnia-Herzegovina)
- Overview of all Member States and Eastern Europe
- Six National Stakeholder Groups (regulators, industry, independent experts, NGOs) for the evaluation of institutional arrangements and policies

B. Technical guidelines and economic evaluation methods to summarise available know-how.

- Production of operational guidelines on technical and managerial options for mine water management at catchment level that could be used by policymakers, industry, regulators and NGOs integrating water management and mining perspectives.
- Development of a methodology for economic analysis of mine water abatement programmes at catchment level, fitting the economic analysis of water use to judge the cost effectiveness of interventions required by the WFD.

C. Analysis of mine water issues in the context of current and future EU legislation

- Comprehensive evaluation of the coverage of mine water issues by EU environmental legislation
  - Overview of the co-ordination of different policy initiatives in DG Environment and other DGs.
  - Analysis of mine water regulatory requirements from the point of view of the "good ecological status" concept (WFD/ Habitats Directive)
  - Analysis of links between the proposed Directive on environmental liability and mine water issues.
- European Stakeholder Group of relevant Commission officers for exchange of information
- Final report focused on Commission requirements (Policy briefs)

2.3 Aim and objectives

Taking into account the background information provided about ERMITE, the aim and objectives of this thesis can now be defined as:

Aim

- **Demonstrate how a European RTD project can be used as a platform to influence European environmental policy-making**

Objectives

This aim will be achieved through the realisation of the following objectives:

1. **Analyse best practice in mine water policy and practice by reference to the UK, by involving key UK stakeholders in critical discussions of both UK and European level policies which influence mine water management.**
2. **Analyse the development of European policies in relation to mine water management.**
3. **Develop interfaces between the project ERMITE and ongoing European policy-making initiatives.**
4. **Propose improvements for European policies.**
5. **Reflect on the interface between technology and policy in the context of the EC funded research.**

2.4 Approach

The work presented in this thesis can be divided into three parts:

1. UK

The first part concentrates on the UK as a case study for mine water management. The importance of the UK as a country in the vanguard of mine water management was introduced in Chapter 1. Hence the logic of the Chapters devoted to the UK is to help develop a corpus of knowledge which has potential utility in achieving the goals of the thesis at the European level. The work was designed as a means to that end. Policy impact at the UK level was neither a stated goal of ERMITE nor of this thesis. However, the stakeholder network structure created conditions which brought about a certain level of policy impact within key institutions in the UK, and opened up a dialogue with UK policymakers involved in the discussion of EU policies. The UK impacts are discussed in Chapter 10.

The United Kingdom comprises Great Britain and Northern Ireland. This study does not consider Northern Ireland, principally because:

- it has hosted relatively little mining in comparison with Great Britain, and
- it has a complex, constantly-changing administrative structure as a consequence of the vagaries of the peace process, which makes institutional analysis extremely difficult.

Within Great Britain the devolved administrations of Wales and, particularly, Scotland differ somewhat in practice from governance in England. Most of the study is devoted to England and Wales, with some reference to the situation in Scotland.

The UK case study has three components:

- Chapter 3 presents a general analysis of the situation in the UK
- Chapter 4 provides the findings of the in-depth investigation of the institutional dynamics involved in the management of mine waters in the UK.
- Chapter 5 presents conclusions and recommendations about mine water management in the UK.

The key element of this part of the thesis was the establishment of a UK National Stakeholder Group (UK NSG). The members of the group were selected to include as

many as possible of the key UK administrative bodies involved in mine water management, industry, consultants and representatives of civil society. A list of attendees at the three stakeholder meetings can be found in the Appendix 1. A very important element for the objectives of the project was the presence of the key regulators (the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and the Coal Authority (CA)), and the involvement of the officer of the Office of the Deputy Prime Minister (ODPM), which represents the UK government in the discussions concerning the proposed Directive on mine waste management.

The UK NSG met three times during the project. Informal regular contacts were maintained actively between meetings, in relation to particular aspects of the work. The meetings were organised as focus groups (cf. May 1997: 113; Oppenheim 1992: 79) with a proposed agenda of items for discussion, presentations of the UNEW team and open, free-flow of conversation moderated by the UNEW team to ensure sustained focus on the key issues. The minutes of the meetings were recorded and distributed amongst the participants. The transcripts can be found in ERMITE document D7 (Amezaga and Younger 2004). The feedback from the participants about the organisation of the meetings was always very positive. The involved individuals and organisations were very keen to participate in them. Additionally, key staff of all the organisations belonging to the UK NSG provided their views in a number of semi-structured interviews (see list of interviewees in Appendix 1).

Attendees of the seminar on proposed EU Directive on Mining Waste sponsored by the Geological Society and the Office of the Deputy Prime Minister (ODPM 2002) and to the national conference on mine water treatment organised by the University of Newcastle (Nuttall 2002) provided additional sources of influential opinions on these matters.

2. EU

The second part of the thesis builds upon the UK case study and other elements from the ERMITE project to create a platform to influence EU policy-making and try to improve European policy from the perspective of mine water technology.

Chapter 6 consists of a review of EU environmental policy in relation to mining. First, it gives a summary of the findings of the Project ERMITE on the overview of mine water management in Europe, examining some key conclusions for EU policymaking. Second, it provides an analysis of the environmental regulation of mines within the *acquis communautaire.* Third, it presents the policy process initiated after the Baia Mare disaster. The fourth part concentrates on the main outcome of this process, and the most important development for the political context of this thesis, namely the elaboration of a proposal for a Directive on the management of waste from the extractive industries.

Chapter 7 consists of an analysis of the different interfaces created by the ERMITE project to interact with the policy process. This Chapter follows an action research approach in which the initial hypothesis that a European R&D project could be used to influence policy-making is tested through the implementation and analysis of the impact of the interfaces for interaction with policy. Action research requires involvement in a problem situation and a readiness to use the experience itself as a research object about which lessons can be learned by conscious reflection (Checkland and Scholes 1990). Chapter 1 provided the theoretical framework which will be used to make sense of the situation and the researchers involvement in it. The first part examines the structure and function of the network of National Stakeholder Groups as a whole. The second part explores the interface with the Commission, the role of the JRC-IPTS and the European Stakeholder Meetings. The third part presents the collaboration with the WWF and the interaction through them with the European Parliament. The methodological aspects of these interfaces will be presented in each section.

Chapter 8 presents the conclusions and recommendations for EU policy. The first part presents the policy recommendations of the ERMITE project for European policies on mine water. The second is an update on the outcomes of the policy process initiated after Baia Mare and the conclusions from the ERMITE perspective concentrating on the proposed Directive on mining waste.

3. Critical discussion on harmonisation of technology and policy

Chapter 9 alone constitutes the third part of this thesis: a critical discussion of the ERMITE project as a platform for harmonising technology and policy. The "Evidence,

Context, Links Model" presented in Chapter 1 is used as a theoretical tool for this analysis. Out of the analysis conclusions are drawn for the interface between EC RTD programmes and EC policy and for the project management of projects with a policy orientation.

3 OVERVIEW OF MINE WATER IN GREAT BRITAIN

3.1 Classification of British mine water problems

The classification of mine water problems in Great Britain will follow the scheme by Younger et al. (2002) presented in Chapter 1, which distinguishes six distinct modes of impact:

1. The mining process itself
2. Mineral processing operations
3. The dewatering which is undertaken to make mining possible
4. Seepage of contaminated leachate from waste rock piles and tailings dams.
5. Flooding of workings after extraction has ceased.
6. Discharge of untreated waters after flooding is complete.

The mining process itself has the potential to disrupt aquifers and surface watercourses by subsidence. Relatively few instances of this have been documented in Britain, although Younger et al. (2002) note several examples, such as subsidence hollows damaging agricultural drainage systems so that perennial lakes form. While a nuisance to agriculture, some of these new lakes have actually developed into nature conservation areas. Ground water levels and permeabilities of aquifers overlying mined Coal Measures have been documented as being affected by mining subsidence in:

1. the Magnesian Limestone Aquifer in County Durham (Younger and Adams 1999), and
2. the Sherwood Sandstone Aquifer, where this overlies active workings of the Selby Coalfield, North Yorkshire. In this case, some of the impacts are actually positive (improved well yields due to increased permeability), and many of them are also transitory, with water levels reverting to pre-mining values within a few weeks (Dumpleton 2002).

Mineral processing operations, especially the disposal of tailings, caused major ecological and economic damage in the 18th and 19th Centuries, especially in Cornwall (Pirrie and Camm 1999) and the Pennine orefields (Macklin et al. 1997). Virtually all tailings were simply released in the nearest stream. In some cases (e.g. the Restronguet Creek, SW Cornwall) tailings sedimentation in downstream watercourses was so severe that navigability was lost, damaging the export routes for mine produce. Such problems

prompted the emergence of tailings dam technology to retain sediments arising from mineral processing, so that active mineral processing has rarely given rise to environmental problems in the 20th and 21st Centuries, and never on the scale of former Centuries.

Dewatering is essential to many mining operations. Although it seems intuitively likely that dewatering will have had many demonstrable impacts on the water environment, very few have actually been reported in the UK, and those that have (which relate mainly to surface mining for limestone and aggregates) have often been amenable to reasonably simple mitigation measures (e.g. Wardrop et al. 2001).

Seepage of contaminated leachate from waste rock piles and tailings dams is a problem in many parts of Britain. While many coal mine spoils have been rehabilitated to some degree (so they at least appear green and pleasant) many continue to leak acidic, metals-contaminated waters to surrounding watercourses (see, for instance, Younger 2001). The situation is even worse in old metal mining districts, where far less reclamation of spoil and old tailings dams has been undertaken than in the coalfields. Because of their accessibility to atmospheric oxygen and infiltrating rainfall (which means that sulphide oxidation proceeds vigorously) spoil heaps and abandoned tailings dams tend to produce more aggressive leachates than flooded underground workings. However, they typically account for only 5 - 10% of the total volume of polluted mine drainage waters in the UK, with the bulk coming from the old mine voids themselves (Younger 2001).

Another water-related problem associated with old spoil banks and tailings impoundments (or 'washery fines ponds') is geotechnical stability: if high pore water pressures are left unchecked, slope stability can be compromised, as occurred with the most tragic of consequences in 1966 when a spoil heap at Aberfan, South Wales, failed suddenly, engulfing a school and killing some 160 people (most of them schoolchildren). Since that disaster, regulations governing the construction and after-care of spoil and tailings depositories in the UK have been amongst the strictest in the world, and no further incidents of this nature have occurred.

Flooding of workings after extraction has ceased can in itself give rise to various geotechnical problems, principally relating to land subsidence and mine gas hazards.

The reactivation of void collapse and seismicity, sometimes leading to land subsidence, has been causally linked to the flooding of mine voids in Leicestershire (Smith and Colls 1996) and various locations in South Wales and the East Midlands coalfields (Donnelly 2000). The process of flooding can also temporarily accelerate mine gas emissions as gases are pushed ahead of the rising water table. This process has been documented recently from mines in northeast England (Robinson 2000), where it has even caused fatalities.

Discharge of untreated waters after flooding is complete is the most common, most sustained and most environmentally- and economically-damaging consequence of mine abandonment and, in particular, of the cessation of coalfield dewatering. As presented in Chapter 1, problems associated with mine water discharge from abandoned workings are of two basic types: surface flooding, and aquatic contamination. Surface flooding cases in the UK are relatively scarce, and have been reviewed by Younger (2002). Water pollution by abandoned mine discharges is one of the most widely-documented forms of aquatic pollution (Younger et al. 2002). Although much of the impact is caused by 'acid mine drainage', it is important to realise that many alkaline coal mine water discharges in Britain are still sufficiently rich in iron to be highly contaminating. Indeed, biological studies of pollution incidents in the North East have revealed that the damage caused to benthic invertebrate faunas by alkaline, ferruginous discharges is generally as severe as that caused by acidic mine water discharge (Jarvis and Younger 1997).

A review commissioned by the former National Rivers Authority in the 90s (NRA 1994) provided a first estimation of the extent of this type of pollution. Close to 100 discharges from abandoned coal mines were considered to be affecting some 200 Km of surface waters, most discharges originated from underground workings and were causing considerable concern. More than 70 discharges from abandoned metal mines affecting some 400 Km of river, brooks and streams. A more recent review in the UK, indicates that some 400 Km of watercourse are currently degraded with pollution by iron from abandoned coal mine discharges, with a further 200 Km similarly contaminated by abandoned metal mine discharges (Younger 2000a). Figures 3.1 and 3.2 show the areas potentially affected by abandoned metal mines and abandoned coal mines respectively.

Figure 3-1 Metalliferous mining fields in Great Britain (Source: Colman and Cooper 2000)

Figure 3-2 Coalfields in Great Britain (Source: Coal Authority)

Examples of aquifer pollution by migration of mine water from abandoned coal mines are surprisingly sparse in the UK, probably due to a lack of investigation. One of the few documented examples concerns Mainsforth Colliery in the southwestern area of the Durham Coalfield (Younger 2002), where mine water rebound after cessation of pumping in 1975 led to recovery of ground water levels over the following 8 years, both in the mine workings and in the overlying Magnesian Limestone Aquifer. Contaminated mine water migrated into the Magnesian Limestone (during this period and since) leading to down-gradient migration of a major plume of highly mineralised water in the aquifer, which now threatens water supply wells.

One issue of particular importance in relation to aquatic pollution from abandoned mines in the UK is the longevity (i.e. long-term persistence) of this form of pollution (Younger 1997). British data show that contaminant concentrations are usually highest shortly after the mine completely floods to surface, and then generally improve over a time period (the "first flush") which endures for about four times as long as the time which it took for the mine to flood. Even after the first flush, long-term concentrations of Fe, Mn and SO_4 are often still unacceptably high. Hydrogeochemical modelling typically suggests that these long-term levels of pollution may well endure for hundreds of years, until such time as pollutant-source minerals are finally exhausted. The development of appropriate, sustainable engineering responses to mine water pollution requires that this temporal persistence be taken fully into account when planning remedial works (Younger 2000b).

3.2 Analysis of mine water problems

3.2.1 Social aspects

Social issues

Mine water pollution is a long term problem for mining communities. In times of active and prosperous mining these communities have historically coped with it as an unavoidable and bearable side effect of the source of their livelihood. However, when mines close, mine water remains for a long time as a blight, adding up to the already heavy burden of severely depressed areas (Waddington et al. 1992). The effects upon the community include the visual deterioration of facilities, decrease in property prices, a deterrent to investment and low morale that leads to a perpetuation of misery. There are even hints of direct health effects of polluted water where people have contact with

it (suggested by the coincidence of certain metal-contaminant related diseases such as primary biliary cirrhosis with areas of mine water pollution), though these associations remain to be fully investigated.

In the coalfields of France, Belgium and Germany, successive governments have taken pains to ensure that the closure process is gradual and fully integrated with generation of alternative employment opportunities in the affected areas (Haugland et al. 1998). By contrast, in Britain the speed of closure has been at times brutal. National statistics give some flavour of this: In 1981, there were 161 collieries in England and more than 200,000 people worked in the industry; at the end of the 90s, only 20 mines remained, employing a workforce of around 10,000. At a finer scale of focus, the closure of the Seaham and Easington Collieries (the last working major collieries in County Durham) in 1993 resulted in overnight redundancies for more than 2000 miners in the already-impoverished Easington District. These redundancies took place in an area where successive governments had bought up and held on to land suitable for alternative industries, in order to ensure a workforce would remain available for the mines. After the rapid closure of the mines, central government propaganda unjustly laid the blame for a lack of economic diversification on local government. Besides such mistreatment of elected representatives of mining families, the level of social protection offered to communities was minimal if compared with similar circumstances in continental Europe (Coalfields Task Force 1998; Haugland et al. 1998).

Governmental sensitivity towards the coalfields has changed since the Labour Party came to the power in 1997. Thus, in October 1997 a Coalfield Task Force was created to carry out the first detailed study initiated by Government of the problems facing former coalfield areas. Following the publication of the Task Force Report, the Government gave a detailed response (DETR 1998; DETR 2000a) and started a long term programme of action to assist communities in Britain suffering deprivation brought about by pit closures. An investment package of £354m over three years was announced. The Coalfield Regeneration Trust was set up in September 1999, with over £52m to help and support coalfield community initiatives until March 2002. At the beginning of 2001, an extra £45m were added to secure the Trust up until 2005.

In spite of this dramatic change of attitude, significant problems remain. The legacy of mining falls heavily into the hands of the Local Authorities. They typically have a lot a

mine water liabilities, such as those associated with abandoned spoil heaps, but do not have the freedom to allocate sufficient resources to deal with them properly (ERMITE D7 Amezaga and Younger 2004). The shifting of budgets to Regional Development Agencies has had the undesired consequence of diverting funds to non-coalfield zones within their areas of operation, since the costs associated with transforming former coalfield areas into environmentally-attractive areas for inward investment means that each RDA pound invested results in less visible development in a coalfield area than in a nearby greenfield area.

From the viewpoint of mine water management all these regeneration efforts suffer from a lack of awareness of the role of environmental recovery in the long term viability of coalfield areas. The environment is duly mentioned in the main reports (Coalfields Task Force 1998) but mine water problems are left mainly to the means of the Coal Authority, which initially struggled to find sufficient funds within its overall budget to cope with mine water remediation schemes. Encouragingly, funding for mine water has recently been ring-fenced from other CA activities (Parker 2000). However, the CA cannot spend money remediating spoil heap leachate problems where the heaps in question have passed into the ownership of Local Authorities.

In the action plan of the Coalfields Task Force, the programme of environmental remediation is just one amongst 40 other action points. This is hardly consistent with the acknowledgement that the high degree of dereliction of these areas is one of the most important structural barriers for real regeneration. Furthermore, communities affected by pollution from metal mining have not received any kind of special attention or funding whatsoever.

Main stakeholders

The main stakeholders in mine water pollution in Britain are, by far, the **communities** affected by it. In some cases these communities are organised in groups which take an active stance towards water issues. However, for the most part they have to rely on the representation provided by **Local Authorities**. The **Coalfield Communities Campaign** represents nearly 100 district and county councils across England, Scotland and Wales and it is one of the key organisations supporting regeneration. While, mine waters are not their central concern, they maintain a keen interest in the topic. Their main focus for

action is lobbying the British Government and Parliament, the Scottish and Welsh Offices, the Welsh Assembly and the Scottish Parliament. Some **Members of the Parliament** and **Members of the European Parliament** from these areas have paid attention to mine water issues. There is no elected regional government in England. In areas affected by mine water pollution, the **Government Offices** and the **Regional Development Agencies** may play some role.

At the policy-making level, the responsibility for mining issues and their environmental impact is spread among several ministries. The **Department for the Environment, Food and Rural Affairs (DEFRA)** is in charge of water management, including water quality, and contaminated land. They are directly concerned with mine water pollution and mine waste management. The **Office of the Deputy Prime Minister (ODPM)** (which before the last government reform was a part of the Department of Transport, Local Government and the Regions, DTLR) deals with minerals planning in England, while the **devolved administrations** for Scotland, Wales and Northern Ireland deal with minerals planning in their areas. They prepare mineral planning guidance documents, which include in their scope the mitigation of the environmental effects of mineral extraction (DETR 2000b). The **Department of Trade and Industry (DTI)** is the interface between Government and the metalliferous and industrial minerals mining industries. They are also in charge of energy policy, which determines the fortunes of coal mining.

Involved in policy-making as providers of expertise but, above all, in charge of hands-on management of mine water are the various regulators. The **Environment Agency (EA)** is, amongst others, responsible for the enforcement of pollution control legislation, water resources, waste management and fisheries in England and Wales. The **Scottish Environmental Protection Agency (SEPA)** has analogous functions in Scotland. The **Coal Authority (CA)** manages coal in Great Britain (which is still publicly-owned) on behalf of the state, issuing licences to private operators. The CA has a strict environmental policy to ensure legal compliance. One of its prime functions is to address historic legacies left by past coal mining. These three organisations are arguably the most active stakeholders in mine water management.

The active **mining industry** in Great Britain is a shadow of what it used to be. However, they are still an important voice to be taken into account when addressing

mine water problems. Among the existing companies, the main one is **UK Coal.** With 8,000 employees in 40 locations, it is Europe's largest totally independently-owned coal mining company. **Scottish Coal** is also relatively large, with some 2000 employees, albeit solely engaged in opencast mining at present, the last deep mine, Longannet, closed in 2002, and two proposed new deep mines in the Canonbie Coalfield remain as yet in the early stage of planning. Several of the largest mining companies in the world have headquarters in the country (e.g. Rio Tinto, BHP-Billiton, Anglo-American plc) but are either not involved or little involved in active mining here. The **Mining Association of the United Kingdom (MAUK)** is subscribed by companies with interests in mining and exploration. The **Mineral Industry Research Organisation (MIRO)** is a research and information trade organisation for the minerals industry. They are involved in mine water research. Linked to the mining industry and with a global presence, there are several British **mining consultants** with mine water expertise. The **Institute of Materials, Minerals and Mining (IMMM)** is the professional body representing mining and exploration geologists, engineers and metallurgists in Britain and overseas. They publish quarterly transactions that sometimes include mine water topics.

The **British Geological Survey (BGS)** is the main Government agency in Great Britain undertaking national work in the earth sciences and is the recognised national repository for geoscience data. The BGS carries out specialist functions for Government departments and private companies such as geochemical investigations and environmental geology studies. They produce the BGS Directory of Mines and Quarries and the United Kingdom Minerals Yearbook. Several British **universities** carry out front line research on mine water topics actively supported by the UK Research Councils. There is a high degree of interaction between researchers and regulators. In some cases the universities are directly involved in community-based mine water projects (see http://www.minewater.net).

Other organisations with an occasional role in mine water issues are the **Country Land Owners Association**, the **Forestry Commission, English Nature,** the **Countryside Agency**. The **National Union of Mineworkers** is the principal trade union defending the rights of present and former miners. They are an important stakeholder in areas with mine water problems.

3.2.2 Economic

Role of mining in the national economy

Mining was once one of the most important industrial activities in Britain. However, at the beginning of the 21st Century relatively few active mines remain. The situation in January 2005 can be summarized as follows:

- Only one tiny active metal mine (Florence haematite mine, Cumbria).
- Coal mining is still active;
  - coal mining underground is now restricted to 8 major mines and 10 smaller collieries,
  - opencast coal (around 30 opencast sites in production, and two more site under active development in Scotland, with scope for several dozen more in the future).
- Industrial minerals (ball clay, fluorite, barite, halite, sylvite (potash) etc) are all still mined underground by a total of about 20 operations. Although this sector is small, it is now a significant proportion of the overall mining sector.
- Aggregates; probably the single largest type of mining nowadays, is virtually all surface mining (quarries), mainly for limestone and Quaternary gravel, but also igneous in some areas.

The BGS Mines and Quarries (BRITPITS) database provides a list of all active sites in the country (see Colman T.B. et al. 2003).

Total consumption of coal in 2000 was almost 60 M tonnes (DTI 2001). This was supplied by stock draw (8.5 %), imports (38.5%) and local production (53%). Table 3.1 shows the production from deep and open cast mines in two recent years (April to March).

Total coal production has been declining steadily in the last 20 years: 130 Mt (1980), 93 Mt (1990), 31 Mt (2000). Compare the above with the fact the Durham Coalfield alone, at its peak (1913) produced 55 M tonnes per year of deep-mined coal.

Table 3-1 Output from British coal mines (Million tonnes). Source: Coal Authority

	1999/2000	2000/2001
Deep mines	19.5	17.3
Opencast	15	13.3
Total	34.5	30.6

Only 7% of the total demand for coal in 2000 was for final consumption (e.g. domestic fires). The rest was used by the transformation sector, mainly electricity generators (78.5%) but also coke ovens and blast furnaces (14.5%). Consumption by electricity generators was at the range 80-90 Mt until 1991 when it started to fall steadily due to the increased used of nuclear power and natural gas. This trend was altered in 1998 and 2000 when coal fired generation covered temporary reductions in electricity imported from France and the nuclear industry suffered a large number of outages. At the end of 2000 the rise in gas prices enabled coal to outbid some gas-fired stations. The proportion of electricity supplied from coal in the early 1990s was around 70%, falling to 28% in 1999, but increasing to 31% in 2000. Recent events in the energy sector may bring about a resurgence of coal as a strategic fuel, coupled with the deployment of "clean coal" technologies. In the short term, there is some prospect that the Labour government's recently launched "Coal Operating Aid Scheme" will support an increase in production in future years.

Economic impact of mine water pollution

It is really difficult to assess the total economic impact of mine water pollution. Most of the impact is hidden by the scattered nature of mine water pollution events and the isolation of some of the sources. A complete evaluation should include the more than 600 Km of rivers already affected (Younger 2000a) together with the risks coming from groundwater rebound in abandoned mines and leachates from thousands of spoil heaps.

One indication of the order of values can be given by the cost-benefit analysis of treatment options in particular examples. The principal cost-benefit analysis methodology used in Britain (FWR 1996) recommends evaluating the impacts on eight categories: abstraction, amenity, angling, commercial fisheries, conservation/non-use, informal recreation, pleasure boating and water sports. Most commonly the average

willingness to pay (frequently taken from previous similar studies) is used as a way of evaluating the often problematic non-marketed commodities.

The closure of whole coalfields in the mid 90s and the fact that the British Coal was legally entitled to switch off the pumps used for dewatering upon closure prompted economic studies analysing the consequent environmental costs in the Durham Coalfield (Younger and Harbourne 1995). The overall outcome, using both net present value and equivalent annual cost criteria, demonstrated that the option of continued pumping of 105 Ml/d from nine pump stations with estimated cost of £1M/annum was less expensive than the option of abandoning pumping in all cases. The study included costs from reduced surface flows, the abandonment of existing water treatment works, the pollution of aquifers, geotechnical effects and ecological impacts. The result was achieved even without quantifying the highly important ecological and amenity values, showing how critical mine water pollution can be when it affects the use of water as a resource for supply.

At the River Rhymney (RPA 1998) several mine water discharges affected 7Km with ochre and elevated iron concentrations. The socio-economic evaluation of options considered amenity, angling, conservation/non use and informal recreation. The net present benefit (25 years) of the assessed options strictly dealing with mine water were in the range £0.5-£1M. In this case the analysis only justified intervention if it was linked with other improvements to the quality of the river, by means of ceasing discharges of untreated sewage and programmes of litter picking.

The Gwynfynydd Gold Mine (Hyder 2000) was closed in 1998, leaving a highly acidic discharge with dissolved metals. The identified areas of impact were angling, conservation, formal and informal recreation and tourism. Amenity value was considered negligible because of the scarce population of the area. The total value of expected benefits over 25 years amounted to £2.2 M for a passive treatment option with whole life costs of £785,000.

The abandonment of Wheal Jane tin / zinc mine in 1991 caused an uncontrolled released of acidic metal laden waters into the Carnon River and the Fal Estuary. A major EA-sponsored study of treatment options (Knight Piésold and Partners 1995; Knight Piésold 1998) considered impacts for non-use values, recreation, bathing, water sports, pleasure

boating, port operations, tourism, calcified seaweed industry, commercial fisheries, shellfisheries, recreational fisheries and amenity. It was estimated that over a 10-year period the benefits of action versus no treatment were in all cases in excess of £17M (Younger at al. 2005).

These examples reveal several important facets of the economic impacts of mine water pollution. Firstly, amenity value is linked to the value of houses in the neighbourhood. This implies that recovery of polluted streams which flow through the middle of settlements (a depressingly common occurrence in abandoned coalfields) will have an immediate economic benefit. Secondly, conservation values can be very significant in protected areas or where the mine waters affect protected species. Finally, when mine water is considered as a supply resource the benefits of treatment are very clear.

During the year in which this review was initiated (2001), the main expenditure on mine waters in Britain (apart from water management in active mines), was incurred by the Coal Authority (Younger 2000a). The CA spent in excess of £2.5M per annum on strategic pumping schemes. In 2001, £4M per annum were invested in capital works establishing treatment systems for the backlog of abandoned mines waters. A further £1-2M is spent annually on monitoring and maintenance. The CA works within the scope of an agreed budget from the Government. As there is no organisation in place to deal with the liabilities from metal and other mines abandoned before 2000, the Environment Agency has frequently to assume responsibility for such mines. Because there is no funding stream in place to deal with these issues, they are addressed on a case-by-case basis with financial bids being made to central Government.

3.2.3 Political

The Chapter 4 will provide a thorough review of policy and institutions related to mine water management based on the interactions with the UK stakeholder group. Here we will simply provide an introduction to those UK mine water management policy questions which remain open.

Until recently the key policy issue in the UK had been the existence of a clause in legislation (most recently enshrined in Section 89 (3) of the Water Resources Act 1991) that exempted waters flowing from abandoned mines from the general prohibition of

permitting polluted drainage to enter controlled waters. As presented in Chapter 1 and Section 3.1 abandoned mines are by far the main source of mine water pollution. The passing of the Environmental Protection Act 1995 was used to amend loopholes in earlier legislation, so that mine waters which might emerge from any mine closed after 31-12-1999 would be subject to the same laws as other polluting discharges. However, this has left open the question of who is responsible for the mines abandoned before that date. The other key issue is: you close a mine here, but the pollution emerge elsewhere, from a mine you never owned or worked , which closed long ago!

As a result of the former nationalisation of the coal mining industry, the government has recognised that the country has a responsibility for its historic liabilities linked to this industry. The same cannot be said for the metalliferous mining industry where all abandoned mines were closed in time for their owners to exploit the exemption against prosecution for 'permitting' pollution from abandoned mines, leaving an uneasy association of public bodies to manage the environmental legacy. As there is no organisation in place (such as the Coal Authority) to pick up the liabilities for metal mines, in the worst cases the Environment Agency often has had to assume responsibility for the mine. In the case of Wheal Jane tin mine in Cornwall the EA has become the mine operator and in the case of South Crofty tin mine, also in Cornwall, it monitored the water rebound very carefully, poised to intervene with treatment if necessary (thankfully this proved not to be needed).

There is also a severe problem with several thousand spoil heaps which are not on the contaminated land register but whose discharges are subject to water quality constraints imposed by the regulator. The five main types of ownership a contaminated mine site may have are:

- The mine owner (or surface rights owner where the surface of the site was leased)
- Coal Authority inherited liability
- Regional Development Agency
- Local Authority – handed to them by British Coal
- Entrepreneurs

The Environment Agency has a risk-based policy for controlling discharges from mine water remediation schemes. When there is little environmental risk (e.g. from a reed-bed treatment system) and the discharge for the scheme is back to a previously impacted

stretch of the river then the degree of control can be minimal. Usually this is by a "descriptive" non-quantitative consent. The Agency believes that this proportionate approach to setting consents produces the greatest degree of environmental improvement. There are concerns that pressure from Europe may require the issue of quantitative consents, in line with Dangerous Substances Directive (76/464 EEC), irrespective of the risk the discharges pose to the quality of controlled waters (ERMITE D7 Amezaga and Younger 2004).

3.2.4 Technical

The technical aspects of mine water management in Britain have traditionally been linked to the need to keep mine workings dry for exploitation. Environmental considerations and care of post-closure impacts have only recently attracted the attention of engineers. As a consequence, there are still plenty of technical questions unsolved on mine water management, such as remediation of catchments with multiple sources and the management of large systems of interconnected voids. While it is fair to admit that Britain's technical expertise is still somewhat lacking in the face of the challenges posed by such complex problems, the experience gained over the last decade has meant that this inadequate expertise is nevertheless far in advance of that yet to be found in most other parts of Europe.

The severity of mine water pollution and its multifarious impacts require thorough environmental impact assessment (EIA) methodologies. The most widely applied method in Britain (Davies et al. 1997) was devised by the National Rivers Authority (now the Environment Agency). The method is implemented in two distinct phases. The first one quantifies the impact on the receiving watercourse using six physicochemical categories. The second one focuses on the impact on benthic macroinvertebrates and the fisheries' potential of the stream. This system, which ranks mine waters according to their severity of impact, has been applied in the various coalfields in the country, supporting the prioritisation of the remediation schemes. Ongoing research (Younger and Adams 1999) is developing complementary techniques for predicting future mine water impacts that may arise from proposed mine closures. Future research should address issues such as impact on water abstraction needs of a catchment, protection of amenity value and incorporation of measurement of public opinion and community pressure (Jarvis and Younger 2000).

Studies over the past two decades have generated insights into the nature and time-scales of the changes of water regimes in abandoned mines, providing a basis for rational planning of mine water management during and after mine abandonment (Younger 1997). The key element of the decision logic is an empirical 'performance model', which uses geological information and seam chemistry data to predict the likely trends in pH and concentration of iron and other metals following the initiation of overflow of mine water from flooded underground workings. In the most common scenario, the first emergence of the mine water (the so-called 'first flush') leads eventually to a dynamic equilibrium quality of consistent lower acidity. A second less common possibility is that, when the availability of neutralising materials is limited, the water reverts to acidic in the long term.

Recognition of the first-flush process in flooded deep mines workings has facilitated the development of responses to newly emerged polluting discharges that allow explicitly for likely changes in the raw water quality over time. The general principle is to make provisions for active mine-water treatment during the first flush while nurturing a simple passive treatment system for long-term use after contaminant concentrations have declined. Where high-volume discharges remain acidic (or revert to being acidic) in the long term there may be no realistic alternative to active treatment. Nevertheless, passive treatment is rapidly becoming the technology of choice for the long-term treatment of mine waters in Britain where certain criteria are satisfied. The criteria are:

1. that flows are relatively modest (as a rule of thumb <5000 m^3/day);
2. that the water quality is not too extreme (it may be acidic but if the total acidity exceeds 500 mgl^{-1} as $CaCO_3$, passive treatment is likely to be unpractical);
3. that a site of sufficient area is available.

A recent review of remediation strategies in the United Kingdom (Younger 2000b) examines the application of hydrological interventions, active treatment and passive treatment.

Hydrological interventions

Miners and water resources managers have a common interest in minimising water ingress to workings, spoil heaps and stockpiles. In the last two cases the most common

approach is the use of appropriate covers, which will be temporary in the case of stockpiles, but more permanent for disused spoil heaps. Adequate covers generally include a coarse-grained 'capillary break' layer, overlain by a low-permeability cap with a final veneer of vegetated topsoil. Although long-term integrity of such covers is difficult to guarantee absolutely, there is little doubt that well-engineered covers can contribute greatly to the minimisation of water pollution from abandoned sites. As mentioned above there are several thousand historical mine waste tips that may require this type of treatment.

When the objective of the intervention is to minimise pollution arising from underground workings the strategic diversion of surface waters away from known zones of infiltration to the mine voids is possible in some cases. The best example in Britain was the reduction by about 95% of the recharge of the Dalquharran colliery, Ayrshire, by interception with a gravity drain of clean water entering the workings.

Active treatment

Active treatment denotes the use of conventional wastewater treatment unit process, which typically requires continuing inputs of electrical power and/or chemical reagents in a closely controlled process. It usually demands frequent operator attention.

The classical approach to acidic and/or ferruginous mine drainage is frequently used in Britain. It involves three steps:

1. Oxidation, usually by a simple cascade, but also possible by chemical dosing.
2. Dosing with alkali, usually hydrated lime ($Ca(OH)_2$) or less frequently caustic soda (NaOH).
3. Sedimentation, either in a simple settlement basin, or else (where space is at a premium) in a clarifier or lamellar plate thickener. Sedimentation is often aided by the addition of flocculants and/or coagulants. Current practice favours the recirculation of the sludge in the so called 'high-density sludge' process.

For most purposes this approach will suffice. However, where it is important that the treatment process yield a net reduction in total dissolved solids in the mine water

alternative approaches will probably be necessary. For instance, reverse osmosis has been used in some isolated cases (Wilson and Brown 1997).

Passive treatment

Passive treatment utilizes naturally available energy sources and requires regular but infrequent maintenance to operate successfully for its design life (PIRAMID Consortium 2003).

Figure 3-3 shows the locations of passive mine-water treatment systems in United Kingdom at 31 December, 1999. They included six pilot systems and four sites at which passive treatment forms only part of an overall treatment system that also involved 'active-treatment' unit processes.

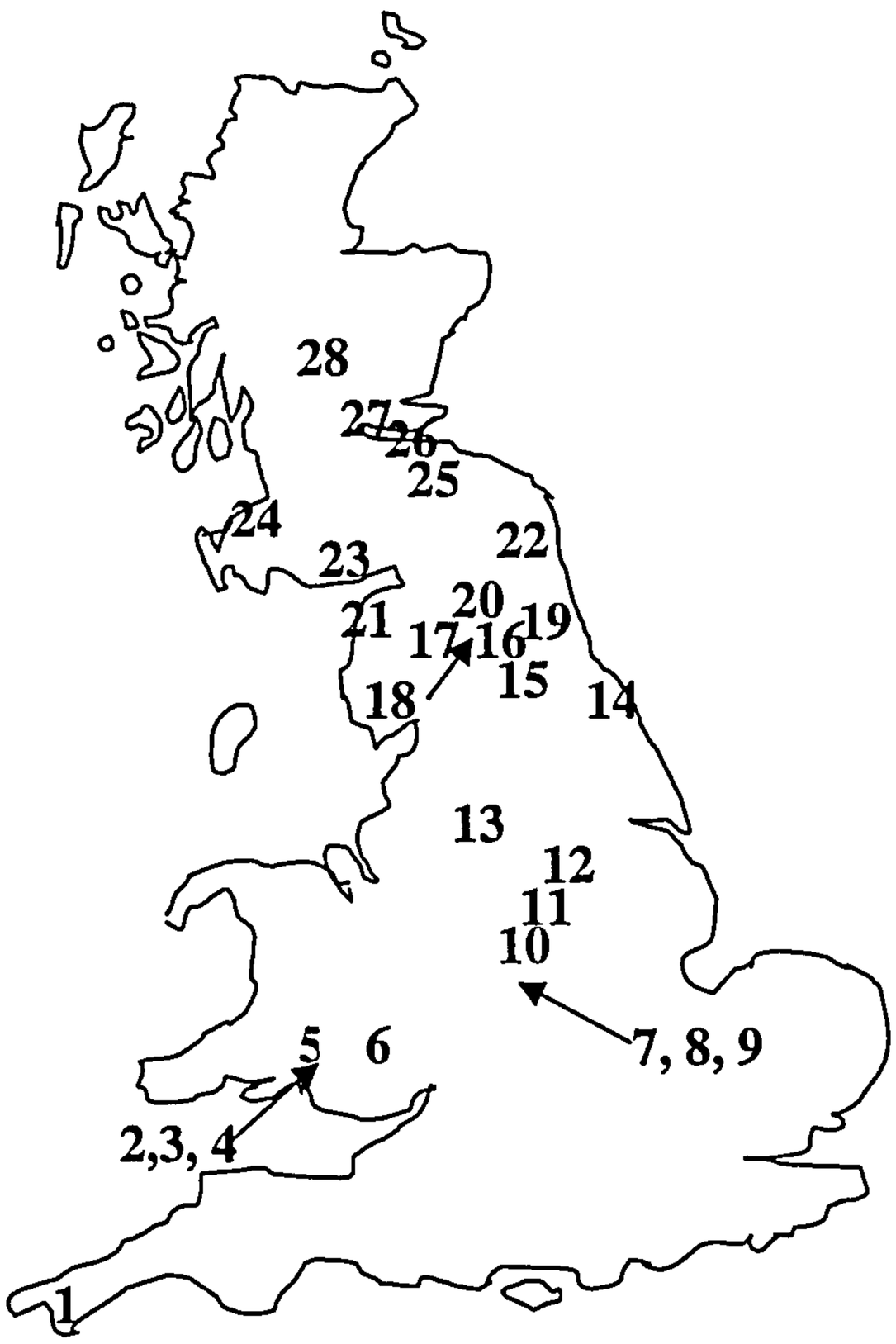

Figure 3-3 Location of passive treatment systems in the United Kingdom (Source: Younger 2000b)

These 28 systems fall into six basic types:

1. Aerobic surface-flow wetlands (reed beds)
2. Anaerobic, compost wetlands with significant surface flows
3. Mixed compost-limestone systems, with predominantly subsurface flow (reducing and alkalinity-producing systems, RAPS)
4. Subsurface reactive barriers to treat acidic, metalliferous groundwaters
5. Closed-system limestone dissolution systems for zinc removal from alkaline waters
6. Roughing filters for aerobic treatment of ferruginous mine waters where there is no room for a surface wetland.

The first three types are widely used internationally and are also the most common ones in Britain (12, 3 and 3 full scale systems respectively). The subsurface barriers were pioneered in Canada and are only now beginning to be introduced in Europe (the first at Renishaw Park, UK; site 10 in Fig. 3-3). The fifth and sixth types are, as far as is known, unique to the UK.

3.3 Conclusions: sustainability and mine water in the UK.

The evaluation of sustainability issues regarding mine water can be placed within the European Union strategy for sustainable development (CEC 2001b). The strategy is built upon three pillars: environmental, economic and social sustainability.

Environmental

There are two key environmental issues arising from mine water pollution. The first one is the impact on aquatic ecosystems. In particular, the effect of toxic metals on micro-organisms, with a knock on effect on whole systems, and the vulnerability of some species of fishes to very low levels of metallic pollution. In the UK at least 600 Km of water courses are affected by mine water pollution (Younger 2001a). The second one is the diminishment of water resources available for supply. This is a critical question in water-stressed regions, which will become ever more vulnerable to loss of resources under likely future climate change. There are already parts of Britain (mainly the most populated areas in the South East) with very tight demand-supply balances. Many catchments in the drier, eastern half of England and Scotland receive mine drainage and

their viability as water resources is potentially vulnerable to long-term increases in, for example, sulphate (which is usually the dominant anion in polluted mine water discharges). Even in the wetter North and West of the country, rebounding waters can write off whole rivers as potential sources of potable water and thus limit the scope for optimal, sustainable development of water supply infrastructure (Younger 2001).

The implementation of the Water Framework Directive (WFD), linking quality and quantity in the context of basin management plans, provides the framework within which these issues should be tackled. The WFD mentions basic and supplementary measures, and specifically refers to diffuse pollution and actions to address it. Under the WFD, and with pressure on water resources from climatic change, it will become increasingly necessary to take action over chronic pollution from abandoned metal mines.

Social

As outlined in Section 3.2.1, mine water pollution is a heavy burden for former mining communities. Any serious strategy for environmental and economic regeneration in the coalfield areas of Britain must address the long term remediation of polluted mine waters. On the other hand, experience in the Durham coalfield has shown that developing local coalitions of interested parties to combat mine water pollution can act as a catalyst for other forms of social regeneration. In the Quaking Houses scheme, what started as a pollution clean-up project ended up engaging major artistic and community development input to the benefit of the entire village and the surrounding area (Kemp and Griffiths 1999).

Economic

Mine water pollution can hinder the economic re-development of former mining areas. It acts as a deterrent on investments of various kinds. Even mining companies hesitate to take on re-mining projects (e.g. opencasting shallow old bord-and-pillar workings, which is often a beneficial activity in the long-term perspective) if this implicates them in assuming responsibility for currently-unassigned liabilities. Mine water pollution can also incur direct costs for local residents when pollution is linked to flooding, as has been the case at Spittal in Northumberland and Jackson Bridge in West Yorkshire, for

instance (Younger 2002). Elevated insurance premiums and property blight can be substantial when mine water flooding leaves behind its orange tide-mark.

Another economic facet of the mine water problematic is the issue of who will provide long-term funding for a problem that will simply not go away. In principle, one can prevent and/or treat mine water pollution but in practice it can rarely be prevented at source. In the case of the more serious mine water discharges, the Coal Authority has a rolling programme of developing and maintaining long-term remediation facilities. However, national priorities may not map well onto local perceptions, leaving many relatively small (but locally important) discharges without hope of early remediation. Furthermore, the Coal Authority's responsibilities derive from the previous public ownership of the coal industry, and it therefore has no responsibilities for the metal mining industry (which was always in private hands). In theory the Environment Agency will take the lead on pollution from metal mines, but in practice it does not have the resources to do so, except in a few well-publicised instances (e.g. Wheal Jane).

4 POLICY AND INSTITUTIONAL ANALYSIS IN GREAT BRITAIN

4.1 Legal and policy framework

4.1.1 Legislation

UK mining law has a long history (e.g. Stanneries Act 1855) which has resulted in a wide-ranging mining legislation, comprising both statute and case law. The earliest recorded case of litigation due to mine water management problems dates from January 26th 1357-58, when the Prior of Tynemouth petitioned the King of England for redress over the disruption by neighbouring miners of his pre-existing mine drainage system in Elswick, Newcastle Upon Tyne (Younger 2004). In the modern era, the Coal Industry Act 1994 and the Coal Mining Subsidence Act 1991 have been the most significant recent enactments. In England and Wales, the basis for the control of mineral development is set out in the Town and Country Planning Act 1990 (as amended by the Planning and Compensation Act 1991 and by the minerals provisions of the Environment Act 1995). An important element of the legislative framework for mining in the UK is the existence of very strict health and safety regulations, in particular, the Mines and Quarries (Tips) Act 1969 (enacted after the Aberfan disaster) and the Quarries Regulations 1999. Equivalent legislation exists for Scotland (see below).

Mine water issues are deeply connected with mineral rights and land ownership. In Great Britain, the rights to non-fuel minerals, with the exception of gold and silver, are mainly in private ownership although a significant proportion is owned by the Crown and by the Government departments and agencies. The rights to coal are vested in the Coal Authority (Coal Industry Act 1994), which issues licences to private operators for underground and opencast operations. Land and mineral rights are not connected. Most land is owned by the occupier or farmer who holds the surface rights. Major tracts are owned by the Crown State Commissioner, the Duchy of Cornwall, the Forestry Commission, water companies and (increasingly) pension funds and other financial institutions.

The legislation governing discharges from active and abandoned mines in England and Wales applies to discharges from all types of mine: coal, metals and industrial minerals. This legislation has been successively updated over the years. The Control of Pollution Act 1974 (COPA 1974) was the forerunner of the current legislation. This was

superseded in England and Wales by the Water Act 1989, which was consolidated into the Water Resources Act 1991. Owners and / or operators of active mines have to treat waters prior to discharge, to the satisfaction of the relevant regulatory agency (at present the Environment Agency (EA) in England and Wales, and the Scottish Environment Protection Agency (SEPA) in Scotland). However, Section 89(3) of the Water Resources Act 1991 (WRA 1991) exempted mine owners from this obligation where they "permitted polluted waters to flow from abandoned mines". It was argued that the exemption to allow 'permitting' of mine water discharges to enter controlled waters protected adjacent landowners against liability for breakouts of mine water on their land through no fault of their own (David Griffiths, *personal communication*). In reality this argument addressed a non-problem: few cases of this type ever existed. The real problem was that others, such as former mine operators, successfully claimed that the exemption applied to them also. Section 60 of the Environment Act 1995 (EA 1995) removed that defence for mines closed after 31.12.99. Section 58 of the EA 1995 also placed an obligation on mine owners to give the Environment Agency 6 months notice of any proposed abandonment of a mine. This obligation was enacted in The Mines (Notice of Abandonment) Regulations 1998, and parallel regulations in Scotland, which require that, for mines abandoned after 31.12.99, the operators must provide the Environment Agency with information on dewatering rates, water quality, mine layout and other factors relevant to mine abandonment assessment, a full six months before abandonment. Clause 55 of the Water Act 2003 has continued this process of regulating abandoned mines by amending the Coal Industry Act 1994 giving the Coal Authority powers to take action to prevent and clean up mine water pollution from coal mines. This power is similar to the Environment Agency's clean-up powers under Section 161 of the WRA 1991.

4.1.2 Evolution of policy framework

The evolution of mine water policy in the UK shows clear signs of dependency on the evolution of other policy strands. The increasing importance of environmental policy has happened to coincide with the ever-decreasing importance of mining as an industrial sector in the UK. Historically, the environment is a recent addition to legislation governing mines and quarries and their attendant waste tips. The first serious attempt to systematically control the environmental consequences of mining was in respect to the ironstone workings in the East Midlands, with the passing of the Mineral Workings Act

1951. The mining sector, and in particular British Coal (formerly named the "National Coal Board") which controlled the nationalized coal industry, was a powerful lobby able to fend off the introduction of environmental controls when began to emerge in mainstream policy in the 1970s. This was a corporate position actively pursued both nationally and in Europe. A clear example was how economic arguments from British Coal delayed the legal duty on mine owners to remediate ferruginous mine waters imposed by COPA 1974 until 1986, just after the 1985 strike. Treatment of abandoned mine discharges still remained out of the question for British Coal after that date. Prior to 1993 there was little that could be done about British Coal's lack of interest in the issue as they were specifically exonerated by the existing legislation. As reported by an expert from the EA "*at that time even the scope and scale of the problem was not clearly understood, which was probably in itself a factor in delaying any progress, as any action may have been perceived as accepting some form of overall liability for the issue*" (Tate 2002).

During the 1970's and 1980's the managers of the Regional Water Authorities (who were the water regulators before 1989) dealt directly with the regional managers of British Coal. The level of cooperation varied from region to region. In Yorkshire (Adrian England, *personal communication*) the relationship with the regulator was not very different from that reported nowadays by the Swedish mining industry (Salmon and Destouni 2001, ERMITE Report D1). The relationship was characterised by regular meetings at managerial level, with frequent liaison amongst operatives in a climate of mutual trust. This was a pragmatic arrangement whereby litigation was avoided. The treatment systems for active mines were planned based on an informal priority list provided by the water authorities. British Coal would avoid causing problems in areas with water treatment plants and pumping stations.

This status quo changed drastically with the run down of the coal industry by the Government in the late 1980's and early 1990's. Coincidentally, the emergence of polluted waters from the abandoned Wheal Jane Tin Mine in November 1991 following the cessation of pumping in March 1991 brought the issue to the attention of the public and forced the engagement of the regulator (then the National Rivers Authority). These events were still fresh in October 1992, when the President of the Board of Trade, Mr Michael Heseltine, announced the UK government's intention to close more than half of the remaining coal mines in Britain. The proposed closures were not spread evenly

around the country. Consequently, for some major mining districts (such as those of Durham, Lancashire, Leicestershire, South Wales, Midlothian and Fife) this closure programme effectively meant that entire coalfields would be finally abandoned. In all cases, British Coal signalled its intention to promptly cease dewatering all such coalfields as soon as the last mine was closed. A political furore followed the initial closure announcement. In this furore, concerns about possible mine water pollution problems after closure were raised (Younger 1993). Eventually the government was forced to make some concessions, which eventually led to the survival of some mines (in Midlothian and South Wales) under new ownership, and to the retention of regional dewatering in the Durham Coalfield on environmental grounds (Younger 1993; Younger and Sherwood 1993; Younger and Harbourne 1995). In many other areas, mines were reprieved in 1992, but were eventually closed on "geological grounds" by the mid-1990s. In the Spring of 1993, a heavily contaminated discharge began to flow into the Neath Canal at Ynysarwed (South Wales), following flooding of Blaenant Colliery, South Wales. Dewatering had ceased little more than a year earlier. In the ensuing furore, it became effectively impossible for further mine closures to take place without a prior environmental appraisal.

The real change in mine water policy came with the privatisation of the coal industry in 1994. The future of the coal industry became an issue of intense political interest and mine waters were part of the debate (CCC 1995). During the parliamentary discussions for the Coal Industry Act 1994, and due to pressure from within and outside the Parliament, the Government acknowledged the potential for mine water pollution. Now that all active mining was going to be in private hands, the political will finally emerged to impose stricter environmental controls for the future. Thus, the loophole in the legislation that exempted mine owners after closure was addressed as described above, albeit this only came into force where mines closed after 1999 (by which time the government had disposed of all its former active mine properties). The Government was unwilling to become statutorily responsible for the legacy of British Coal. However, the same Government, through Lord Strathclyde, declared in the House of Lords that the Coal Authority (CA; the new Non-Departmental Public Body created to regulate the privatised coal industry and deal with legacies of the former nationalized industry, such as gas and subsidence), would "...*go beyond the minimum standards of environmental responsibility which are set up by it's legal duties in these areas and to seek the best environmental results which can be secured from the use of the resources available to it*

for these purposes..." (Parker 2002). It also announced that the resources available to the CA would be limited, but in due course there would be a specific budget earmarked for mine water. This Governmental declaration and the availability of funds provided to the CA by the Department of Trade and Industry are the "official" basis of the CA's successful national mine water remediation programme.

Based on this official position, the Coal Authority have stated repeatedly that their actions to prevent mine water pollution are 'voluntary', since they are not part of the duties which it was given in its vesting legislation. It is important to understand that in relation to the Coal Authority itself, this is of course true. Nevertheless, the UK government as a whole has a clear obligation to prevent the pollution of waters by rising mine waters in abandoned coal mines. This obligation originally came from the European Commission's specific admonishment of the UK government in 1995, in relation to official complaint no. 95/4020, which arose from adjudication on the conduct of previous governmental agencies (British Coal and the National Rivers Authority) in relation to a long-standing mine water pollution and flooding incident at Brusselton Farm, County Durham. This ruling effectively prohibited the UK government from allowing any further deterioration in the quality of controlled waters due to uncontrolled outflows from any mines abandoned after enactment of the EU Dangerous Substances Directive in 1982, irrespective of previous domestic legislation which sought to limit liability for mines closed after 31st December 1999. The power of this ruling was clearly manifest in decision-making by the EA and DETR in relation to the closure of South Crofty mine, for instance, where compliance with the 'no deterioration' criterion had to be demonstrable, albeit the definition of 'no deterioration' required recourse to historical data concerning the status of the local watercourses in 1982. It also forced water policy staff at DEFRA to concentrate (temporarily) their attention on a pollution reduction programme for iron (Tate, *personal communication*). Since the enactment of the EU Water Framework Directive's 'no deterioration' rule (Art. 4), the implications of this 1995 adjudication are now clearer. It is therefore beyond dispute that if the UK Government did not charge the CA with managing this issue, it would have to allocate the task to another (probably less appropriate) governmental agency.

After taking power in 1997 the new Labour government created a Coalfield Task Force which in its report included the environment and, specifically, mine waters (CTF 1998). The open issue of long term financing of the coal legacy was addressed with a

declaration by the Minister of Energy within the Department of Trade and Industry providing for a top-sliced budget for the mine water remediation programme of the Coal Authority. Previously the CA had received a single grant where mine water had to compete with other budgetary items. The role of the Coalfield Communities Campaign as a pressure group fighting to achieve mine water improvements cannot be overestimated, especially with a Labour government in Whitehall, which has strong links to the predominantly Labour-controlled councils in CCC.

4.2 Institutional roles

4.2.1 Institutional map

In England, mine waters are affected by the policies of three different Government departments, each of them influencing an Agency or Authority with a hands-on role on the management of the environmental impact of mining (see Figure 4-1).

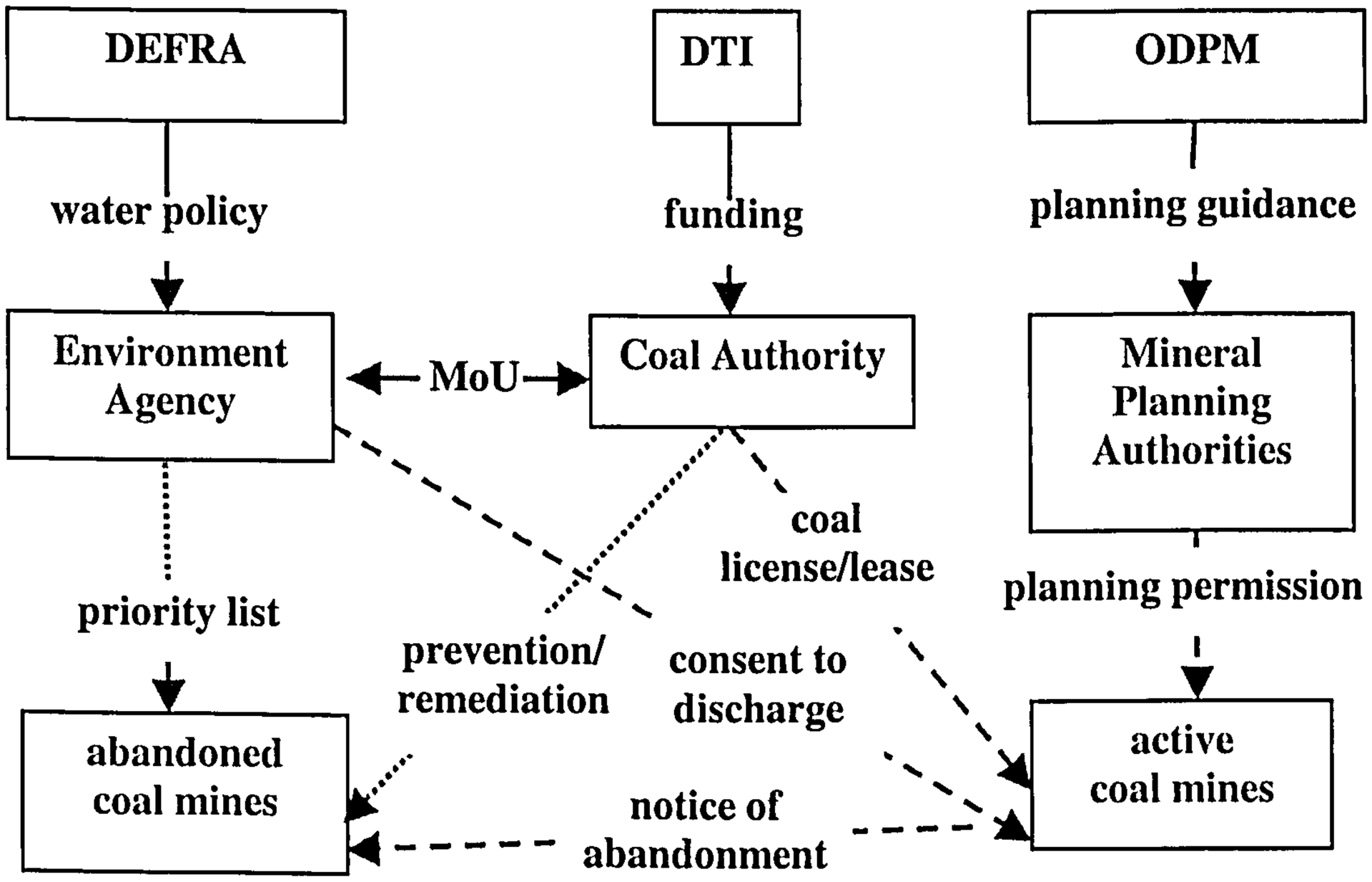

Figure 4-1 Simplified institutional map of mine water management in coal mines in England

The Department for the Environment, Food and Rural Affairs (DEFRA) is ultimately in charge of water (including water quality) and contaminated land policies. The Environment Agency (EA) is the main agency responsible for the enforcement of pollution control legislation, regulation of water resources and licensing of waste management. The EA is responsible for the control of discharges from all types of mines.

The Office of the Deputy Prime Minister (ODPM) deals with minerals planning in England. They prepare mineral planning guidance documents, including the mitigation of the environmental effects of mineral extraction. The Mineral Planning Authorities (MPAs) are responsible for planning control over mineral workings. The MPAs mainly comprise county councils, plus a number of unitary authorities and National Park authorities (see http://www.bgs.ac.uk/mineralsuk/planning/legislation/home.html).

The Department of Trade and Industry (DTI) is the interface between Government and the mining industry. They are also in charge of energy policy, which determines the fortunes of coal mining. The DTI funds the Coal Authority. The Coal Authority (CA) manages coal in Great Britain (which is still publicly-owned) on behalf of the state, issuing licences to private operators. The CA has a strict environmental policy to ensure legal compliance. One of its prime functions is to address historic legacies left by past coal mining. The CA is in charge of the delivery of the programme for prevention and remediation of mine water discharges from abandoned coal mines previously owned by British Coal. (Although as previously mentioned this is not explicitly stated in the functions established in Section 1 of the 1994 Coal Industry Act; however, the new amendments introduced by the Water Act 2003 do acknowledge this function (see Section 4.1.1)).

The devolved administrations for Scotland and Wales deal with water policy and minerals planning in their areas in generally similar manners. In Scotland, SEPA has analogous duties and functions regarding mine water to those of the EA in England and Wales. Unless stated otherwise, in the text which follows, the principal reference is to English conditions, which are broadly applicable to Wales as well.

4.2.2 Control of mine water pollution from abandoned coal mines

There is no statutory duty under UK law to remediate pollution from mines abandoned before 31.12.99. However, as explained in the Section 4.1.2, during privatisation of the coal mines a policy framework evolved which allowed the emergence of a successful national remediation programme addressing the legacy from British Coal inherited by the Coal Authority. Although not originally conceived as such, this now provides the UK government with a means of complying with EU obligations. The origin of the programme was a Memorandum of Understanding (MoU) established in 1993 between the National Rivers Authority and British Coal which set the framework for dealing with the round of pit closures in late 1993. This was followed in 1994 by MoU's between the then RJB Mining Ltd (now UK Coal) and the Coal Authority as the principal parties taking over previous responsibilities of British Coal (i.e. mining and regulating mining respectively). After Lord Strathclyde's political declaration that the CA would take steps to address the mine water legacy within the available means, both the CA and the NRA (which was subsumed into the newly-formed Environment Agency in 1996) started to collaborate on the development of a prevention and remediation programme.

The CA inherited a series of mine water pumping stations previously operated by British Coal to prevent water migration to active mines. British Coal had proposed to switch off the pumps in the Durham Coalfield, predicting that the waters would eventually discharge without problems to the North Sea. After concerns were expressed that these predictions were weakly-founded and self-serving (Younger 1993), the CA took over the operations of the pumps as an environmental protection measure. In the Durham Coalfield the existence of monitoring points and pumping stations allowed the controlled recovery of water levels in areas where this could be achieved without detriment to the surface environment. In other coalfields little monitoring was possible, as most shafts had been filled as part of the closure programme (Parker 2002). In 1995 the NRA initiated a project to quantify the scope and scale of the problem of coal mine water discharges at the national level. Over 300 abandoned mine water discharges in the country were evaluated and ranked, of which the top 50 were selected for remediation schemes. This allowed the real cost and benefits of tackling mine water to be quantified for the first time. The priority list proposed by the Environment Agency and the MoU between the CA and the EA are the basis of the national programme in England and

Wales (Tate 2002). Similar arrangements exist in Scotland between the CA and SEPA. By September 2002 the priority list numbered 108 discharges, of which around 24 schemes have now been completed, with 6 new builds per annum at present (CA 2002). Many other discharges exist but are at present not being considered for treatment under the CA programme, as their impacts are in general modest and highly localised.

The current version of the MoU (CA 2001) is based on the following aims and objectives: i) prevent any significant new pollution of controlled waters from outbreaks of mine water from abandoned coal mines; ii) enhance the environment by reducing pollution of controlled water from existing discharges from abandoned coal mines in the ownership of the Authority; iii) provide a coherent framework to bring together the available resources of the two organisations and develop an action plan to fulfil objectives i) and ii) above; iv) ensure, so far as their power and duties allow, that the operators consider and deal responsibly with potential pollution in respect of closure of licensed coal mines; v) further the understanding of the processes involved in mine water rebound and sustainable prevention and treatment of pollution from mine waters.

The EA carries out a comprehensive chemical and biological water quality monitoring programme, and the CA has a network of facilities to monitor water levels in abandoned coal mines. There is a National Co-ordination Group (NCG) with up to six representatives from each organisation that meets every six months. They advise on issues of prioritisation and formulate the monitoring, prevention and remediation programmes. The CA will consider the technical issues and will normally fund and implement the agreed programmes, within the resources allocated to it, in collaboration and partnership with other organisations where appropriate. The NCG provide a forum for considering research, emerging techniques, forthcoming legislation or other issues that may impact the programme. They also steer the Regional Working Groups formed by the CA and the EA in the North East, North West, Midlands and Welsh regions of the Agency. The RGWs meet formally at least once every six months. They implement the national strategies and identify new significant risks.

The four programmes of action are:

i) **Monitoring**: All coal mine water bodies subject to change are monitored and the need for preventative or remedial action is assessed. The programme has two parts, mine water rebound monitoring (to help decisions on where potential outbreaks will next

occur) and mine water impact assessment (to ensure that the current discharges are properly ranked).

ii) **Preventative:** In sites where the NCG advises there is a need to carry out works to minimise the threat of future pollution.

iii) **Remediation:** The priority list established with a methodology agreed by both parties is updated every October. The Authority will fund and progress works at sites on the list through a programme of scoping and feasibility studies.

iv) **Operational Works:** The CA carries out pumping operations at abandoned sites in its ownership to prevent uncontrolled pollution. Cessation or modification of operations are agreed with the Agency in due time if possible. *Subject to available funding* the Authority will continue to operate it's existing pumping and treatment plants and will operate completed new schemes. The CA will seek to optimise those operations, identify with the Agency more appropriate long term solutions and explore the practicality of transferring any of its operations to more locally-based parties.

The MoU also includes the commitment by the Agency to ensure a consistent approach to the applications for consents covering mine water treatment schemes. The Agency will issue consents to protect the environment, whilst recognising the aims of the wider programmes and not involving the CA in excessive costs by over-zealous prescription of standards. Descriptive consents will be issued wherever possible.

4.2.3 Control of mine water pollution in active mines

Currently, the management of mine waters from active mines follows well-established procedures. New mines have to pass planning requirements, discharges from active mines are controlled by the Environment Agency and, after the introduction of The Mines (Notice of Abandonment) Regulations 1998, there is a clear framework for mine water management during closure. In the case of coal mining, there is the additional requirement of acquiring a lease for the coal and a license for exploitation from the Coal Authority, which has to be satisfied with the condition of the mine during and after working.

The Mineral Planning Authorities (MPAs) have responsibility for planning controls for mineral working. This involves the formulation of policies and plans to guide future developments (development plans) and regulating individual developments through

deciding planning applications and enforcing planning consents (development control). If a planning permission is approved it will be subject to a number of conditions such as measures to mitigate environmental impacts, restoration and aftercare, the date for ending extraction and management of the restored site. The MPAs monitor and enforce these conditions. All modern planning permissions have adequate environmental operating and restorations conditions attached. Recent legislation requires that mineral permissions be periodically reviewed and updated (every 15 years) to ensure the conditions remain up to date. Following the EC Environmental Impact Assessment Directive, all applications for sites over 25 ha must be accompanied by an Environmental Statement. For smaller sites the MPA dictate whether or not a Statement is required.

A series of Mineral Planning Guidance Notes (MPGs) provide the policy framework for mineral planning. MPG1 (MPG1 1996) covers general considerations and the development plan system. Amongst the policy considerations, section 52 on the water environment refers to the existing legislation and the need to protect surface and groundwater. MPG2 (MPG2 1998) gives advice on the handling of planning applications and the imposition of planning conditions. Annex C includes guidance on protection of groundwater, surface water, drainage and pollution control (sections C34-45). It points to the Environment Agency as the competent authority for the water environment and the requirement for consents to discharge groundwater and surface water. The MPAs in consultation with the Environment Agency should impose detailed safeguards for water management when the statutory powers of control do not apply or could not be applied effectively. MPG14 (MPG 14 1995) provides guidance on the review of planning permissions to fulfil the requirements of the Environment Act 1995. Annex M lists a series of conditions that should be used to provide for the protection of surface and groundwater where not controlled under other legislation. MPG 11 (MPG 11 2000) is a guidance note on controlling and mitigating the environmental effects of minerals extraction in England. MPG11 was being updated at the time of this study. Sections 22-24 are devoted to the water environment. Annex 6, to be published in the future, will give detailed advice on the reduction of the effects of workings on the water environment (this is not seen as a priority by ODPM and within the current funding environment there were no resources available to commission this task; Dave Brook, *personal communication*).

MPG2, Annex C section C40 indicates that operators should take appropriate action to avoid pollution when abandoning a mine, as required by the Water Resources Act 1991. Section 91B of the Water Resources Act requires a mine operator to give notice of abandonment of a mine or part of a mine to the Environment Agency at least six months before any proposed abandonment. Regulation 2 and Schedule 1 of The Mines (Notice of Abandonment) Regulations 1998 prescribe the information that must be contained in the notice of proposed abandonment or abandonment under section 91B(1), (4)(b) (notice following an emergency) or (5) (notice given by the official receiver or the accountant in bankruptcy). This information includes the mine layout; volume of water discharged to the surface for two years prior to the date of notice; extent and chemical composition of underground water in the worked areas; projected volume to be discharged to date of abandonment; proposals for the monitoring of groundwater levels and chemical composition to date of abandonment; proposals to treat, lessen or prevent the discharge of water from the mine; operators opinion about the future evolution of water within the mine and the volume likely to be discharged to the surface for a period of two years after abandonment. There are a number of guidance documents available to support the EA staff and the operators on this issue. In the case of the coal mines, the operator must leave the mine in *"satisfactory conditions"* before being able to hand the lease back to the Coal Authority.

A key factor in the success of mine water pollution controls is the strict enforcement of health and safety regulations regarding tip (heaps and ponds in the terminology of European legislation) stability. Walton and Cobb (2002) provide a concise introduction to this legislation, which is critical in the context of the proposed Mining Waste Directive to be discussed in the following chapters. The Mines and Quarries (Tips) Regulations 1971 still apply to tips from underground mines, but the definition of tips associated with quarries and opencast has subsequently been extended by the Quarries Regulations 1999. They include all backfill, mineral stockpiles, temporary or permanent spoil heaps, top and subsoil mounds and environmental or landscaped screening banks. Liquid tips include settlement ponds, lagoons or tailings dams structures to settled suspended solids. All tips, regardless of size and of whether they are in a temporary or permanent location, are considered engineering structures that have to be designed, constructed, operated and maintained according to standards. The legislation identifies and requires special measures for tips where *significant hazards* (i.e. a potential for harm that can affect premises and places where people may be present or if death and

injury would be likely in the event of failure) are apparent. Importantly, larger tips are automatically defined as significant hazards:

Solid tips;

- covering more than 10,000 m^2; or
- more than 15 m high; or
- on ground/foundations sloping more than 1 in 12.

Liquid tips;

- more than 10,000m^3 of contents; or
- contents lying more than 4 m above land within 50 m of the tip.

Both Walton and Cobb (2002) and the report commissioned by ODPM (Colman et al. 2003) on the nature of waste produced by active mineral workings in the UK conclude that this legislation has proven to be very efficient in the elimination of severe failures and in the reduction of minor accidents.

As a final remark, all the interviewees contacted for this research expressed high degrees of satisfaction with the water management practices of the main current mine operators in England and Wales.

4.2.4 Scotland

The devolved administration of Scotland deals with minerals planning and water management in their territory. The Parliament has the power to issue laws, regulations and statutory guidance in environmental issues. The Scottish Environmental Protection Agency (SEPA) is essentially an agent of the Scottish Executive. SEPA supports the executive in the implementation of environmental legislation. Although Scottish law is written specifically for Scotland it is frequently modelled on similar legislation introduced previously or simultaneously to cover the same issues in England and Wales. COPA 74 still applies in Scotland albeit amended by the Environment Act 1995. Figure 4-2 shows a simplified scheme of the management of mine water from coal mine in Scotland.

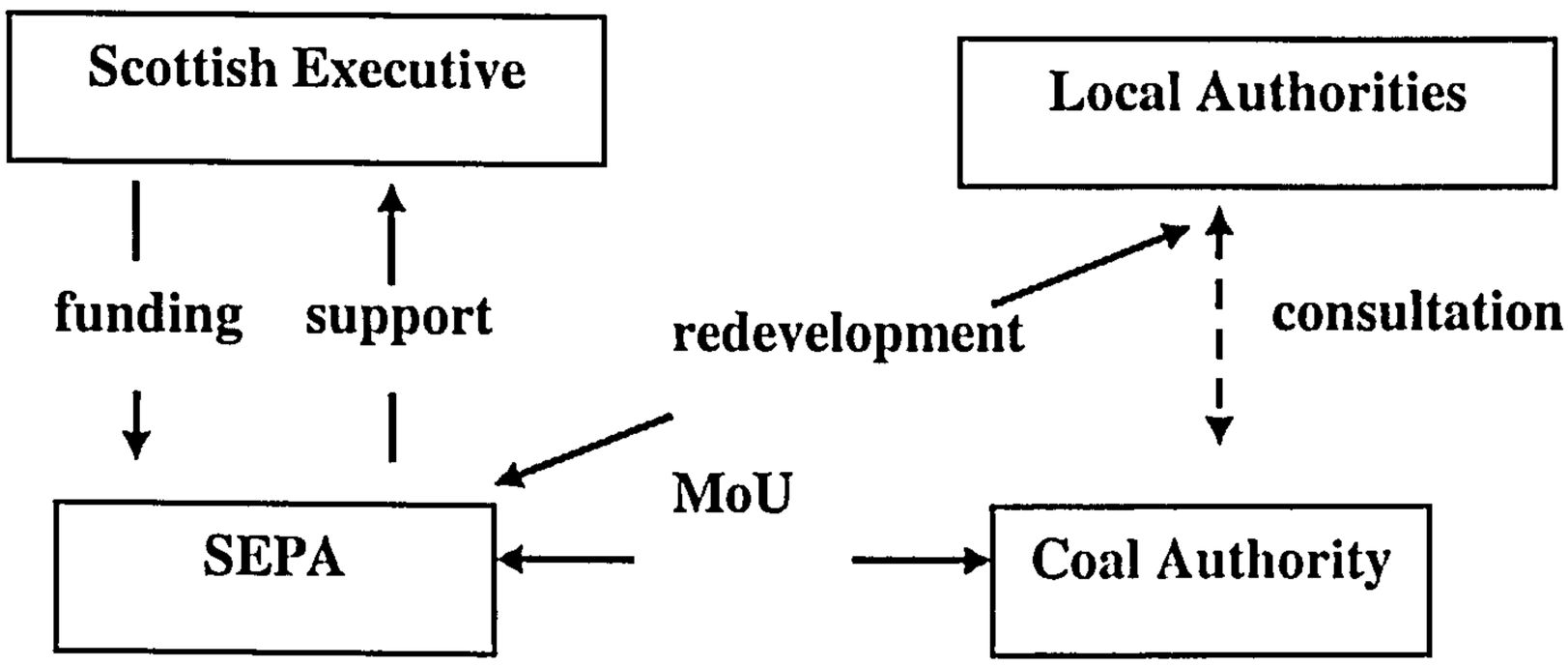

Figure 4-2 Simplified scheme of the institutional relationships for management of mine water from coal mines in Scotland

SEPA and the CA are also linked by a Memorandum of Understanding (MoU) signed in 2001 to prevent and reduce pollution from **abandoned coal mines**, provide a framework to bring together the available institutional resources, encourage existing operators to plan for abandonment and develop understanding. The MoU also seeks to encourage opencast coal operations in locations where environmental problems from previously abandoned mines can be addressed by extraction and restoration techniques.

SEPA is in charge of chemical and biological monitoring to identify polluted waters, evaluate environmental impacts and prioritise known mine discharges and leachate emissions from spoil heaps. The CA will fund and implement a preventative, remediation and operational programme in relation to flooded deep mines.

Operational issues between SEPA and the CA are managed by local teams under the general policy and guidance of a National Working Group. All active coal mining in Scotland (entirely opencast nowadays) is concentrated in the central belt and in limited areas in the south west. Policy issues, such as the impact of new legislation on future strategies, are the responsibility of SEPA's Head Office which is also represented in the SEPA/CA Liaison Group that controls the relationship between SEPA and the CA.

Unlike in England, Scottish Local Authorities retain a statutory duty to promote the recreational use of the water environment, which appears to result in them being more involved in water issues than their counterparts south of the Border. The Local Authorities in coal mining areas also own large areas of "brownfield" sites with spoil heaps (bings) which they are seeking to re-develop within the planning system, avoiding its designation as contaminated land under the Part IIA of the Environmental Protection Act. SEPA has an important role in the discussion of these schemes. The recent example from the Polkemmet mine in West Lothian shows how a particular CA scheme to prevent an outbreak of mine water can be discussed within the framework of a major redevelopment scheme with consultations involving SEPA, the CA and the local authority.

Pollution from metal mines is not perceived to be an important issue in Scotland, albeit significant concentrations of contaminant metals are associated with such mines in the Leadhills / Wanlockhead area of the Southern Uplands, and the Tyndrum and Strontian sites in the Highlands. Currently there is only one small private gold mine, mothballed at present. More important by far, and second only to coal mine waters in prominence, are discharges from **abandoned fire clay mines and quarries**. Clay overlays the coal strata, and they were frequently exploited together. Many spoil heaps with mine water problems originated with these exploitations. There is also pollution from the barite mine at Foss, near Aberfeldy, partly controlled by active treatment of a rudimentary nature.

The control of mine water from new **active mines** is part of the planning control process enforced by the Town and Country Planning (Scotland) Act 1999. The company has to apply for a planning permission to the local authority. This usually involves an EIA or an Environmental Statement in the case of small projects. The Local Authority consults with the planning units of SEPA, which then refer to the officers in the corresponding Area Office. SEPA expects to see a Drainage Strategy covering the impact on the water environment, plans for the operational phase and for the closure phase. Historically not much attention was paid to the post-closure arrangements (Younger 2001). Following a number of salutary negative experiences, SEPA now expects closure management strategies to be fully covered in the Environmental Assessment. If the mine receives planning permission the operator has to apply to SEPA for consent to discharge before commencing extraction. The control of water discharges is ruled by the Control of

Pollution Act 1974 as amended by the Environment Act 1995. The controls affect both ground water and surface water. The Directive on Groundwater (80/68/EEC) was fully transposed into Scottish law by the introduction of the Groundwater Regulations 1998. SEPA has published guidance on the evaluation of the potential impact of opencast coal mining on water quality (Younger and Sapsford 2004). The Mines (Notice of Abandonment) Regulations 1998 will be applied when closure finally comes around, although in Scotland these only apply to underground mines (Dave Holloway SEPA, *personal communication*)

In general SEPA is satisfied with the level of care shown by the industry, namely Scottish Coal and several other small private operators. The role of the consultants is very important, particularly in the application for consents. SEPA maintains an open discussion with the consultants.

4.3 New European legislation interaction and impacts

4.3.1 Proposed Directive on Mining Waste

The UK has been actively involved in the consultation process for the proposed Directive on mining waste. The issue is being tracked by the Minerals and Waste Planning Division of the Office of the Deputy Prime Minister, which is also in charge of the preparation of domestic legislation and guidance on all aspects of planning for mineral working and waste management. It should be noted that this is dealt with as a waste policy issue, not a water management issue. DEFRA is, according to the ODPM officers interviewed for this study, involved within the normal procedures of interdepartmental consultation. However, in spite of having established direct communication with the Minerals Division of ODPM, it is certainly difficult to ascertain the decision-making process involved in the development of the official UK position. The EA policy unit is following the evolution of the directive but seems to have had no influence (and to a certain extent, apparently no high-level corporate interest) in the policy process. So far the Water Unit of DEFRA appears not to have played an important role in the process, and the Waste Unit has handled DEFRA's input.

The ODPM person in the *Expert Committee* (see 'Making EU legislation' in Section 1.3.1) in the consultations organised by DG Environment during the drafting of the

proposed directive was a member of the ERMITE UK NSG. Later the same person was seconded to DG Enterprise in Brussels to work on the minerals industry. As such he also participated in the Second ERMITE European Workshop (see Chapter 7). During the discussions it became clear that the existence and importance of The Mines (Notice of Abandonment) Regulations 1998 was not taken into account at all in the then "unofficial" UK position. It is clear from the analysis of the written replies sent by ODPM to the consultations organised by DG Environment for the successive drafts of the directive that the UK's constructive criticism has influenced (and improved) the outcome of the process. As a consequence, the UK government seems to be confident that the main elements of the current proposal for a Directive are already covered by existing domestic legislation. Accordingly, it will probably support the development of a Directive subject to adequate negotiation. The impact of the unexpected European Court of Justice (ECJ) Avesta Polarit ruling (see Chapter 6), establishing that extractive industry waste could be excluded from the Waste Framework Directive where there is already national legislation in force, could yet affect the final UK position.

The ODPM has commissioned a series of studies (e.g. GHK 2003 and Colman et al. 2003) and meetings (e.g. ODPM 2002 where ERMITE positions where presented) to help establish the UK negotiating position. The Consultation document of 17 October 2003 (ODPM 2003) gave a clear indication of the UK negotiating intentions. The UK ERMITE response to the consultation can be found in the Appendix 3. The main critical points are presented in Chapter 5. Our group has received no reaction on the comments and there has been no official change in the UK position.

4.3.2 Water Framework Directive

The WFD has been transposed into national law at the end of 2003. The Government's approach appears to be to do the minimum necessary to comply with the Directive (ENDS 2002c). On the one hand the Government wants to avoid "gold plating" the Directive. On the other hand, the final content of the WFD came to be very influenced by British thinking and is, on paper, very similar to the pre-existing UK water management instruments. The EA is the competent authority for implementation of the Directive. There are 11 river basin districts for which the planning activities will be carried out. The Directive has been implemented by secondary legislation (regulations), using powers in the European Communities Act 1972 or other more specific powers in

other primary legislation such as the Environment Act 1995. This means that a number of new regulations will be needed to fine tune existing water legislation, but a few will have to go further to grant new powers to the Environment Agency.

Some of the new powers in discussion may have an effect on the management of mine waters. The Agency has always considered the control of mine waters as part of its Diffuse Pollution Policy. Existing controls on diffuse pollution are inadequate to comply with the Directive. New powers will enable obligations to be placed on land owners or others undertaking activities that may give rise to diffuse pollution. The main focus here is diffuse pollution from agricultural activities and urban areas. However, they may also have an impact in the control of particular metals in the environment. The Directive also imposes a prohibition on direct discharges of "pollutants" into groundwater. There will be a need to define "pollutants" and/or amend the list covered by the existing 1998 regulations. It will also be necessary to implement the classification of waters, set objectives and impose duties for the purpose of achieving good water status, as required by the Directive, which goes further than the Water Resources Act 1991. This may have an impact on mine water remediation policy. Moreover, as explained in Section 4.1.2, the Art.1 of the WFD has clearly confirmed the duty of the UK government to reduce and prevent water pollution from abandoned mines. However, the UK government doesn't appreciate that the new Directive in Mining Waste is the best opportunity to create a rational framework for remediation at European level establishing national programmes able to target the use of resources.

The views gathered in the interviews pointed towards important changes in the management of groundwater and the prevention of pollution of aquifers from mine water. There could also be a need to review the management of water from abandoned metal mines and spoil heaps. It is not clear whether the implementation of the WFD will affect the current remediation programme of the Coal Authority. The Government is keeping a tight control on the review of the cost-effectiveness of options to achieve the Directive's environmental objectives. The view from the CA is that any expansion of the programme will have to prove its cost-effectiveness.

Scotland is leading the way in the UK in the transposition of the WFD. The Water Environment and Water Services (Scotland) Bill was on its way through the Scottish Parliament before analogous legislation in England. Scotland is following a more proactive approach in the implementation of the Directive. One particular area that may

have an impact on mine water management is the control of discharges. The plan is to allow SEPA to choose three options (water use licences, standard "general binding rules" or simple registration) giving it more flexibility in deploying resources in relation to risks from particular discharges. The views gathered in one-to-one interviews were that the WFD will not bring a change of approach, but the rate at which remediation schemes for mine waters are introduced will have to increase in order to meet the new standards. This will affect water from deep mines and bings (spoil heaps). A potential problem relates to the multiple small sources of seepage of ferruginous mine water associated with historic mining in shallow strata, which are difficult to intercept but can cumulatively cause major damage to watercourses.

4.4 Discussion: issues, institutions and policies

4.4.1 Issues

Closure of coal mines and large coalfields

The country was not prepared for the scale of coal mine closure programme in the 1980s and 1990s. Much has been learned since then but it is far from being a resolved question. When the CA inherited the mines, closure procedures had not taken into account the long term environmental management of the sites. There were a lot of uncertainties about water levels and the future evolution of the systems, yet very few monitoring data were available. After 1998, a base line review of every coal field in the UK provided the basis for the current risk based approach. One important lesson is that one should think very carefully before closing a shaft. It is essential to make early consideration of the potential longer term full closure plans in designing underground roadways and shaft sealing strategies.

The monitoring programmes are still in their infancy, and are still changing as new information becomes available. Despite an early draft plan being prepared in 1999, the ability to prioritise mine water rebound issues to develop a rational prevention programme is still not in place. Specific solutions will require considerable expertise in order to get a ranking system that is robust enough to target actions but does not demand disproportionate maintenance cost (Tate 2002).

The views of some interviewees are that mine closure planning must include considerations of water, subsidence and gas issues within an integrated framework. The

possibility for gas extraction has to be contemplated at the early stages of planning for closure. The need to keep gas drainage pathways open implies a need to rethink the process regarding selection of optimum pumping water level for mine water control purposes, and the approach to sealing of shafts. In the UK, the DTI has commissioned several studies to establish the UK capability for coal methane extraction and utilisation. The company Alkane initially created six energy parks based on mine gas in the East Midlands and West Yorkshire. At the time of this research it had a portfolio of 28 licenses covering abandoned and operating mines across the UK (ENDS 2002b). However, more recently the company has closed its operations in the UK as they were not financially viable, due to central government refusal to offer a 'green' tariff to energy produced from this source.

It is still too early to judge the overall efficacy of the 1998 mine abandonment regulations. However, some indications of problems are beginning to appear. The long term liability of mine owners comes into question when the company disappears. This is particularly onerous for small operators, as in the recent closure of Blenkinsopp Collieries (Wrytree and Castle Drift Mines) in August 2002 due to the failure to secure coal operating aid. This is a case where the aid could have been justified on environmental grounds, but no such provision was made. Despite the best intentions of the owners of Blenkinsopp Collieries, the legal responsibility for following-up on monitoring and remediation for the underground workings after the company was unexpectedly forced into liquidation (as a consequence of turbulence in the pensions market) is currently a matter of debate. Although the CA has stepped in to provide preventative treatment facilities in any case. Another question arises in relation to the need for the operator to publicise closure 6 months in advance. Where closure arises due to an unanticipated disaster, this is clearly going to be problematic. A recent case in point is the closure of the Longannet Mine (near Alloa, Scotland) in March 2002, which was precipitated by an unanticipated inrush of water to this, the last underground coal mine in Scotland, from nearby old workings which had previously been considered to be safely isolated from the modern workings by subsurface dams. The mine had to close suddenly, forcing the company (Scottish Coal Deep Mines Ltd) into liquidation. The still-operating branch of Scottish Coal Group which deals with opencast mines is legally an entirely separate company, without any responsibility for Scottish Coal Deep Mines Ltd or its properties. Receivers for the liquidated company were at the time of writing reported by SEPA to be refusing to transmit to them the information stipulated

in the Mines (Notice of Abandonment) Regulations 1998, making planning for post-closure monitoring / preventative action virtually impossible.

Abandoned metal mines

Metal mines have always been in private hands and until 1999 were also free to pollute upon abandonment. In fact most of the metal mines in the country closed before that date, leaving a legacy of metal mine water pollution without a liable owner. The case of Wheal Jane has been by far the most dramatic episode of mine water pollution from a UK metal mine to date. The Environment Agency has taken care of this case with an emergency treatment and the further commissioning of an active treatment plant (Younger et al. 2005). A contractor was appointed to design, build and operate the plan for a period of 10 years with a total budget of £16.9 M (Coulton et al. 2002).

The Environment Agency Wales has prepared a draft Metal Mines Strategy for Wales (Howarth 2002). From the total of 1300 known non-ferrous metal mines in Wales, the worst 50 sites were selected for studies on stakeholder views on their remediation. Neither Scotland nor England have any similar strategy. In England, the general (informal) strategy is effectively to wait and see if a particular abandoned metal mine site really demands remediation. In specific cases (South Crofty in Cornwall, and Frazer's Grove Mine in Durham), steps have been to monitor rebound and water quality evolution to establish if remediation is necessary. The lack of any organisation really responsible for such sites, and above all, the absence of any specific budget to deal with them, is not a sustainable solution. During the interviews it became clear that from the planning perspective, these sites can only be regenerated through development, and most of the sites are in remote upland areas where this is little or no prospect of this ever happening. Even, in Wales where the strategy envisages a "partnership approach", a group of local residents and other interested parties interested in the re-development and remediation of the Mynydd Parys copper mines (Anglesey) struggled to develop a *modus operandi* acceptable to the EA regulatory officers. Such problems carry the distinct risk that stakeholders will withdraw altogether from the voluntary clean-up of orphan sites which they previously contemplated.

There is no *a priori* case for the absence of an active policy for remediating the pollution from abandoned metal mines along the lines of the successful national coal

mine water remediation strategy. It can only be surmised that the lack of such a policy for metal mines reflects:

- the remoteness of most of the polluted sites and affected communities from the locations of decision-makers, and
- the fact that (with few and brief exceptions) metal mines were never nationalised, and thus never the object of a politically-controversial privatisation, which might have increased the public feeling of collective responsibility for them.

Several of the interviewees expressed the view that the best solution would be to extend the powers (and budget) of the Coal Authority to deal also with metal mines. The fact that these mines were all in private hands is an initial hurdle for the acceptability of this approach. Nevertheless, the reality is that the state was in the first instance the one that allowed this situation to develop and the one that will eventually pick up the bill. The CA has a good record of cost-effective solutions for coal mine waters. Metal mine water is often more difficult to treat than coal mine water and the CA so far lacks this specific expertise. However, such expertise does exist within the UK, particularly in the circle of engineers responsible for the remediation of the Wheal Jane discharge. It is probably true that, subject to acquisition of additional skills, the CA would feel more naturally comfortable with this task than the EA, which holds these problem sites in its portfolio of concerns at present.

Spoil heaps

British Coal owned huge amounts of land to enable its extensive mining and coal processing operations. Upon privatisation the CA retained land with value with respect to coal and other considerations, while the remaining pieces of land were transferred to commercial parties, local authorities and development agencies. There are also spoil heaps from mines that were never privatised. Run-off from this material is often highly acidic, with high concentrations of metals. In England alone spoil disposed above ground has affected almost 22000 hectares of land (DOE 1996). In the North East Region of the Environment Agency, a total of thirty-nine former spoil disposal sites have been investigated for their pollution potential.

Probably the best way to deal with these sites and their accompanying water pollution problems is through re-mining or redevelopment. Operators complain that at present it

is often extremely unattractive to mining companies to re-mine old spoil heaps and brown field areas. In England, English Partnerships (EPs) do have a ring-fenced budget from the ODPM for coalfield regeneration. The EPs coalfield programme at the time of the research involved 86 sites, most of them former pit sites. This included 56 sites that were transferred directly from British Coal at the time of privatisation. Other sites were added as a result of the 1998 Coalfield Task Force report and reflect the burden that EPs was able to absorb at that time. The CCC has produced a list of an additional 53 sites, including the remaining pit sites still in need of reclamation (CCC 2002). According to the CCC the arrangements with a budget managed by a national body would provide the certainty that more fragmented administrative support could never guarantee. An important question is the role of the recently created Regional Development Agencies. Most of the RDAs in coal areas do not have a particular coalfield focus. They would rather target easy sites than deal with the mining legacy. A more consistent approach is needed from the RDAs, giving adequate priority to the regeneration of mining areas and ensuring that EPs can deliver the full potential of the coalfield regeneration programmes.

A very positive development has been the establishment of an independent Land Restoration Trust (http://wwwlandrestoratiotrust.org.uk). In 1996 a report called 'The Post-Industrial Landscape" called for the establishment of a "UK Trust for the restoration of derelict land" which would "act for the nation in the acquisition of land at then end of its economic life and to hold such land as trustees; working with the community, to restore it to health and manage it for public benefit". The Trust was created by a partnership comprising English Partnerships, Groundwork, the Forestry Commission and the Environment Agency with the vision of acquiring, owning and managing 10,000 hectares of previously derelict land within 10 years. In 2003, the government's Sustainable Communities Plan endorsed the establishment of this Trust. The Trust has been working since 2004 in several abandoned collieries and coal processing sites, previously restored by RDAs with funds from the National Coalfield Programme, such as Monkton Cokeworks (South Tyneside) and Hickleton Colliery (Barnsley).

Working mines and quarries

The mine abandonment regulations have forced the operators to be very careful with some of their decisions. In particular, open mines have to avoid connecting with older workings. The case of Ellington Colliery (Northumberland) shows well the possible consequences. Ellington is the last remaining mine in a large coalfield and it is also the low point from the point of view of drainage. Some 50% of the water pumped at the mine originates in other mines. The managerial problem is that Ellington is now in hands of UK Coal and the rest of the coalfield is the responsibility of the CA. The pit will be closed in 2005, thanks to water inrush from old workings.

Companies can still improve considerably the degree of care on mine water issues in the early stages of exploration and operation. The Newcastle University mine water research group has proposed the concept of defensive mine water planning as a new approach to this topic (Younger and Robins 2002). Defensive planning starts from the realisation that closure is the longest part of the life cycle of a mine and it has to be planned for from the very start of a mining project.

Ground water management is still an unresolved problem. This will become ever more important with the forthcoming new Groundwater Directive. Scotland has made some progress with the publication of a code of practice for mineral extraction in relation to the Groundwater Regulations 1998 (Environcentre 2002) and an assessment framework for evaluating the potential impact of opencast coal mining on water quality (Younger and Sapsford 2004).

Finally, the release of sediments to streams causing temporary water quality problems is still the most common pollution incident in the extractive industry. Although this is perceived as a minor problem by sectors of the industry, it is still a serious disturbance of the aquatic ecosystem which should not be tolerated.

4.4.2 Institutions

Coal Authority

There is total agreement among the interviewees that the Coal Authority is doing an excellent job. The pragmatic approach of a national budget managed by a central organisation is proving to be very cost-effective. From the point of view of the CA there are some problems to be resolved. There is an issue with problems of acquiring suitable

land for remediation scheme development. Sometimes the land is owned by local authorities that disagree with the CA's plans, sometimes private owners refuse to sell. This problem has been addressed by the Water Act 2003 which has given the CA compulsory purchase powers (see Section 4.1.1). The CA would also like to develop more "sustainable" solutions to mine water than just treatment. Concepts on ochre and mine water utilisation are being explored.

Most of the interviewees think that the CA is too dependent on consultants and should have more in-house capabilities. The CA has so far been limited by the Governmental wish to maintain a cap in the number of staff. This policy is changing and the CA has been allowed to recruit some more personnel with the required technical expertise. Some criticism was oriented at the management of the whole programme. An asset management approach should allow for the long term planning of work and maintenance and operation of the existing sites. For this the CA should have the technical ability to validate schemes and project-manage complex programmes. Some interviewees think that the Authority could be more proactive in the dealing with mine water, providing more comprehensive mining reports and highlighting possible problems in areas for development. The CA thinks that according to regulations this is exclusively the responsibility of the developer.

There is also a widespread feeling that the CA could better use available local knowledge of the many people who formerly worked for British Coal. At present, use of such local knowledge depends entirely on the degree to which consultants engage relevant people in their project teams, and few consultancies have socio-geographical configurations suited to achieving local involvement. This could be changed by the CA specifying involvement of people with local knowledge in their tender documents.

Environment Agency and SEPA

Both the EA and SEPA have acted as responsible partners in the development of the mine water remediation programme. However, there are some issues that could be improved. Interviewees with long experience compare the behaviour of the officers of the Environment Agency with the old Regional Water Authorities. The latter had more autonomy to apply common sense solutions. Now there is more rigidity. There are now more young, inexperienced officers whose instinct is to apply guidelines to the letter,

even if this means violating the spirit of the law. The biggest problem is that, in spite of the MoU between the EA and the CA, most of the local EA officers involved in particular schemes do not understand the big picture of the national remediation programme. The inflexible application of all types of regulations brings unnecessary delays and unwarranted costs to the development of schemes. One example is the strict application of the abstraction licensing procedures when mine water is pumped for treatment purposes (whereas pumping for mine drainage purposes has always been exempt from a requirement for licensing). In contrast with British Coal, the Coal Authority presents a low corporate profile in such conflicts. However, the CA work is based on a priority list produced by the EA. The EA should facilitate the development of the schemes on the list. Better national guidance to the EA area officers could ease these hurdles.

The core of the problem is that both SEPA and EA rely on a handful of experienced officers from some of their regional offices to maintain the bulk of the relationship with the CA. Due to pressures of time and limited resources, this knowledge is not widely shared within the organisation. This could become an important issue after the recent reorganisation within the EA, as several key officers have been allocated to different tasks leaving an important vacuum behind and losing the contact with higher levels of management within the Agency which are not so aware of mine water issues. One positive step has been the establishment of an EA fellow at Newcastle University who is supporting the Agency in addressing these problems.

4.4.3 Policy

There is a real danger of mine water being forgotten by water policymakers in England. The reality is that mine waters have never been a priority in water quality. The drive for remediation came from active lobbying from coalfield communities, mainly to the DTI. Problems with Brussels in respect to the Dangerous Substances Directive forced policymakers to concentrate temporarily on the development of a Pollution Reduction Programmes for iron. However, the attention is now completely focused again on pollution from agriculture and diffuse urban sources. In some respects the progress made by the CA has been so successful that the issue has now dropped down the environmental and political agenda (Tate 2002). A recent document about water policy

in England for the next twenty years (DEFRA 2002) does not even mention mine water (or groundwater for that matter).

In Scotland, at least the policymakers of SEPA that are working with the Scottish Executive in the transposition of the WFD are also directly involved in the Steering Committee of the SEPA/CA. Policymakers have direct exposure to the mine water problematic in general with a strong emphasis on environmental outcomes. This is a better situation for strategic coordination of mine water management within water policy.

The analysis of impacts and pressures required by the WFD should show the real requirements for mine water management in the next year. However, it is important that the EA and SEPA apply the necessary know-how to identify the risk of pollution and not only existent incidents. There is the expectation that pressure from Brussels on the management of diffuse pollution from metals may reactivate interest in the mine water problematic. Until now the focus has been only on iron but soon there will be the need to consider other metals including manganese. This may also affect the problems of issuing appropriate consents to discharge for mine water treatment plants. The EA may be forced to abandon the current policy of facilitating descriptive consents where possible, which would be a significant retrograde step.

4.5 Conclusions

The institutional research in Great Britain shows how the management of mine waters from **active mines can be controlled if adequate regulations are properly enforced at each stage of the life-cycle of a mine.** In particular, the problems of stability of waste structures that prompted the proposed Directive on Mining Waste have been successfully resolved with the Regulations introduced after the Aberfan (Wales) disaster in 1966. The introduction of The Mines (Notice of Abandonment) Regulations 1998 provided a clear framework for mine water management during closure. However, there is scope to improve mine water management in the early phases of exploration; there are still too many pollution incidents arising from the handling of sediments; groundwater management is an unresolved problem; and there is a need for a clear strategy for coping with liquidation of mining companies prior to resolution of post-closure problems.

The key issues in mine water management in Great Britain presently centre around dealing with the **legacy of abandoned mines** as mines abandoned before 31.12.99 were exempted from the obligation to treat mine water. The fear of the scope and scale of the problem caused by abandoned mines acted as a deterrent for action; with hindsight it turned out to be cheaper and simpler than was feared beforehand. Now the Coal Authority is in charge of a very successful national programme of remediation addressing the legacy from British Coal. The (questionable) official position is that this is done on a voluntary basis, with an earmarked budget from the Department of Trade and Industry, within the framework of a Memorandum of Understanding with the Environment Agency and the Scottish Environment Protection Agency. There is a still a problem with the promotion of remediation initiatives through re-mining or redevelopment of old sites. Although the creation of the Land Restoration Trust is starting to address some of these issues, there is still a need for EA / SEPA to develop an "enabling" approach to regulation of voluntary remediation initiatives, rather than blind application of the last letter of the law. There is also a need for a proper national strategy for metals mines and one in which the EA engages fully, rather than being afraid to be part of a problem-solving consortium. Much has been learned with the development of the national mine water programme for abandoned coal mines. However, there is still a need for capacity building and further development of understanding. In general there should be better use of local knowledge for the management after closure.

Finally, national water policy should embrace the mine water issue, not pretend it does not exist, as it is a major cause of pollution in many northern and western catchments.

5 GREAT BRITAIN: CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Gaps in mine water management in Great Britain

According to the working definition of the ERMITE project, the term "mine water" refers to water flowing through mined ground, waste rock and/or tailing deposits, and/or such water draining into adjoining bodies of water, such as streams, lakes, aquifers, wetlands, and coastal and marine waters. The management of such mine water must constitute an integral part of water management plans and action programmes, based on relevant surface and groundwater catchments for different water management levels. The challenge is that the prevention and control of water pollution from active and abandoned mines requires bridging the separate worlds of mining and water management.

In recent times the UK has developed a relatively successful model for the management of mine waters as described in the Chapters 3 and 4. However, the drivers for this success have usually been external to national water policy. The reality is that mine waters have never been a priority for water quality policymakers. Active lobbying by the Coalfield Communities Campaign and pressure from Brussels have been key elements for policy development. From this point of view, it is quite significant that the project ERMITE was not able to engage that particular policy community in the activities of the project, in spite of active collaboration with all other relevant stakeholders at that level. National water policy should embrace mine water issues, as it is a major risk of pollution in many northern and western catchments. Furthermore, this should be reflected in the implementation of the Water Framework Directive.

The UK government has taken a positive stance in the consultations organised by the European Commission on the proposed Directive on the management of waste from the extractive industries. However, on some key issues there are profound mismatches between the findings of the ERMITE project and the official UK position. The next section provides a summary of the response of the UK ERMITE team to the Partial Regulatory Impact Assessment of the Directive for the UK, in which these mismatches were exposed. The key points are that the UK government should support the approval of the Directive and seek the inclusion within its scope of excavation voids and

abandoned mines. So far the government (as well as the European Commission) has failed to grasp the policy implications of the Directive within the current framework of European water policy, i.e. that although this is a waste initiative it is the only foreseeable chance to include mine water protection provisions in EU legislation[1]. The UK Government has played a less positive role as a Member of the European Council in the subsequent phase of the process for the development of the Directive. In Section 8.2 there is a brief discussion on the UK role in European policy making.

The key issues in mine water management in Great Britain presently centre on dealing with the legacy of abandoned mines. Mines abandoned before 31.12.99 were exempted from the obligation to treat mine water. Now the Coal Authority is in charge of a very successful national programme of remediation addressing the legacy from British Coal. However, the management of the closure and post-closure phases of large coalfields is far from being a resolved issue. The monitoring programme has to be further developed and the prevention programme has to be more proactive than it has been so far. In the North East, there is an urgent need to find a sustainable solution to a very real and urgent threat to public water supplies and the wider environment. The willingness of the government to establish such a remediation programme in relation to abandoned coal mines presumably reflects the fact that the coal industry was formerly in public ownership, for no analogous commitment has been made in relation to metalliferous mines (which were never nationalised *en masse*). A substantial legacy of pollution from such metalliferous mines remains largely un-addressed: with the exception of the Wheal Jane site in Cornwall, where a combination of pressures from the EU and unplanned assumption of some liabilities by the former National Rivers Authority conspired to require remedial action (Younger et al. 2005), only local, largely 'voluntary' remedial efforts are so far being proposed for any other abandoned metal mine sites. The Environment Agency's recent 'National Metal Mine Strategy for Wales' seeks to deliberately encourage such voluntary initiatives, but even this rather mild policy instrument is not replicated in Scotland or England. Currently, there is no official framework to deal with these mines in the UK.

As mentioned above, there is still a problem with the promotion of remediation initiatives through remining or redevelopment. There is a need for EA / SEPA to

[1] **This issue is discussed in-depth in Section 6.3**

develop an "enabling" approach to regulation of voluntary remediation initiatives, rather than blind application of the last letter of the law.

Much has been learned with the development of the national remediation programme for abandoned coal mine waters. However, there is still a need for capacity building and further development of understanding. In particular, the environmental regulators, EA and SEPA, have very limited resources devoted to this topic; consequently, they are sometimes unable to fulfil their strategic role. Even the Coal Authority is concerned about the increasing 'age profile' of its staff, and its excessive reliance on consultants. A large void in experience and knowledge will be created once key staff start to retire. More planning is needed to ensure an educated and experienced succession. The EA has acted recently to address this gap by supporting an EA Fellow at the University of Newcastle who is working closely with the National Science Group of the Agency on mine water issues.

In the UK the industry works, generally, according to the highest standards. However, there is still scope to minimise impacts during the exploration and working phases; groundwater management is an unresolved problem; and there is a need for a clear strategy for coping with liquidation of mining companies prior to resolution of post-closure problems. Some sectors of the extractive industry need to improve substantially their management of fine-grained silts. Where silt is released *en masse* to receiving watercourses, it tends to clog stream-beds, cutting off light penetration to benthic algae and thus halting primary production. Vigilance must therefore be maintained at any mine waste operation that involves handling fine-grained materials, whatever their chemical or mineralogical composition.

5.2 The UK and the proposed Directive on mining waste

As discussed in section 4.3.1, the UK representatives in Europe have played a largely constructive role during the consultations organised by the European Commission for the proposed Directive. They have had an important influence on the evolution of the text from the first working document, which drew heavily (but inappropriately) on the wording of the Landfill Directive, towards the current proposal, which is far more in accordance with industrial and regulatory practices in the extractive sector. This constructive engagement has helped to make many of the requirements of the proposal

reflect existing good practice in the UK. However, there are several issues in relation to which the UK position should be revised (see Appendix 3 for the full text of the response to the ODPM consultation on the proposed Directive).

1. Are water issues related to mining already adequately covered by the Water Framework Directive and associated instruments?

The UK views the proposed Directive as strictly a waste management issue. Based on this position, while acknowledging the importance of the prevention of water pollution left to flood after closure, they have not supported its inclusion in this Directive. The official understanding is that this is already covered by the provisions of the Water Framework Directive (2000/60/EC). In reality the **Water Framework Directive alone is a very poor instrument for the prevention of pollution from mining activities,** and the proposed Directive on mineral waste management is likely to represent the only opportunity to close this loophole in EU legislation (see Section 6.3). Moreover, this is exactly the role of The Mines (Notice of Abandonment) Regulations 1998, which all UK companies have to fulfil. Accordingly, in order to create a level playing field for companies within the EU, the UK should support the inclusion of specific provisions to prevent water pollution from excavation voids.

2. Are existing provisions for abandoned mine sites adequate?

The current proposed Directive is the best opportunity for establishing a rational (and not specially onerous) programme of remedial measures for abandoned mine sites at the European level, following the model of the national rolling programme managed by the Coal Authority. As noted above, even the UK lacks such a programme for abandoned metal mines. So the inclusion of this item would indeed represent an environmental improvement in the UK. The version of the proposed Directive that was finally produced by the European Commission had watered down unacceptably the provisions in this respect of the previous working document. Now, the European Parliament has introduced amendments to this particular Article (19) with more robust proposals (EP 2004b). The UK should support this stronger version of Article 19.

3. A level playing field in relation to stability of mine and quarry tips.

The UK has sought to limit the scope of the Directive in relation to the permanent or temporary storage of waste that will be used to recontour, landscape and rehabilitate the excavation voids. However, in the UK the Mine and Quarries Regulations apply to all kind of structures, regardless of size or their permanent or temporarily character (Walton and Cobb 2002). It would therefore be logical for the UK to argue that the provisions of the Directive related to the control of stability and the control of water and soil pollution should apply to all structures regardless of their temporary character or their labelling as waste or residues.

5.3 Recommendations for mine water management in Great Britain

Recommended Action	Implementing entity	Priority
1. Provide specific guidance for the management of mine waters in the implementation of the Water Framework Directive.	DEFRA/EA Scottish Executive/SEPA	Very High
2. Support the proposed Directive on mine waste and seek to include excavation voids and abandoned mines	ODPM	Very High
3. Improve the existing framework for the management of large closed coalfields with particular attention to groundwater issues	CA/EA/SEPA	Very High
4. Develop and fund a national programme for remediation of metal mines based on the example of the existing coal mines programme	sponsors: DEFRA/DTI actors:EA/CA	Very High
5. Develop a national framework to facilitate the voluntary remediation of abandoned sites	ODPM/DEFRA Scottish and Welsh Exec.	High
6. Increase research and capacity building in the EA, SEPA and the CA to fulfil their regulatory roles	EA/SEPA/CA	High
7. Improve the performance of industry (preventative measures, groundwater and silts)	Industry/EA/SEPA	Medium

Table 5-1 Recommendations for mine water management in Great Britain

6 EU POLICY CONTEXT: EU ENVIRONMENTAL POLICY AND MINING

6.1 Introduction

The previous Chapters have presented the UK case study undertaken within the ERMITE project. Other members of the project team in the other five focus countries carried out similar case studies. A comparative analysis of the six case studies confirmed the point made in Chapter 1 that the UK provides the most advanced platform for the analysis of mine water policies. The **evidence** from the UK gave the best leads for policy development at the European level and provided the main arguments deployed in the interaction with the European policy process (see Section 7.2 for a brief summary of national recommendations in the other countries).

The second part of this dissertation will present how the evidence gathered in the first part was mobilised to influence European policy-making, which was the central goal of this work (and of the ERMITE project as a whole). In Chapter 6 the **context** for policy development is analysed. First there is a short summary of the findings at the European level of the ERMITE project; then an analysis is presented of the position of mining within EU environmental policy, including observations on how this position has been changed by the influence of a number of catastrophic events. These changes gave rise to an intensive policy-making process contemporaneous to the ERMITE project, which gave the opportunity for interaction at the highest European level. Chapter 6 ends with a preliminary assessment of the requirements for the policy process from the point of view of mine water management.

Chapter 7 will explain in detail the different interfaces that the project ERMITE used to establish **links** and their impact in the process. Chapter 8 will give the final policy recommendations coming out of the ERMITE project, together with an evaluation of the policy process from the mine water perspective, as evident at the time of writing.

6.2 Mine water in Europe

Mining is a very old industrial activity which was present to at least some extent in all countries in Europe. However, the importance of the industry has declined in the 20th century as coal production ceased to be the main source of energy and, together with

metal mining, became less competitive in the global market. Nowadays, its production is small compared to the global production (eg. 7% copper and 6% of coal) and these sectors operate under severe economic conditions (IPPC Bureau 2004).

Younger (2002) provides a synopsis of the growth and decline of European coal mining. Large **coalfields** were developed in the 19th Century in the **UK, northern France, Belgium, Germany, Poland, the Donbass Basin (Ukraine) and the Central Asturian Basin (Spain)** (Figure 6-1). In most of Western Europe, coal production peaked shortly before World War I. By the mid-1960s, decline became the dominant trend, manifest in widespread closure programmes in the UK, Belgium and France. Ever since, the pace of closure has depended on the willingness of individual governments to implement policies of production subsidies. Until the collapse of the Soviet Union, the coal industries in Eastern Europe were immune to this pattern of decay. Production increased five-fold between 1946 and 1989 in the former USSR, former Czechoslovakia, former Yugoslavia and Poland. However, now that these countries have open economies full (or at least major) closures are underway.

Figure 6-1 Main coalfields of Western and Central Europe (Source: Younger 2002)

Index: AL: Asturias/León (Spain); Ar: Ardennes (Belgium) and southern Netherlands; BiH= Bosnia-Herzegovina; CSF= Central and southern French; DN= Durham and Northumberland (England); FL= Fife and the Lothians (Scotland); LS= Lower Silesian (Czech Republic); NpC= Nord-Pas-de-Calais (France); NWL= North Wales and Lancashire (Wales and England); Po= Po Basin (Italy); R= Ruhr (Germany); SL= Saarland (Germany and France); SW= South Wales; US= Upper Silesian Coal Basin (Poland and Czech Republic); WS=West of Scotland; YEM= Yorkshire and East Midlands (England).

In the case of **metal mining**, some 75% of the total production is concentrated in **Finland, Sweden, Ireland, Portugal, Spain and Greece.** There are difficulties to find new profitable ores in spite of the increase in consumption. Within the non-energy sector, extraction of industrial and construction minerals is evenly spread across the EU. The construction minerals sector is by far the biggest employer (some 140.000 direct employees) with extraction of aggregates, sand and gravel active in all the countries. In contrast to the decline of coal and metal mining, the production of industrial minerals has expanded on a European scale representing an important fraction of the world production for certain commodities (e.g. 64% of feldspar and 20% of potash) (IPPC Bureau 2004; CEC 2000a).

As explained in Chapter 2, one of the activities of ERMITE was to provide an overview of mine water problems in Europe (ERMITE D2 Wolkersdorfer 2002). There is so far no comprehensive inventory of mine water problems in Europe, but the heavy pollution of a number of streams is well documented (e.g. Rivers Tinto and Odiel, Spain; Erft River, Germany; Vistula and Odra Rivers, Poland; Odra River, Czech Republic; Avoca River, Ireland; Reigous Creek, France and River Ore, Scotland). ERMITE research showed some awareness of mine water issues in all EU members states (in 2001-2), but only a few non-EU member states showed this awareness. National mine water remediation plans were only found in force in the UK, Portugal and the Czech Republic. See Table 6-1 for a summary of mine water problems in Europe.

Areas of particular concern are the hard-coal mining areas of Belgium, Germany and Poland. Currently those areas are mainly under constant pumping, but the pollution threat will increase after pumping ceases. As happened in the UK, the discharge water quality will likely worsen. In the case of Belgium, where there are officially no recorded mine water problems, groundwater and surface water might become polluted.

From ERMITE experiences and studies it can be assumed that tens of thousands of active, abandoned and orphan mine sites giving rise to polluted mine water discharges exist in the EU and candidate countries. According to Polish statistics, in 1998 about 150 million m^3 saline mine waters were pumped out of mines and quarries. If these numbers are extrapolated it can be assumed that several billion m^3 of polluted mine waters are discharged into European watercourses per year. By far, the main source of problems are abandoned and orphan sites.

Table 6-1 ERMITE summary of mine water problems in Europe (as at 2002)

ERMITE Summary of Mine Water Problems in Europe	
Severe pollution recorded	**Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Greece[2], Hungary, Ireland, Macedonia, Poland, Portugal Romania, Slovakia, Spain, Turkey, Serbia and Montenegro, United Kingdon**
Mine water problems known	**Austria, Finland, France, Germany, Italy, The Netherlands , Slovenia, Sweden,**
No mine water problems known	**Belgium, Denmark, Latvia, Lithuania, Luxembourg, Malta**

The regulation of mine water issues differs substantially from country to country. The only countries that were found to address explicitly mine water in the legislative framework were the UK, Czech Republic and Austria. Other countries, e.g. Germany, regulate mine water problems within the existing mining legislation but only for active mines. In all Member States European water directives apply to mine water discharges from active mining. The same Ministries or Authorities do not necessarily manage mining and water. The basic conclusion of the ERMITE review was that mine water regulation needs to involve both mining and water expertise within the legal framework created by the Water Framework Directive. Mining impacts don't end when mining does, unlike most other industrial sectors. This is precisely why whole life-cycle approach is crucial.

6.3 Mining in EU environmental legislation

Chapter 1 gave a general introduction to European environmental policy. It showed how consideration of the environment was not originally included in the Treaty, but was gradually incorporated through a succession of Environmental Action Plans. It also explained how mining policy in the Commission has been mainly driven by industrial considerations; the energy extractive industry being covered by DG TREN and the non-

[2] There has been at least one recent Wheal Jane type outburst from the TVX gold mine in Greece, and the Greek government is currently commissioning acid drainage remediation work at the ancient Ag-Au mixed sulphide mine of Laurium (P.L. Younger, *personal communication*).

energy extractive industry by DG Enterprise. Now we will see in detail how mining as a sector managed to avoid becoming subject to a good deal of environmental legislation.

At the beginning of the ERMITE project, the team dealing with European policy (the author and A. Kroll at JRC-IPTS) undertook a review of European environmental policy and mining to position mine water within the existing policy context (Kroll et al. 2002). The review was mainly based on the thorough analysis published by Krämer (1999) after the Aználcollar accident, augmented by direct interaction with Commission officers in charge of portfolios under development. Krämer is a leading expert on European policy (see Krämer 1998) and he has played a key role in the development of waste and environmental legislation within DG Environment. His views on this matter at the time differed to some degree from the official position of the Commission. After the publication of the ERMITE review (Kroll et al. 2002) similar reviews were produced by the PECOMINES project (Hámor 2002) and by Ginige (2002). The explanatory memorandum of the Commission proposal (CEC 2003a) also includes a review of the legal situation at EU level. The following account is an expansion on Kroll et al. (2002) and represents the situation around 2001 when both ERMITE and the policy process for the development of the Mining Waste Directive commenced. Table 6-2 lists the relevant EU legislation which is discussed below.

Table 6-2 Review of EU legislation

EU legislation relevant to mine water issues	
Waste Framework Directive	75/442/EEC
	(91/156/EEC)
Landfill Directive	1999/31/EC
IPPC Directive	1996/61/EC
Seveso II Directive	1996/82/EC
Environmental Impact Assessment Directive	85/337/EEC
	(97/11/EC)
Habitats Directive	92/43/EC
Environmental Liability	2004/35/EC
Dangerous Substances Directive	76/464/EEC
Groundwater Directive	80/68/EEC
Water Framework Directive	2000/60/EC

The **Waste Framework Directive** 75/442/EEC (as amended by Directive 91/156) lays down general provisions and principles for the handling of waste, which is defined in the article 1 (a) as "*any substance or object in the categories set out in Annex 1 which the holder discards or intends or is required to discard*". Until recently, views differed as to whether this directive applies to residues from mining waste (Krämer 1999). For instance, Annex I Q11 specifies that "*residues from raw material extraction and processing (e.g. mining residues)*" are considered wastes. However, Article 2 states that "*waste resulting from prospecting, extraction, treatment and storage of mineral resources and quarries*" shall be excluded from the scope of Directive 75/442 "*where they are already covered by other legislation*". In the original version (75/442/EEC) the exclusion was unconditional. This clause was introduced with the Directive 91/156/EC, which modified the Waste Directive into a Framework Directive. The issue is whether the "other legislation" referred to is national legislation, as vigorously maintained by a number of Member States (e.g. Germany, Austria and the UK), or whether it refers to EU legislation, which is the view of the Commission. This ambiguity and the absence of specific Community legislation meant that mining wastes have not being actively regulated by this directive until now.

It is worth noting three recent cases from the European Court of Justice (ECJ) which addressed debate about the definition of "wastes" (cases C-9/00, C-6/00 and C-114/01). The outcomes of these cases, which appeared as the policy process developed, have influenced the initiative on new EU rules for mining wastes. For *Palin Granit Oy v Vehmassalon Kansanterveystyon kuntayhtman hallitus* (case C-9/00) a Finish court requested under Art. 234 EC Treaty that the ECJ clarify the definition of wastes for unused quarry stones, over granite blocks from a Finnish quarry. The opinion of the ECJ Advocate General was to consider leftover quarry granite blocks as "waste" within the meaning of the relevant legislation, so that they are therefore subject to EU waste handling rules (Opinion of 17 January 2002 in Case C-9/00 Palin Granit; available at http://www.curia.eu.int). The final ruling on 18 April 2002 (ENDS 2002a) established that materials such as topsoil, waste rock, overburden or tailings from extraction activities are waste when they fulfil the definition in Article 1(a) of the Waste Framework Directive.

In several European countries wastes not produced on the same site are used to infill mining cavities. In the second case *Abfall Service AG (ASA) v Bundesminister fiir*

Umwelt, Jugend und Familie C-6/00, an Austrian court requested the ECJ to give a clarification between waste used for site restoration and waste intended solely for disposal. The context was a transfrontier shipment of slag and ashes for their later deposit into a former salt mine to secure hollow spaces (mine sealing and support). The ECJ view is that the deposit of wastes in a mine may be either disposal (where the waste legislation would apply) or recovery depending on whether "*the waste serve a useful purpose in replacing other materials which would have had to be used for that purpose*" (C-6/0 judgment of 27 February 2002; available at http://www.curia.eu.int).

The key case has been that of *AvestaPolarit Chrome Oy* (Case C-114/01) which originated from an application by a Finish company for an environmental licence in respect of a site that was changing from opencast to underground mining (ENDS 2003). The licence was granted with conditions relating to leftover rock from the extraction of ore and/or ore-dressing sand, which were considered as waste. This would force the company to comply with the Finish waste law that transposed the Waste Framework Directive. The company appealed the decision arguing that the material did not constitute waste in law, and the issue was eventually referred to the European Court of Justice. According to the company, designation of the rock and sand as waste would lead to them bearing additional costs when compared with their competitors, including, in particular, the need to obtain a waste licence with a financial guarantee of 1.2 Millions Euro (http://www.avestapolarit.com/template/NewsPage_4043.asp).

The ECJ was asked two questions by the Supreme Administrative Court of Finland:

1. Are leftover rock and residual sand to be regarded as waste?
2. Does other legislation within the meaning of Article 2(1)(b) of the Waste Framework Directive mean exclusively the European Community's own legislation?

The Commission, as well as the Finish authorities, argued that the reference to "other legislation" meant "other *Community* legislation". The opinion of the Advocate-General, delivered on 10 April 2003, confirmed this interpretation proposed by the Commission. However, the final ruling of the ECJ (11 September 2003), which came after the proposal for a new Directive left the Commission (CEC 2003a), was full of surprises. First, it concluded that the leftover rock and residual sand are waste unless the holder "*uses them lawfully for the necessary filling in of the galleries of that mine and*

provides sufficient guarantees as to the identification and actual use of the substance to be used for that purpose." This means, backfilled material is to be considered residue and not waste, provided its use for this purpose was permitted. Second, it ruled that "*national legislation must be regarded as other legislation...if it results in a level of protection of the environment at least equivalent to that aimed at by the directive, whatever the date of its entry into force*". It must be noted that the conditions attached for national legislation to qualify are very stringent. The effects of this ruling at such a late stage of the policy process will be discussed in Chapter 7.

The **Landfill Directive** (1999/31/EC) is designed to cater for general and common aspects of landfill management that could arise in connection with the deposition of municipal, commercial or industrial waste in a typical landfill. Landfills are defined in Article 2(g) as "*a waste disposal site for the deposit of waste onto or into land*". Storage of waste prior to recovery or treatment for a period less than three years and storage of waste prior to disposal for a period of less than one year are excluded from this definition. The wording of this directive has clearly been written with municipal waste disposal operations in mind. The provisions of the directive generally cover waste from the extractive industries but it is explicitly stated in Art. 3(2) not to apply to "*the deposit of unpolluted soil or of non-hazardous inert waste*" and in Art. 3(3) "*of non-hazardous waste, to be defined by the committee established under Article 17 of this Directive, other than inert waste, resulting from prospecting and extraction, treatment, and storage of mineral resources as well as the operation of quarries*". This exception for mining waste was pushed by the Swedish Government (Ginige 2002). Since sulphidic wastes are not inert, it could be argued that the directive will apply to them. However, as it explicitly excludes the disposal of liquid waste streams (Art.5 (3)), it is not compatible with tailings dam technology. It also has a general ban on the co-disposal of non-hazardous with hazardous waste or with inert waste (Art. 6), which is contrary to the practice in the mining sector of co-disposal of waste from the same extraction site. Finally, the requirement to install a barrier and a liner under the landfill site in order to prevent groundwater pollution (Annex 1, point 2) is neither necessary nor advisable for certain types of mining waste. These shortcomings are properly acknowledged in the Explanatory Memorandum of the proposed Mining Waste Directive (CEC 2003a: 10-11); however, this didn't stop the Commission from using the Landfill Directive as the template for the first working documents (DG Env A2 2001). The role of ERMITE in the subsequent change of position will be described in Chapter 7.

The **IPPC Directive** (1996/61/EC) concerning integrated pollution prevention and control requires specified industrial activities (see Annex 1 to the Directive) to be subject to operating permits from the competent authorities in the Member States. These permits shall contain conditions based on Best Available Techniques (BAT) but also taking account of the technical characteristics of the installation concerned, its geographical location and the local environmental conditions. According to Article 16(2) of the Directive, BAT reference documents (BREFs) are produced by the European Commission at the European IPPC Bureau (http://eippcb.jrc.es) which is collocated with the IPTS in Seville (Spain). The IPPC Directive addresses the overall impact of the production process including air, water and soil pollution, the generation and handling of process residues, and the use of energy. Crucially, mining is exempt from the IPPC provisions, as mineral extraction is not mentioned in Annex 1 of the IPPC Directive. Mineral processing is included insofar as it fits the description of "*production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes*". However, tailings ponds (with waste other than inert waste) could be considered as landfills within the ambit of the directive. The Annex I, point 5.4 refers to "*landfills receiving more than 10 tonnes per day or with a total capacity exceeding 25000 tonnes, excluding landfills of inert waste*". This Directive doesn't provide any definition of landfill; but if we apply the definitions of the Landfill Directive most tailings dams would be covered. Annex I points 5.1 and 5.3 provide, respectively, thresholds for installations for the disposal of hazardous and non-hazardous waste. So waste rock heaps of those dimensions would also be covered. New installations have had to comply with the Directive since October 1999, but pre-existing installations do not have to be brought into compliance with the Directive until 2007.

The **Seveso II Directive** (Directive 96/82/EC) aims at the prevention of major accidents which involve dangerous substances, and the limitation of their consequences for man and the environment. The EU adopted the first Seveso Directive 82/501/EEC on the hazards of certain industrial activities following a large-scale contamination event in Seveso (Italy). Subsequently this directive was replaced by Directive 96/82/EC. Both directives imposed certain measures to prevent industrial accidents (e.g. emergency plants on and off-site, information for the adjacent population, monitoring requirements for public authorities). The Directive applies to establishments where dangerous substances are present in certain quantities (as defined by the Annex 1, Part 1 Named

substances and Part 2 Categories of substances with certain properties classified in the labelling of dangerous substances directives). However, Article 4(e) of the Seveso II excluded from its field of application *"the activities of the extractive industries concerned with exploration for, and the exploitation of, minerals in mines and quarries or by means of boreholes"* and Art. 4(f) *"waste land-fill sites"*. Notwithstanding this exclusion, the Directive might be deemed to relate to some mineral processing activities, insofar as mining, mineral processing, and the disposal of mining wastes can be deemed to be distinct activities (Krämer 1999). However, in practice, this is likely to prove difficult. In the case of Aznalcóllar, for instance, Directive 82/501/CE did not come into force with respect to the waste disposed in the tailings pond before 1993, and thereafter it seems that it still did not apply, since the quantities of chemicals mentioned in the annexes of the Directive were not reached.

The **Environmental Impact Assessment** (EIA) Directive 85/337/EEC (as amended by Directive 97/11/EC) requires that an EIA be carried out for all public and private projects which are likely to have a significant impact on the environment.. This is the directive with the most direct provision for the mining sector. The Annex 1 lists the projects of obligatory assessment including *"15. Dams and other installations designed for the holding back or permanent storage of water, where a new or additional amount of water held back or stored exceeds 10 million cubic metres."* and *"19. Quarries and open-cast mining where the surface of the site exceeds 25 hectares, or peat extraction, where the surface of the site exceeds 150 hectares."* Annex II of the Directive lists those types of projects for which the Member States have the freedom to judge whether to require the assessment or not. The list includes practically all the extractive industry not included in Annex 1. The EIA Directive emphasises a preventative approach; assessment is required before authorisation is given. The assessment must cover effects from waste and include a description of measures to prevent, reduce or offset any significant adverse effects. In the case of Aznalcóllar, the mine began to operate before this Directive entered into effect, so it did not apply to the mining activities or discharge of wastes into the ponds. However, the post-spill disposal of sludge and contaminated soil in the old mine void should have been subject to the Directive (Krämer 1999), though it is not clear whether any formal EIA was undertaken despite the risks to groundwater and the close proximity to the Doñana Natural Park (see later in Section 6.4 a description of the accident).

The **Habitats Directive** 92/43/EC has the objective of creating a network of Special Areas of Conservation (SACs) in need of special protection. Article 6.3 establishes that projects in the vicinity of SACs must be examined from the perspective of their compatibility with the conservation objectives of the area. This Directive was not in force at the time of the Aznalcóllar spill; although there was no doubt that the Doñana reserve was going to become a major SAC. Although the Habitats Directive requires careful consideration of new developments in the vicinity of SACs, as with many other directives, the provisions apply only to new projects and not to existing ones (see in Section 8.1 ERMITE recommendations about this Directive).

In 2001, there was no EU legislation on **liability** for damage caused to the environment. A White Paper on Environmental Liability introduced by the EC in 2000 contained a number of proposals to improve the implementation of existing EU laws to ensure adequate environmental restoration (Council of Ministers of 30/03/2000). In 2002, the Commission issued a proposal (CEC 2002) to establish a framework directive for environmental liability. In the final document (Environmental Liability Directive, 2004/35/CE) Annex III the regime applied to (2.) waste management operations and all discharges into the (3.) inland surface water or (4.) groundwater that require a permit, authorisation or registration in pursuance of the Water Framework Directive. However, the operator will not bear the cost if the emission fully complies with the permit conditions (Art. 8.4(a)). One of the activities in ERMITE was fully devoted to the analysis of environmental liability issues. The final recommendations of this activity can be found in Section 8.1. Independently of this legislation, assuming that the causes of dam failure were precisely known so that the responsibility of the mine operator could be established, the polluter-pays principle would apply, since accidents due to dam failures (dams being human constructions) are "foreseeable" (Krämer 1999).

The **Dangerous Substances Directives** (Directive 76/464/EEC and 5 daughter Directives) have the purpose of eliminating pollution from list I substances and reducing pollution from list II substances (Art. 2). In principle the Directives address intentional, deliberate discharges to water, rather than accidental spills. However, the Directives do not define the distinction between direct and indirect discharges (Art. 1.(2.d and 2.e)); so some authors think that it could be interpreted to apply to both (Ginige 2002). The Directive divides dangerous substances into two lists: List I which includes a number of particularly dangerous substances due to their toxicity, persistence

and bioaccumulation. The "candidate list I substances" included a total of 132. Only 18 individual substances have been regulated in five specific Directives setting emission limit values and quality objectives at the EU level. The only metals in List I are cadmium and mercury and their compounds. For substances in List II (and the other 114 "candidate list I" substances), EU Member States had to establish **pollution reduction programmes** including water quality objectives according to Art. 7. One of the categories in List II are metals, metalloids and their compounds, including arsenic, chromium, copper, lead, nickel, vanadium and zinc. Iron is also included as a substance which has a deleterious effect on the taste and/or smell of water. In section 4.1.2 it was discussed the influence of the pollution reduction programmes on mine water management in the UK. Discharges from all these substances (List I and II) require prior authorization by the competent authority. Mine sources are included as well. The need to give numerical consents is seen as a potential problem by the UK regulator, which has tried to encourage voluntary remediation with the provision of qualitative consents for passive remediation schemes. This has certainly also been a problem for passive remediation in other countries (Wolkesdorfer, *personal communication*). When this review was undertaken, these directives were in the process of being subsumed into and replaced by the new Water Framework Directive (see below), and an expansion of the current list of substances (and revision of limit values) was part of this process. The Directive 76/464/EEC, with the exception of Art.6 (list I substances, which was repealed with effect of the entry into force of the Water Framework Directive), will be repealed at the end of 2013. Art. 16 of the WFD is devoted to the strategies against pollution of water. A list of "priority substances" including cadmium, lead, mercury and nickel has replaced the "candidate list" (Decision 2455/2001/EC). The Annex VIII of the WFD gives an indicative list of the main pollutants (category 7 Metals and their compounds) to be considered in river basin plans, and to which Art. 16 provisions may be applied.

The **Groundwater Directive** (Directive 80/68/EEC) is intended to protect groundwater against pollution by certain dangerous substances defined in an Annex. Art. 3 forbids the introduction into groundwater of substances in list I (including mercury, cadmium and compounds) and limits the introduction of substances in list II (including many metals and metalloids such as zinc, copper, chromium, lead and arsenic). List II also includes all substances that have a deleterious effect on the taste and/or odour of water *"to render it unfit for human consumption"*, which would cover pollution caused by

excessive concentrations of iron and salinity. Art. 5 request Member States to undertake prior investigations concerning the disposal or tipping of wastes containing these dangerous substances which may lead to indirect or direct discharges to groundwater. This investigation will include "*examination of the hydrogeological conditions of the area concerned, the possible purifying powers of the soil and subsoil and the risk of pollution and alteration of the quality of the groundwater*" (Art. 7). The Art. 22 of the Water Framework Directive establish that the Groundwater Directive will be repealed at the end of 2013. However, during the conciliation it was not possible to achieve an agreement on the coverage of groundwater by the new directive, so Art. 17 stipulated that the Commission would propose specific measures to prevent and control groundwater pollution by 2003 (CEC 2003b). Amongst others the new directive would establish EU groundwater quality standards for a core list of pollutants. Progress with the new proposal is proving difficult.

The **Water Framework Directive** (Directive 2000/60/EC) is an innovative piece of legislation which seeks to manage water quantity, quality and ecology at the river basin scale for all waters (rivers, lakes, coastal waters and groundwaters). A key requirement of the Directive is the production of river basin management plans (Art. 13) specifying how the environmental objectives set for that basin will be achieved within the timescale set (Art. 4: aim of achieving good surface and groundwater status, and achieving standards for protected areas at the latest by 2015). On the face of it, the WFD ought to improve the regulation of mining activities, since it specifies in Art. 11 (l) "*measures required to prevent significant losses of pollutants from technical installations, and to prevent and/or to reduce the impact of accidental pollution incidents*" and "*systems to detect or give warning of such events*". Art. 5 of the Directive require the characterization of pressures and impacts in a river basin by 2004. Mining is not explicitly mentioned[3], but it is clear that pollution from mining sources has to be included in this analysis and, accordingly, in the programme of measures included in the river basin plans. This has been confirmed by the guidance documents of the Common Implementation Strategy for the WFD (CIS-WFD Guidance Document No. 3 2003). However, there is **a very fundamental gap** in the structure of the Directive. The development of European water policy before the WFD can be divided in

[3] The only specific reference to mine waters is found in Article 11 (j), which allows re-injection of mine-derived water into the same aquifer.

two phases (Kallis and Butler 2001): An initial phase in the 1970s and early 80s was characterised by the proliferation of directives protecting different types of water; in 1988 a Ministerial Seminar on water reviewed the existing legislation and initiated a second phase, concentrating on **preventative** measures to address specific sources of pollution that were unabated. These included:

- 91/279/EEC Urban Waste Water Directive on the collection and treatment of urban waste water and certain biodegradable waste water (agro-food industry).
- 91/676/EEC Nitrates Directive aiming at preventing and reducing nitrate pollution from agriculture.
- 96/61/EC Integrated Pollution Prevention Control Directive to prevent and reduce emissions to air, water and land from industry.

The complementary character of these directive to the WFD is clearly indicated in Art. 10 "The combined approach for point and diffuse pollution" where Point 2 states:

"*Member states shall ensure the establishment and/or implementation of:*

(a) the emission controls based on best available techniques, or

(b) the relevant emission limit values, or

(c) in the case of diffuse impacts the controls including, as appropriate, best environmental practices

set out in:..."

The list that follows includes the three directives listed above, the directives adopted pursuant to Art. 16 of the WFD, a list of directives in Annex IX (dangerous substances), and "*any other relevant Community legislation*". As has been shown in this review, due to the exemption of mining from the IPPC Directive **there is no relevant Community legislation addressing the preventative control of mine water pollution**. By any standards, this amounts to a very privileged treatment of that particular sector by the regulator. The key point that mining is precisely the sector in which early decisions in the design of a site can have an impact for decades (or more) after closure (ERMITE Consortium 2004) seems to have been overlooked entirely by everybody involved in the development of European water policy. And, of course, the requirements of Art. 3 (f) of the IPPC Directive which says, "*the necessary measures are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state*" do not apply to mining. This, in practice, leaves the whole burden of

control to the expertise of the water regulator, which in most cases lacks appropriate knowledge of mining operations, upon which any remedial measures must be based if they are to be effective.

The summary conclusion of this review of legislation is the same as that reached by Hámor (2002: 8): "***An in-depth study of relevant Community legislation leads to the conclusion that the mining industry was in a favoured status with respect to other industrial sectors***". The perils of this situation were starkly demonstrated by the two catastrophic mining accidents, Aznalcóllar and Baia Mare, which are described in the next section.

6.4 The Aznalcóllar/Baia Mare process

6.4.1 Aznalcóllar and Baia Mare accidents

The Los Frailes Mine, adjoining the village of Aznalcóllar (SW Spain), was most recently worked by Boliden/Apirsa, a wholly-owned subsidiary of Boliden Group, a Swedish-Canadian company, which acquired the site after it had already been exploited for many years. The mine produced Cu, Zn, Ag and Pb concentrates from a pyritic ore body. The pyrite-rich gangue contained arsenic, cadmium, thallium, and other metals in lower concentrations. After milling, the gangue was separated from the ore by an aqueous flotation process, which involved the use of sulphur dioxide, hydrated lime, copper sulphate pentahydrate, and proprietary surfactants. Some of the acidic water arising from this process was discharged to the nearby stream, the Río Agrio, but most was recycled before disposal with the gangue sludge to a 1.5 km^2 tailings pond (which held about 31 million tons of sludge by April 1998). This tailings dam had been extended several times to contain the ever-growing volume of sludge, with conventional use of coarse discard for dyke construction.

During the night of 24-25 April 1998, some 3 Mm^3 of pyrite-rich sludge and about 4 Mm^3 of acid waters flowed in a torrent through a 50 m-wide breach that developed in the dam following slippage of the dyke toe. The sludge and water engulfed the Río Agrio and the Río Guadiamar into which the Agrio drains (Figure 6-2).

Figure 6-2 Aznalcóllar tailings dam failure (Photo: Junta de Andalucía)

The Guadiamar is one of the principal freshwater sources of the Coto de Doñana, a Biosphere Reserve of exceptional importance for migratory birds and other wildlife. The Doñana ecosystem is administered as two contiguous nature reserves, the Doñana National Park (at the centre of the system) and the Doñana Natural Park (an outer 'ring'). The subdivision is not natural; rather it represents a distinction between legal protection regimes (Santamaría and Amezaga 1999): the national government of Spain manages the National Park, whereas the regional government (Junta de Andalucía) manages the Natural Park. The Aznalcóllar spill polluted an estimated 4500 ha of land that night, much of which lies within the Natural Park. The spill would certainly have impacted the Doñana National Park downstream had it not been for the prompt action of local residents and officers of the Natural Park, who rapidly constructed a series of earthen embankments across the course of the Guadiamar. This eventually stopped the progress of the spill and contained the acid water long enough to allow some treatment before eventual discharge to the Guadalquivir estuary. The subsequent clean-up work continued through most of 1998, as a joint effort by regional and national governmental agencies and the mining company. Sludge and contaminated soils were excavated

throughout the path of the spill and transported back to the mine site, where they were placed in a recently abandoned open pit (Kroll et al. 2002), which is now itself causing concern (P.L. Younger, *personal communication*). As legal investigations began, it soon became evident that no legislation at European or local level could be used to specifically handle this type of mining contamination (Krämer 1999).

In spite of the severity of the event and the early realization of the existence of dangerous gaps in European legislation, the Commission took no immediate action. Such was the inertia regarding the environmental regulation of the mining sector that it required a second catastrophic event to initiate a real policy process. On the evening of 30th January 2000, a tailings pond burst at a facility operated by AURUL near the city of Baia Mare (Romania) (Baia Mare Task Force 2000). AURUL was as a joint venture between Esmeralda Exploration of Australia and REMIN, the Romanian state-owned mining company. AURUL had been established to re-process the tailings of an old abandoned tailings pond, to extract gold and silver. The facility had been designed as a "zero discharge" process, with no emission of water to the local river. The tailings pond received process waters with high levels of cyanide, which was later recycled into the plant. AURUL began processing tailings in May 1999. After 7 months of operation, a period of rainfall and sudden snow melt caused the dam to overflow washing away a stretch of the embankment 25 metres long and 2.5 metres deep. Approximately 100,000 m^3 of tailings dam water containing up to 120 tonnes of cyanide were discharged into the nearby Lapus River. The pollution travelled downstream into the Somes and Tisa Rivers into Hungary before entering the Danube. The contaminant plume of cyanide/copper devastated large numbers of plants and aquatic animals in these river systems.

Some months later, on the 10th of March 2000, another tailings dam burst at Baia Borsa in the same region close to the Ukrainian border. A dam at the Novat tailings management facility, belonging to REMIN, released 100,000 m^3 of water and 20,000 tonnes of tailings sludge containing heavy metals. Some material was retained by two lower dams, the rest flowed into the Novat River and from there reached, again, the Tisa River. In this case, most of the mud remained close to the tailings pond and the majority of the heavy metals within the water were deposited in the upper reaches of the Tisa River.

6.4.2 Policy development after Baia Mare

In the aftermath of the Aznalcóllar and Baia Mare accidents, the EC finally took steps to address the continuing risks of pollution from mining activities. It created an International Task Force chaired by the Commission (March 2000) to follow-up these events and propose a plan of action. The Baia Mara Task Force (2000) recommended an urgent review, and possible adaptation of existing EU legislation relating to the environmental safety of mining operations. The EC implemented these recommendations in full, and with speed.

In less than one year, two different DGs within the EC had published three communications on environmental aspects of mining:

- *Communication on Promoting sustainable development in the EU non-energy extractive industry* (DG Enterprise; COM (2000) 265f);
- *Community Mechanisms for the Co-ordination of the Civil Protection Interventions in case of Emergencies* (DG Environment; COM (2000) 593f).
- *Communication on Safe operation of mining activities: a follow-up to recent mining accidents* (DG Environment; COM (2000) 664f) and

The Baia Mare Task Force (2000) had particularly recommended three key actions:

- amendment of the Seveso II Directive,
- publication of a document on Best Available Techniques (BAT) for mineral processing, similar to those produced under the IPPC Directive, and
- an initiative on the management of mining wastes.

Conspicuously, the Task Force with its narrow focus on tailings dam safety failed to identify the need for a water related initiative (Kroll et al. 2002). Thus, the Baia Mara Task Force report effectively resulted in the narrowing of the mining-related environmental policy agenda within the European Commission to mining waste, which theme was itself then narrowed to the management of certain types of waste facilities and accidents. Most importantly, the development of a proposed new directive was

defined as a waste initiative, and as such it became the domain of one particular unit within the Commission, DG Environment Unit A2[4] (see Chapter 1).

The discussion about mining in the Seveso II Directive became convolved in a wider review of the Directive following accidents in other industrial sectors (Toulouse, Enschede) and studies on carcinogens and substances dangerous to the environment (Kroll et al. 2002). Thus it was that the question of mining accidents became only one of several issues covered in this particular policy process.

Although the IPPC Directive does not include mining *per se*, a special BAT document was commissioned on the management of tailings and wasterock in mining activities. The IPPC Bureau at the JRC-IPTS was given the task of developing this document following the same procedures laid down for the BREFs formally required by the IPPC Directive. However, as mining is exempt from the IPPC Directive, the legal basis of this BAT document will not be that Directive but the aforementioned Commission communication on 'safe operation of mining activities' (COM (2000) 664f). After some debate, the mining sector expressed its willingness to participate in the development of BAT document, which has since been compiled to 'first full draft' status by an "expert" group comprising public authorities and industrial representatives. The ethos of the IPPC Bureau is based on developing intensive links with industry and working only at the level of technical experts.

For the purpose of this thesis, the key policy initiative was the development of a completely new proposed directive on mining waste. This proposed directive was intended to be based on article 175 (1) of the Treaty, and as such it would follow the complex co-decision procedure for a Directive of the European Parliament and of the Council presented in Chapter 1 (see Figure 1-2). This procedure includes a series of sequential steps involving the Commission, the Parliament and the Council. The European Commission has a central role as the originator of legislation. The first step of the process is completely controlled by the Commission. In this particular case, it started with the communication after Baia Mare (COM (2000) 664f) and finished with

[4] For the purpose of the thesis A2 would be referred to as the Waste Unit and B1 as the Water Unit although these are not their real names and the location of waste and water changes with different reorganisations.

the official presentation by the Commission of a proposal for a Directive on the management of waste from the extractive industries (CEC 2003a). The modus operandi of the EC is that the desk officers of a Unit have "ownership" of the process. As explained in Chapter 1, there is a degree of consultation between Units, and at certain steps in the process there are compulsory inter-service consultations involving all relevant DGs of the Commission. Nevertheless, the directives are predominantly shaped by the Unit in charge. This proposal had a very open consultation with all kinds of external stakeholders until the draft proposal was released for inter-service consultation within the Commission. In Chapter 7 the evolution of the working documents will be commented upon, highlighting the interactions with the ERMITE project. Table 6-3 give the dates of the steps in the development of the new directive.

Table 6-3 Steps in the development of the proposed new directive on mining waste

European Commission - DG Environment Unit A2 Waste	
EC Communication COM(2000)664f	**(23.10.2000)**
1st Working Document (based on Landfill Directive text)	**(15.06.2001)**
2nd Working Document (fresh text)	**(04.02.2002)**
3rd Working Document	**(05.06.2002)**
Draft Proposal for interservice consultation	**(Feb 2003)**
Proposed Directive on Mining Waste by the Commission	**(02.06.2003)**
European Parliament- Environment Committee	
Roundtable Discussion by Rapporteur	**(03.11.2003)**
Rapporteur draft report	**(17.11.2003)**
Adoption by Environment Committee	**(16.03.2004)**
First Reading Plenary vote by European Parliament	**(31.03.2004)**

The next step was the first reading by the Parliament. There the key body is the Environment Committee of MEPs, and the key actor is the MEP acting as *rapporteur* for the Environment Committee. The proposal has now been sent to the Council, whence it will return for a second reading by the Parliament, before being returned to the Commission. Most probably the final conciliation between the Council and the Parliament will happen in 2005 under the UK presidency.

6.5 Conclusions: ERMITE perspectives on policy requirements

From the perspective of the findings of the ERMITE project, a number of issues can be defined that should be taken into account in the policy context described above.

1. **The integration of the energy and non-energy mining activities which up till now have been treated by the EC as being independent, in spite of their commonality in terms of process and management techniques of mine water.**

The first step in all three initiatives launched after the Baia Mares report was the definition of the scope. Seveso II is clearly constrained by its purpose of dealing with accidents caused by dangerous substances. However, both the BAT document and the proposed Directive on mining waste should include all types of extraction activities. As shown in the UK case studies, mine water problems arise in all mining activities. In particular, problems with so-called "inert waste" appear in all sectors, including the construction minerals sector. Following a long tradition of lobbying for regulatory exemptions, the danger is that entire sectors (e.g. German lignite production) will try to avoid this round of legislation by gaining support in the key industrially-oriented DGs within the Commission and the bargaining capabilities of Member States. This would be a tactical error for the industry itself, however, as it would remain subject to the less appropriate, broad provisions of the Waste Framework Directive.

2. **The desirability of taking a full life-cycle approach to the environmental regulation of mining activities, as opposed to concentrating exclusively on accidental pollution (e.g. dam breaks) and management of waste facilities.**

Both the UK case study and the ERMITE European review show that the key issues for pollution control often became most critical after closure. If the full life-cycle of a mine is considered, the post closure period is by far the longest. The policy process seems to be focusing only on the operation of new waste facilities. This is missing three important points:

- Waste facilities cannot be de-linked from the management of the whole mine site.
- Mine water pollution prevention has to start at the early stages of mine design, including the first exploration bore holes.

- Closure procedures are critical for the post-abandonment phase. Mines are closed as whole sites not as piecemeal facilities.

3. The scope of the draft BAT document should be expanded to encompass key mine water issues as well as wastes.

The spirit of the IPPC Directive is the integrated prevention and control of pollution from industrial activities to land, water and air. Application of the "source-pathway-receptors" (Table 6-4) risk assessment model to mining sites should provide the framework for BAT guidance:

Table 6-4 Application of the source-pathway-receptor to mining sites

Sources	mine voids themselves mine wastes (tailings & spoil)
Pathways	water-borne (dissolved, particulate) air-borne dusts
Receptors	Human livelihoods Ecosystems

Water is the main pathway for pollution, and its sources are both mine voids and mine waste facilities. Limiting the BAT guidance to the management of tailings dams and waste rocks would fail to address the integrated prevention of pollution from mining. The guidance should encompass the entire site. It should include key provisions for water management in the early stages of the exploitation and the IPPC provision for whole site restoration.

4. The inclusion of mining voids in the mining waste initiative.

The UK case study has shown how the main policy issues for mine water management were related mainly to voids and not to waste facilities. The management of rebound from abandoned mines is the key activity for pollution prevention at the large scale. The Mines (Notice of Abandonment) Regulations 1998 regulating the management of voids at closure and post-closure was the key piece of legislation for this sector. If the mining waste directive fails to include provisions for the management of voids it will miss the

main source of long-term pollution for all the EU countries, which do not have regulations similar to the abandonment regulations.

5. The key environmental issue in the mining sector is pollution from abandoned mines.

In an era in which mining is in retreat in Europe, and where modern companies are already working to high environmental standards, the EU is going to introduce legislation that will mainly affect new mining facilities. Although the creation of an European framework is commendable, it will be a lame-duck from the point of view of environmental quality improvements if it doesn't address the legacy of abandoned mines. Most of these mines were operated when there were no environmental regulations and most were closed without appropriate care being taken. The UK case study showed how in any country with a long mining history abandoned mines are going to be the main and most intractable problem. However, it also showed that a relatively non-onerous risk-based rolling programme of remediation can be successfully implemented, provided the proper expertise (mining and water) is invoked.

6. The degree to which the present policy initiatives take into account the scale of the river basin unit defined by the WFD, and the need for the implementation plans for the WFD to incorporate specific guidance on the management of mine water pollution.

The Baia Mare Task Force failed to recognise the need for a water initiative, and the water policy unit at the Commission failed to identify the existing gap in European water policy arising from the exemption of mining from the IPPC provisions. However, the WFD has been under implementation since December 2003, and the river basin is now officially the unit of water management. Accordingly, mine water problems, from voids and waste facilities, should be managed with this perspective in mind. So, whatever the final outcome of the current mining policy initiatives, the Common Implementation Strategy of the Water Framework Directive should issue specific guidance (complementing the new directive and BAT document) for the management of mine waters at the catchment level.

7 INTERFACING TECHNOLOGICAL INSIGHTS WITH EUROPEAN POLICY-MAKING

7.1 Introduction: ERMITE policy interfaces

The case study of mine water management in the UK provided the basis for the critical analysis of the coverage of mine water in European legislation presented in the previous Chapter. As explained in Chapter 2, other sources of evidence offered by the ERMITE project were an overview of mine water issues across Europe, allowing the comparison of UK practices with five other national case studies, and complementary research on the technical, economic, legal and ecological aspects of mine water management.

This Chapter describes how the findings of ERMITE were placed at the service of the development of European policy in this area. It should be remembered that ERMITE worked under severe constraints of time and budget. Contractually the project team was forced to devote most of its resources to the production of a detailed set of deliverables (see Chapter 2): achieving policy-impact was a desirable outcome rather than a contractual obligation. However, it was always the intention of the ERMITE management team (and of the author of this dissertation in particular), to explore whether, given the structural limitations, an RTD project could be designed and managed to maximize policy impact. The critical elements for success revealed from this experience, and their implications for the harmonisation of European RTD and policy development, are analysed in Chapter 9.

ERMITE worked in parallel with the policy process described in Chapter 6. The initial policy objective of the project was to improve the handling of mine water issues within wider water policy initiatives within DG Environment (especially the implementation of the Water Framework Directive). This meant trying to establish an interaction with the WFD group with DG ENV Unit B.1, i.e. the 'Water Unit' (see Figure 1-3). However, as the EC policy agenda came to be fixed on mining waste, the ERMITE project focused on raising the profile of the water aspects of the mining waste policy initiative. Although the Water Unit of DG Environment is fully devoted to the implementation of the Water Framework Directive, its officers did not perceive that a catchment approach to mine water management ought to be a central issue in the current phase of environmental policy-making for the mining sector. This stance became evident in the

ERMITE EU Stakeholder Meetings discussed later in this Chapter. In contrast, direct ERMITE interaction with the group working on the proposed directive within the Production, Consumption and Waste Unit (DG ENV A.2, referred to in this text as the Waste Unit) was very successful and has helped to increase the awareness of water issues in the current proposal. The impact of this interaction can be seen in the evolution of the working documents produced by the Waste Unit. Regretably, the final proposal sent from the Commission to the European Parliament was watered down in the process of inter-service consultation within the Commission. Some elements which are regarded as key from the ERMITE perspective (i.e. abandoned mines, mining voids and inert waste) received a much weaker treatment in the proposal sent to the Parliament (CEC 2003a) than in the 2nd (DG ENV A2 2002a) and 3rd working documents (DG ENV A2 2002b) produced by the Waste Unit.

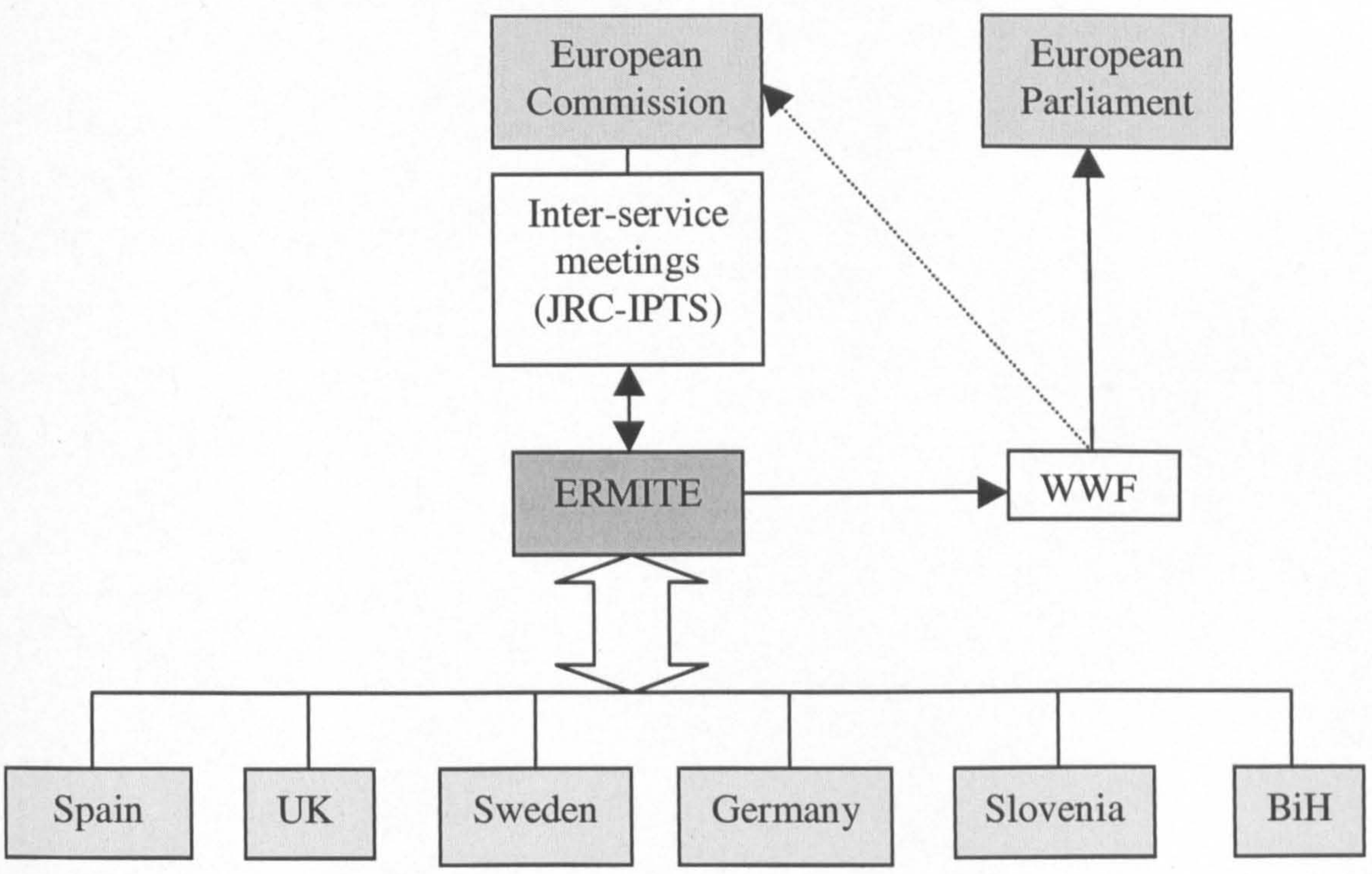

Figure 7-1 ERMITE policy interfaces

ERMITE had three key policy interfaces for the promotion and dissemination of the ideas of the project (Figure 7-1). Two were designed in the original concept of the project (National Stakeholder Groups and European Stakeholder Group); the third one (WWF European Water Policy Function) evolved during the lifetime of the project. Originally, it was envisaged to establish contacts with both European mining interests

and environmental NGOs. As discussed later, the Euromines interaction proved very difficult to maintain and the interface could not be properly established during the project. By contrast, the interaction with WWF grew organically towards full co-operation in a very successful lobbying operation with the European Parliament which achieved a wholesale revision of the text of the proposed Directive which brought it much closer to positions suggested on the basis of the ERMITE findings.

Overall, the ERMITE policy interfaces proved to constitute a successful mechanism for policy interaction within the time and budget constraints of a research project. The establishment and operation of these interfaces was a key element of the personal workload reported in this dissertation. In the rest of the Chapter, a description and analysis of each of these interfaces is presented. The Chapter finishes with an overall discussion and conclusions on the effectiveness of the interfaces for policy impact. As explained in Chapter 1, the EU policy process is extremely complicated. It follows a lengthy procedure involving many actors. Unpredictability of both the final outcome and the balance between the influence of the different actors characterise this process. From the point of view of the overall policy process, ERMITE was a minor actor working on the sidelines. From the point of view of the average DG Research-funded RTD project, ERMITE was a remarkable success in bridging RTD and policy. The account of the interactions between the different actors involved in discussions of the proposed Mining Waste Directive and the evolution of the policy texts would require a whole dissertation. The following account will concentrate only on the most important elements of the struggle to let the voice from RTD be at least heard (if not listened to) in the policy process.

7.2 European Stakeholder Groups

ERMITE established networks for stakeholder dialogue in six case study countries: Spain, UK, Sweden, Germany, Slovenia and Bosnia-Herzegovina. Each network was adapted to the particular conditions and contacts of the local research group. They included representatives from industry, regulatory bodies, independent experts and civil society (in Appendix 2 there is the list of organisations that participated in all the National Stakeholder Group Meetings). In particular, the groups sought to recruit network members so as to integrate both water management and mining expertise. The role of the UK stakeholder network in this thesis was explained in Chapter 2. The

stakeholder networks in the other case study countries played similar roles. The National Stakeholder Groups met three times during the lifetime of ERMITE. Each local partner had autonomy to steer the national group in the direction most appropriate to local circumstances. However, local research teams were instructed to engage, when possible, national actors with an interest and role in the development of the proposed Mining Waste Directive. They discussed the development of the project, the management of mine water management in the country and the evolution of European policies. The minutes of these meetings and the national recommendations for each country can be found in ERMITE Report D7 (Amezaga and Alvarez 2004).

7.2.1 Spain

The Spanish partner was located in Asturias, a region in the north of Spain in which the most important coalfield in the country is located (now preparing for final closure) (see Figure 6-1). Asturias also hosts active deep mining for gold and fluorite, plus open-pit mining for gold and construction materials. The School of Mines enjoys a high level of prestige with the mining sector, regional authorities and branches of government concerned with mining.

The Spanish partner chose to organise their meetings as parallel sessions to professional events organised by the School of Mines. This ensured an abundant representation from industry. At the same time, the meetings were always attended by representatives of the Instituto Geológico y Minero de España (IGME: the Spanish Geological and Mining Institute) which is the key reference institute for mining issues in the country. However, they failed to engage the water authorities and other bodies from the regional and national administration. These organisations were contacted and agreed to participate but failed to attend any of the meetings. This failure reflects the low priority given to these matters by the water authorities. Perhaps, this engagement would have been more successful if the Spanish team had been able to pursue more direct contacts at senior level.

The most successful element of the Spanish Stakeholder Group was the debate in the second meeting (18th June 2002) of the working documents of the proposed Directive, which followed a presentation by the technical expert of IGME who had attended the *Expert Committee* in the consultations organised by DG Environment (and was also a

member of the Working Group for the BAT organised by the IPPC Bureau). As such, he was not the official negotiator of the Member State, but was representing "unofficially" the opinion of the country in this stage of the process (see 'Making EU legislation' in Section 1.3.1). There is no evidence of the Spanish position being influenced by this interaction, but it certainly helped to increase the mediational capacity of the project at the European level. At this stage of the negotiations the DG Environment policy officers pay considerable attention to the opinion of the *Expert Committee* in order to facilitate the further progress of the Directive. So in the eyes of the Commission officers a research project can be taken more seriously if it is also engaging with the other actors that play a role in the process. Another outcome of the Spanish Stakeholder Group was the increased attention paid to the European policy process by the industrial participants, which was reflected in written answers sent to the open consultations by the Commission.

Table 7-1 shows the recommendations produced by the Spanish partners as an outcome of the local research and the interactions with the stakeholders. The emphasis is on clarifying the role of mine water in a review of the Mining Law and integrating mine water management in the implementation of the WFD. The problem of old mining sites is also highlighted.

Table 7-1 Recommendations for mine water management in Spain

1. Introduce specifically the concept of mine water into water policy and legislation.
2. Establish coordination mechanisms amongst the three different administrations (national, regional and local) which deal with mining issues.
3. Rigorously review all the existing legislation that affects the mining industry, seeking a more appropriate and synthetic focus.
4. Implement a new Mining Law, which leads to an adequate regulation of mine waters.
5. Assign adequate human and financial resources to the implementation of the Water Framework Directive in Spain.
6. Assign a budget to mitigate environmental problems related to old mine workings (and mining waste deposits) improperly closed in the past.
7. Disseminate information about mine water issues among NGOs and the wider population.

7.2.2 Sweden

The Swedish partner was the one that initially experienced most difficulty in identifying with the policy and stakeholder involvement process, though they finally obtained very good results out of their work. The key Swedish Partner was the Royal Institute of Technology, a very prestigious institution based in the capital city. The team has an excellent track record of research in water pollution of mining origin within the country. Sweden is one of the Member States that have played a very active role in European policy-making in mining issues. Traditionally they have had a great interest in Environmental Policy; as evidenced by the fact that the Environment Commissioner during the life of ERMITE was a Swede (Margot Wallström). Further more, Sweden is currently the most active mining country in the EU. Consequently the Swedish viewpoint was very important for the ERMITE objectives.

The Swedish Stakeholder Group included the key institutional actors from the administrative perspective. An interesting observation is that the Stakeholder Group went into considerable detail in their analysis of the deficiencies of Swedish water management in general and mine water management in particular, in spite of the general spirit of self-congratulation about the effectiveness of the existing system that reigns in the country. One outcome of the process was a number of recommendations for the implementation of the Water Framework Directive that were discussed with the Swedish Water Director (representing Sweden in the Common Implementation Strategy for the WFD). Another interesting point was the role of industry in the first stakeholder meeting, where a representative of a big mining company had a very active (if not domineering) presence. This person had a dual role as member of the company and representative of local government, which shows the high degree of control that the industry has in some areas of northern Sweden. This person argued against allowing the term "mine water" to be used in the discussion at all, as the view of the Swedish industry is that there are "no mine water problems in Sweden". (Sweden is one of the key actors labelling all mining pollution problems as waste problems at the EU level). He was unable to explain why PIRAMID and other EU projects had been able to spend thousands of euros in Sweden on pit lake remediation studies, which are classic mine water problems. At the same time, his position was that the way forward in Europe was to build on the principle of self-regulation and shared responsibility between authorities and industry (!).

Table 7-2 Recommendations for mine water management in Sweden

1. Give the parliamentary commission for reviewing the Swedish Environmental Code and its implementation of the WFD the task of particularly considering the environmental regulation of mine water pollution from inactive and abandoned mine voids and mined ground.
2. Change the Swedish contaminated land assessment, risk classification and prioritisation system (MIFO) towards considering and quantifying the source-pathway-receptor combination already at the first classification and prioritisation stages, for mine waste sites and mined ground, as well as for contaminated land in general.
3. Give one of the planned new water district authorities, or a central water competent authority (see 4), the responsibility and required resources for national coordination of mine and general water management, and other institutional activities involved in contaminated land provisions and environmental permit issuing.
4. Give a competent central water authority (see also 3) the responsibility and required resources for: (a) guiding and coordinating national mine water and general water monitoring; and (b) developing a comprehensive and publicly available environmental information system for integrated mine water and general water management.
5. Give the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS), or the General Swedish Research Council (VR), the task to review the Swedish research funding situation and propose nationally coordinated avenues for funding of research on mine water and general water and contaminated land monitoring, information provision, management, protection and remediation.

Following instructions to engage with policy actors involved in the European policy process, the Swedish Team established contact with members of the Swedish Parliament and, most importantly, with the Swedish MEP Jonas Sjöstedt (of the Confederal Group of the European United Left/ Nordic Green Left and coming from the same northern mining region of Sweden) who was acting as *rapporteur* for the proposed Directive in the Environment Committee of the European Parliament. The *rapporteur*

met personally with the Swedish ERMITE research team in the process of consultation before the 1st reading in the European Parliament. In this case, the interaction with the ERMITE team provided an opportunity to express an alternative view to the official Swedish position, further reinforcing the impact of ERMITE at the EU level.

Table 7-2 shows the recommendations produced by the Swedish partners for mine water management in Sweden. The emphasis on integrating water and mining resonates with the UK experience, as does the clear reference to the need to include inactive and abandoned voids. This is a very innovative position in the context of Swedish environmental management, where all mining issues are seen as a waste problem and water management has been traditionally dispersed.

7.2.3 Germany

The German partner was the Technical University and Mining Academy Freiberg (UF) situated near Dresden in Eastern Germany. The UF is one of the oldest mining academies in the world and is a leading institution in mine water research. They have good contacts with industry and State level government but are too remote to be able to reach the German Federal Government. Accordingly, the German Stakeholder Group was very successful engaging with industry but not with the Federal Authorities involved in the discussion for the proposed Directive.

However, the industry representatives attending the Stakeholder Group did include key staff involved in the *Consultative Committee* set up by DG Environment for the proposed Mining Waste Directive (see Section 1.3.1 'Making EU legislation') and one State bureaucrat representing Germany in the IPPC Bureau working group. After an initial phase of scepticism, these stakeholders started to take very seriously the capacity of ERMITE to influence EU policy development. This was manifest in an unusual interest in the revision of all the outputs produced by the German ERMITE team, and in distributing the ERMITE D1-4 report containing the German case study amongst the extended networks of the German Mining Industry Association. The stakeholders discussed all the comments and the stakeholder group approved a new version of D1-4. This meant, for instance, that in the general overview of Germany in ERMITE Report D1 all references to abandoned mines were eliminated; as industry understands mine

water as exclusively water from active mines. In this sense there were two very strong opinions expressed by key members of the NSG:

- In Germany mine water, understood in the sense given by German legislation, is not waste water (hence the ERMITE definition of 'mine water' doesn't match the idiosyncratic German position)
- Germany doesn't need new mine water legislation and there is no need for more regulations at the EU scale.

These two negative conclusions are consistent with the very negative official position that Germany has taken in the whole process of development of the proposed Directive on Mining Waste. Not by chance it was also the opinion of the German delegate at the IPPC working group. The fact is that if a country already has in place mechanisms equivalent to those proposed in a new Directive transposition would not require new measures. However, the official position of Germany has been clearly dominated by concerns over their beleaguered coal mining industry, which is fighting for survival and already feels over-regulated. The important issue of pollution from abandoned mines, especially in Eastern Germany, could only surface in the final ERMITE reports that were not subject to censorship by the German National Stakeholder Group.

All in all, in spite of the difficulties to engage stakeholders who already thought that everything was very well regulated in the country, the German Stakeholder Group did contribute to the objective of influencing European policy by raising ERMITE's profile amongst the actors involved in the consultation process. An important consideration is that some of the German industry experts were also involved in the technical discussion for the development of the BAT document.

From the perspective of the German ERMITE team, and based on the discussions with the National Stakeholder Group, only four things should be changed in handling mine water issues (Tab. 7-3) in the country:

Table 7-3 Recommendations for mine water management in Germany

1. Besides fixed element concentrations, loads should be used as legal limits for mine water discharges, and mine operators should be allowed to trade standards or exceed the concentration limits for a short time period, if the total load is not exceeded at all. 2. Mine drainage not under the control of the mining authority should be allowed to be treated by simple means without having to comply with long-lasting and difficult-to-achieve legislative requirements. 3. Every mine should be handled separately, using geological background values and not fixed limits as a basis. 4. Flooded mines and mine water discharges should be listed in a national mine water database.

7.2.4 Slovenia

The Slovenian partner was the most problematic regarding Stakeholder Groups. The local ERMITE partner, IRGO (Institute for Mining, Geotechnology and Environment), is the key Slovenian institute in the field of mine water; and the local Principal Investigator is a well-respected researcher with excellent contacts at all levels of government. However, the turmoil caused within Slovenian institutions by the accession process and, mainly, by changes in the professional situation of the Principal Investigator (from Director of IRGO to other positions in the Slovenian establishment) meant that the Slovenian Stakeholder Group was never properly constituted.

At the beginning of the ERMITE project, the Slovenian partner did engage with all relevant senior managers in the country, including the Minister of Environmental and Physical Planning, Director of Mineral Resources, Head of Mining and staff from the Slovenian Environmental Agency. All of them supported ERMITE and were ready to contribute to the project. Unfortunately, due to the above-mentioned difficulties, there was no follow up to these contacts, despite it being certain that the Slovenian Stakeholder Group could have included all the relevant policy actors in the country. A summary of the conclusion and recommendations for Slovenia is presented in Table 7-4.

Table 7-4 Summary of conclusions and recommendations in Slovenia

1. Active mining in Slovenia is dying out. The existing mine water problems are related to abandoned mines. 2. Improve the implementation and inspection of the current legal system in Slovenia which is currently quite complete. 3. Accommodate mine waters within the new structures created by the accession to the EU. 4. Inspections at EU level would help to provide a valuable external control. 5. In order to make those inspections effective at EU level some common legislation would be required.

7.2.5 Bosnia and Herzegovina

The ERMITE Stakeholder Group in Bosnia and Herzegovina (BiH) could not have any impact in the European policy process, as BiH was not an accession state; however, it was by far the most influential group at the local level. The local partner, HEI (Hydro-Engineering Institute of the Civil Engineering Faculty, University Sarajevo) has been involved in nearly all major projects in the water sector in the country and has direct access to government and external aid organisations. This important role is compounded by the fact that HEI's general manager, who had been Lord Mayor of Sarajevo in 1994-7, was still playing an active role in nation building and, at the time of the project, was the co-chairman of the inter-entity Environmental Steering Committee for BiH.

The list of stakeholders in Appendix 2 shows clearly the tremendous success of the BiH partner raising the profile of mine water issues to all levels of the administration of BiH (Cantons, Federation, Republika Serpska and Central Government), industry, stakeholders in Serbia and Macedonia, external aid agencies and the Office of the High Representative. The last meeting of the BiH Stakeholder Group was held as part of a regular session of the Environmental Steering Committee of BiH. After the meeting a number of recommendations and priority actions were presented to the Committee. Tables 7-5 and 7-6 show the legal, policy and technical recommendations.

Table 7-5 Legal and policy development recommendations in Bosnia-Herzegovina

1. Development of legal framework that encompasses environmental liability.
2. Development of legal framework that encompasses mine water pollution prevention and control within all regulatory stages, from licensing to monitoring.
3. Development of legal framework that will address problem of pollution minimisation and control from the abandoned mines.
4. Harmonization of existing and future laws with European directives, especially with the Water Framework Directive and proposed Mine Waste Directive.
5. Development of Physical Plan with defined mining zones, industrial zones, urban zones and protected environmental zones based on the plan of socio-economical development and the environmental protection plan.

Table 7-6 Technical recommendations in Bosnia-Herzegovina

1. Sustained monitoring of surface and ground waters.
2. Technical and managerial measures for prevention of possible accidents – rehabilitation of tailing dumps, ponds and dams, etc.
3. Construction of mine water treatment systems.
4. Introduction of EMS and ISO 14000.
5. Reduction of technological/industrial water consumption in mines.
6. Construction and reconstruction of existing closed technological mine water recirculation systems.
7. Implementation of BATs and BEPs in mining industry.
8. Technical and biological remediation of polluted rivers and land.
9. Technical and biological remediation of tailing dumps, flotation ponds and old mining sites.

7.2.6 Evaluation of the National Stakeholder Groups

As envisaged in the design of the ERMITE project, the networks established around the National Stakeholder Groups played a very important role providing an interface with the institutional dimensions of mine water management at the national and European levels. Their co-ordinated action increased the presence and influence of the project far

beyond that of an 'average' RTD project. The difficulties in motivating a group of engineers and scientists to embrace policy research and stakeholder involvement are discussed in Chapter 9. The fact is that the groups worked as well as they could be expected to within the constraints of the project and the characteristics of the partners. The only exception was Slovenia, where for circumstantial reasons the key researcher could not devote the necessary attention to this task.

In some cases the national stakeholder networks provided an interface with national policy-making. Thus, the UK group became an important platform for dialogue of the key institutional actors, which they found very useful. In Sweden, the group looked in depth at the issues related to the implementation of the Water Framework Directive in the country. The group of Bosnia-Herzegovina reached all levels of the administration in the country and interacted directly with national Environmental Steering Committee.

Some groups also had an interface with European policy-making. The German stakeholder group had a strong industry representation, which also participated in the stakeholder consultations for the new directive. Some meetings of the Spanish and the UK group (see Section 4.3.1) were attended by the national representatives in the consultations organised by the EC. The UK representative was later detached to DG Enterprise in Brussels and became involved in the inter-service consultations discussed later in this chapter. The Swedish group established contacts with the Swedish MEP who acted as *rapporteur* in the first reading of the proposed Directive on management of mine waste.

7.3 European Commission

7.3.1 Overview

The interface with the European Commission was crucial to the success of the ERMITE project and a fundamental step to prove the core thesis of this dissertation. Similar to the national stakeholder networks, this interface was already envisaged in the design of the ERMITE project in the form of a European Stakeholder Group established around the Commission services that would try to meet three times during the lifetime of the project. This was always a risky assumption but there were three grounds for optimism:

- The JRC-IPTS, one of the ERMITE partners, is a service of the European Commission, so it could act from within the organisation.

- The key individual at the JRC-IPTS had worked before at DG Environment, was very well connected within the Commission, and was also a natural networker very willing to undertake this task.
- Exploratory contacts in the preparation phase of the ERMITE projects showed enough interest from several Commission services.

Notwithstanding these factors, the task of organising this stakeholder group was really difficult. It required a high degree of brinkmanship, trust building, in-depth knowledge of the ways of the Commission and a careful consideration of the political atmosphere of the on-going policy process. It was a touch-and-go activity carefully coordinated between the JRC-IPTS and the UNEW team, led for this purpose by the author. Two European Stakeholder meetings, in the form of *ad-hoc* inter-service meetings (see 'European Commission' in Section 1.3.1), were held. It was decided that this was the format most likely to attract the key staff in the Commission. The initial idea had been to form a European Stakeholder Group with Commission officers and other European stakeholders such as industry organisations, NGOs and researchers. However, after the Baia Mare report initiated the policy process within the Commission (see Section 6.4), it was clear that the only way to achieve good communication with the key services was to exclude all other external organisations and, instead, try to promote the idea of informative meetings between Commission services and researchers. Even within this format, it was only possible to organise one of those meeting at the very beginning of the consultations for the proposed Directive (see Tables 6-3 and 7-7) and immediately after the proposal was officially presented by the Commission. In the interim period, the situation was too "political" to organise such a meeting.

However, ERMITE managed to have a presence in the process through direct interaction with the officers of the Unit A.2 that were working on the proposal. This interaction was based on the perception that the project and, in particular, the Technical Coordinator (Prof. P.L. Younger) were a technically very proficient and independent source of information. During this time, Prof. Younger submitted written comments to the different working documents on behalf of the ERMITE partners. At the same time, our JRC-IPTS partner kept promoting and disseminating ERMITE outputs within the Commission both through direct mailings and through presentations in internal events.

Table 7-7 shows the key milestones in the interactions between ERMITE and the European Commission. The subsequent analysis will concentrate on the initial meeting, the interactions in the middle period and the final meeting. The narrative unavoidably reads rather like a "travelogue"; this is a consequence of the "action research" approach which this part of the work demanded.

Table 7-7 Milestones in the ERMITE-EC interface

Interface ERMITE- European Commission	
1st ERMITE EC Inter-service Meeting	**(01.06.2001)**
Written comments to A.2 for 2nd Working Document	**January 2002**
DG ENV Workshop 'Mine and quarry waste – The burden from the past' Lake Orta	**(27 – 28.05.2002)**
Written comments to A.2 for 3rd Working Document	**August 2002**
Written comments on draft Directive presented for Inter-service Consultation through DG Research	**March 2003**
2nd ERMITE EC Inter-service Meeting	**(14.11.2003)**

7.3.2 1st ERMITE European Stakeholder Meeting

The project ERMITE started on the 01.02.2001. Soon after that a project meeting was used to discuss the strategy for the 1st European Stakeholder Meeting. It should be borne in mind that at this moment the Baia Mare policy process was already progressing at full steam. The EC Work Programme for 2001 announced the proposal for a Directive for September 2001. The Unit A.2 had been working on the production of a first Working Document (DG Environment A2 2001) using the recently approved Landfill Directive as a template. A first technical meeting between industry and the EC took place on 25.01.01. A second meeting, again with industry but also involving DG Enterprise and WWF, happened on 06.04.01. Paul Younger attended this meeting as a technical expert invited by WWF (the WWF interface is discussed in Section 7.4). This gave ERMITE inside information about the technical discussions between the parties.

At the same time, the ERMITE partner at JRC-IPTS was tracking the process within the Commission. She also undertook the task of convincing the key policy officer at A.2 to co-organise an inter-service meeting bringing together all the Commission services with

an interest on the environmental regulation of mining and a number of research initiatives supported by the Commission. The policy officer was a French national with whom our JRC-IPTS partner (of joint Belgian/French parentage) soon developed an excellent rapport. In order to facilitate the event the JRC-IPTS did all the legwork, contacting the different services and looking after the logistic of the meeting. This was only possible due to her contacts and knowledge from her previous post at DG Environment; even so, it took a great deal of persuasive one-to-one conversations with all the EC actors involved. However, a meeting of this type did fit the logic of the process because, as explained in Chapter 1, *ad-hoc* inter-service meetings were a common procedure within the Commission. The official aim of this meeting was "*for the JRC to support the Commission services in the process of elaboration of EU legislation regarding mining activities*". Later during the meeting the participants were also informed that the event was also the 1st ERMITE European Stakeholder Meeting.

It is indeed noteworthy that the normal policy development process within the Commission does not include a step where DG Environment and DG Research take stock of the available outputs and expert networks from current and past projects. Instead, the Commission engages immediately with industry (which lobby other DGs and will be a stumbling block in the way) and, if necessary, NGOs. If RTD input is required it will take the form of *ad-hoc* studies commissioned to institutes within the networks of the Commission (or, frequently, the networks of the desk officers). And so in this case, the EC (A.2) commissioned a number of studies:

- A study on the management of waste in the EU (BRGM, a French research and consultancy institution).
- PECOMINES: Inventory, Regulations and Environmental Impact of Toxic Mining Waste in Pre-Accession Countries (JRC Ispra, Institute for Environment and Sustainability, Soil and Waste Unit).
- A study on the cost of improving the management of mining waste (Symonds Group in association COWI).

For internal political reasons ERMITE had already identified PECOMINES as one of the stakeholders that had to be invited to the meeting. The policy officer at A.2 pointed out to the need to involve BRGM, whose study was technical in nature and already quite advanced. Table 7-8 shows the list of entities participating in the meeting (the names of the Units correspond to the DG Environment organisation of the time and may

differ from the division shown in Fig. 1-3). The person representing each Unit was the key officer in charge of that particular portfolio. For the IPPC Bureau there were both the Head of the Bureau and the officer working on the BAT.

Table 7-8 Participants in the 1st ERMITE EC Inter-service Meeting

1st ERMITE EC Inter-service meeting (01.06.2001)	
DG ENV A.2	Proposal for a mining waste directive
DG ENV C.1	Seveso II Directive
JRC Seville	IPPC Bureau (BAT on tailings dams and waste rocks)
DG ENV B.1	Water Framework Directive
DG ENV 2	Follow up of Baia Mare and candidate countries
DG Enterprise	Non-energy extractive industry
DG Research	ERMITE desk officer
JRC Ispra	PECOMINES
BRGM	Study on mining waste in Europe
JRC-IPTS	ERMITE
UNEW	ERMITE

Remarkably, the ERMITE meeting managed to gather together for the first time both the full suite of initiatives triggered by the Baia Mare process and the on-going research projects linked to the Commission services. This in itself changed the perception of ERMITE from being a remote DG Research business-as-usual RTD project into a Commission resource, potentially useful within the constellation of the policy process. By sharing a platform with PECOMINES and the BRGM study, ERMITE had already acquired a degree of "respectability"; now the key issue was to use the occasion to demonstrate the potential usefulness of the project, its technical proficiency and to convey some targeted policy messages. This was the thinking behind the organisation of the event, which was carefully planned by the JRC-IPTS partner and the author.

The meeting was co-chaired by A.2 and the JRC-IPTS ERMITE partner. It started with a general introduction to the policy initiatives and the wish to offer policy support from research. It was followed by a number of short presentations with discussions split into two sessions, policy initiatives and research and a final plenary discussion. It was

purposely designed as a morning for friendly interchange of information in an "apolitical" context, in which the Commission officers could talk free of pressure. The emphasis was on promoting conversation between Commission services, which is why there were only 2 ERMITE representatives from UNEW and nobody else from the project.

ERMITE's contribution was:

- Presentation of the project by the author
- Presentation on the environmental impacts of mining activities by the technical coordinator with the core policy message arising from the PIRAMID and ERMITE projects

ERMITE was presented as a policy-oriented project, backed by a strong consortium and with the declared intention of raising the profile of mine water issues in European policy-making. The technical presentation focused on some of the key issues taking into account our knowledge of the on-going technical discussions for the proposed directive. In summary:

- Water is the main pathway for mining contamination.
- Regulating only the mine waste facilities and not the mines voids misses the main pollutant source.
- If the full life-cycle of mine operations is considered, the post-closure phase is dominant, but is poorly regulated.
- Problems are substantial and impact at the catchment scale (and beyond).

From the ERMITE perspective the meeting was only a half success. The presentations were very well received and the project lauded as very timely for the policy process. The discussions were lively and went in-depth into the topics. However, it also became clear that the original policy objective of the project, i.e. raising the profile of mine water issues in the Water Unit, was a lost cause (at least for the time being). On the one hand, the Unit saw themselves as being completely detached from the Baia Mare initiative. On the other hand, the only thing they could think about was the enormous task of the Common Strategy for Implementation of the WFD. It didn't help much that the leader of water issues in B.1 at the time was a poor listener, who came, gave a presentation (mainly about the CSI), discussed briefly and left. His opinion was that emissions from mines have to fulfil water quality objectives so there was nothing to

worry about. However, after his presentation it become apparent that something was not so clear if mines were out of the IPPC, as they were. The Head of the IPPC Bureau quickly (but inaccurately) pointed out that the BAT document would assure the protection of water quality; in spite of the fact that the remit of the BAT was still under discussion and its legal base very weak. At that time, the analysis of European polices presented in Chapter 6 was a task under construction. So the ERMITE partners could not articulate a clear answer to that statement. It was also apparent that none of those present had enough understanding of mine water processes to grasp the longevity of these problems (this one was a key point of the technical presentation) and the need to regulate for preventative action. These were important lessons that were taken into account in the 2nd Inter-service Meeting.

The importance of mine voids did impact on the other policymakers. It was an issue that nobody had contemplated so far. The officers from A.2 and C.1 took good notice of the message. It could be said that this meeting brought the issue quietly into the policy agenda by direct contact with the key Commission policy officers. Abandoned mines were also discussed. There was a request for information from A.2 about the ecological impacts of mine voids and mine management following closure. This information was later provided by the technical co-ordinator of ERMITE via JRC-IPTS. The inadequacy of the Landfill Directive as a template for the proposed Directive (see analysis in Section 6.3) was also discussed. The A.2 policy officer acknowledged that the reason they were using it was that it was seen as a recent well-structured Directive and with such a short timetable it was thought to be a good starting point. He also admitted that the feedback from ERMITE was similar to the feedback from industry.

Another potentially important outcome of the meeting was the contact established with the IPPC Bureau team working on the BAT document. This meeting happened before the first expert meeting at the IPPC Bureau so ERMITE could also have followed up that link. The reasons why that didn't happen are discussed in Chapter 9. However, after that point the technical credentials of the project were clearly know to the IPPC Bureau.

7.3.3 ERMITE/ Commission interface between Inter-service Meetings

Immediately after the 1st ERMITE Inter-service Meeting the policy process started to become more political with the organisation of the consultation meetings to discuss the

first Working Document; and so it would remain until the adoption of the proposal by the Commission (02.06.03). In this period the organisation of further *ad-hoc* inter-service meetings was out of the question. The Waste Unit was so entangled in the complexity of the consultation process that they would have seen another meeting as an unwanted extra burden. That meant that in the interim period the project had to find other ways of interfacing with the policy process.

The first step was to follow-up the 1st Inter-service Meeting with the distribution for comments amongst the key officers in the meeting of a draft version of the paper Kroll et al. (2002) *Regulation of Mine Waters in the European Union: The contribution of scientific research to policy development.* This paper included the key policy messages presented in the meeting, and a number of conclusions similar to those stated at the end of Chapter 6. However, part of this good work was undone by changes in the Commission. The policy officer of A.2 abandoned the Commission to take a job back in France. That left momentarily a vacuum in the process. Another officer from the Unit (an Italian national) was given the difficult task of progressing this dossier. This officer had been working until then in a completely different dossier (proposal for a sludge directive). In theory his appointment was a temporary arrangement. Later in 2002 a less experienced officer (a Greek national) was officially given this task; but the Italian officer continued to play an important role in the process. At more or less the same time, a new Director General came to manage DG Environment. Her appointment was seen as another step in the process of increasing the influence of business in the work of the Directorate[5]. A key issue for ERMITE was that the JRC-IPTS partner didn't have any previous contact with the new policy officer. So the interface with the A.2 had to be built up again from scratch.

The importance of networking and promotion of a project if it is going to be used as a policy platform is shown by the way in which this hurdle was overcome. The DTLR (later to become ODPM) Minerals and Waste Planning Division, which was in charge of following up the proposed Directive, and with the Environment Group of the Geological Society co-organised a **Workshop on the proposed EU Directive on**

[5] In January 2001 a written question (P-4150/00) from the European Parliament to the Commission expressed the view that the on-going reorganisation of DG Environment (including the dismantling of the very active Waste Unit headed by L. Krämer) was motivated by a pro-industry shift in emphasis.

Mining Waste in London on 12.12.2001 (ODPM 2002). The aim of the meeting was to inform, and receive feedback from, a wider audience about the plans for the Directive in order to shape the UK official position. The Technical Co-ordinator of ERMITE contacted the organisers pointing out that the UNEW was the co-ordinator and technical co-ordinator of two key European RTD projects, PIRAMID and ERMITE. As a consequence, he was invited to attend and give a keynote address ("The proposed EU Mine Waste Directive - a researcher's view from the drafting table"). Also presenting were other leading experts (including the author of Symonds Group study for the Commission), the DTRL officers representing the UK and, critically, the new EC policy officer. The ERMITE presentation repeated the arguments presented to the Commission in the 1st Inter-service Meeting, with an emphasis on the need to render the regulation of mining more compatible with the WFD. This meeting had several important outcomes. Firstly, the ERMITE message was presented to the key UK actors and the new EC policy officer. Secondly, the DTRL officer following the Directive joined the UK Stakeholder Group. Thirdly, it afforded an opportunity to have a good conversation with the EC policy officer (who was already aware of the project thanks the to 1st Inter-service Meeting and e-mail contacts with the JRC-IPTS), in which he explained he had the daunting task of producing a new Working Document early in the next year and he would really welcome input from ERMITE (particularly in the form of text that could be included in the proposal).

The UNEW team eagerly seized this golden opportunity. The author helped the Technical Co-ordinator to compile written comments on behalf of ERMITE, which were then sent to and discussed with the officer in a number of e-mail interchanges. The key issues taken on board by the officer were:

- Mine voids are an important source of pollution that should be included in the Mining Waste Directive (MWD).
- The MWD should take into account the long-term effects of pollution after abandonment.
- The MWD will have to be carefully designed to interlock with existing directives and, in particular, the WFD.
- The MWD should include arrangement similar to UK's mine abandonment regulations.
- Operators of limestone aggregate quarries and sand and gravel pits should not have to follow tests for acid drainage.

- Recognition has to be given to the intrinsic hazards of fine-grained materials that are classified as *"inert"* in addition to acid-generating materials.
- The need for binding rules for annual inspection and design review for tailings dams over a minimal size threshold.
- Minimum standards to ensure the need to put in place adequate after-use strategies for waste rocks and tailing dams (i.e. to plan for eventual decommissioning from day one).
- Avoid the Landfill Directive rules on no liquid disposal and no mixing of different kinds of waste.

While only the policy officer could definitely certify the influence of the ERMITE inputs in the text of the **Working Document No. 2** (DG ENV 2002a released on **04.02.02**), this text had already the main characteristics of the final proposal, and clearly incorporated most of the above features. The most important elements displaying influence by ERMITE were in:

- Art. 12 "Prevention of water and soil pollution from disposal facilities"
- Art. 13 "Prevention of water and soil pollution from mine voids" (to be completed)
- Art. 15 "Closure and after-care procedures" (more attention to surface and groundwater issues)
- Art. 16 "Inventory of closed mines and quarries" (now requiring to rank them according the environmental impacts and start remedial action of the upper tier within four years)
- Frequent cross-referencing to the Groundwater and Water Framework Directives.

This working document was better received than its predecessor. The next meeting of the ***Expert Committee*** **(21-22.02)** showed quite clearly that it was a better starting point for the negotiations towards a proposal. The ERMITE partner at JRC-IPTS attended the meeting as an observer from the EC services and provided feedback on the positions of the different member states. It was at this point that the UK representation (which included the ODPM officer who had joined the UK Stakeholder Group) started to show the main elements of disagreement with the ERMITE arguments, in an early indication of what would later become the official UK position (see Section 5.2 and Appendix 3).

These were: (i) the proposal to define "inert waste" so that it could be left out of as many provisions as possible and (ii) the reluctance to include non-waste issues (namely voids and abandoned mines). Regarding this point, it became clear during the discussion in the 2nd UK ERMITE SG Meeting that ODPM officers were oblivious to the existence of The Mines (Notice of Abandonment) Regulations 1998 (see Section 4.3.1). Later it also became apparent in discussions with the ODPM officers that the advice received from DEFRA was that mine voids were already covered by the WFD (which, as we have seen, is inaccurate to say the least).

ERMITE involvement in the EC policy process continued with the invitation to address the **Workshop on "Mine and quarry waste- the burden from the past" organised by the project PECOMINES (JRC Ispra) and DG Environment on the 27-28.05.02.** The paper presented by the Technical Co-ordinator "*Don't forget the voids: aquatic pollution from abandoned mines in Europe*" (in Puura et al. 2002) explained in clear terms the evidence for the need to regulate mine voids and elements that should be incorporated in the proposed Art. 13 of the Directive. This paper was very well received by the 70 participants and, following a request from the UNEP Mining Advisor present at the meeting, it was later translated into Spanish and French and posted as a special report on the UNEP website (it was also published in Mining Environmental Management, Younger 2003). ERMITE was referred to positively by many of the speakers including PECOMINES and Euromines Environmental Advisor.

The draft text proposed for the Art. 13 was based on the key elements of The Mines (Notice of Abandonment) Regulations 1998. The A.2 officers (the Greek officer was now in the team) thought it was sound, although they were anxious that the member states would vote it down. However, the text did find its way into the **Working Document No. 3** (DG ENV 2002b) published on the **05.06.02.** The new Art. 10 "Prevention of water and soil pollution" included the text as paragraph 10(5):

"*Member States shall ensure that appropriate measures are taken to prevent water and soil pollution from voids left to flood after closure. In order to do this, the operator shall provide the competent authority with information on the following elements:*

(a) Layout of workings to be allowed to flood;

(b) quantity and quality of water encountered in the workings during the last two years;

(c) prediction of the impact of any future pollution discharges to groundwater and plans for mitigation;

(d) proposal for flood monitoring.

The elements in subparagraphs (a) to (d) shall provide sufficient information to enable the competent authority to evaluate the operator's compliance with the requirements of Directive 2000/60/ECC."

The Working Document received many written comments that were posted on the webpage of DG Environment dedicated to the consultations for the proposed Directive. At this stage the consultations were really open and all the material was readily accessible (that webpage is now no longer available). It included the written comments to Working Document No. 3 prepared jointly by the author and the Technical Co-ordinator, who submitted them on behalf of the ERMITE project. Working Document No. 3 is the version of the text that best represented ERMITE's perspectives. The ODPM officer involved in the ERMITE UK Stakeholder Group sent the "non-official" comments from ODPM. His contributions had helped to improve substantially the Working Document No 2 and would also be taken into account in the next version. However, regarding the issue of mine voids the comments in his letter of 06.09.02 were: "*While the prevention of water pollution from voids left to flood after closure is an important issue (probably more so in relation to environmental protection than the management of mineral wastes), it is not a waste management issue and should not be included in this Directive. I understand the matter is already covered by provisions within the Water Framework Directive, and will be covered further by daughter Directives*". Euromines (letter of 02.09.02) asked to have the whole of article 10 deleted on the grounds of "duplication of legislation". Both positions reflect clearly the mainstream misperception that the WFD will be the panacea that will alone sort out all the water problems in all the sectors. Euromines argues its position from the perspective of avoiding repeating legislation, as recommended by the Commission's guidelines. However, as argued in Chapter 6 there is no repetition, as the WFD does not provide sufficient elements to ensure the same preventative measures apply to mining as are applied to other industries by means of the IPPC regulations. It is also remarkable that the UK argues that mine voids will be covered in further daughter Directives, when it is clear that this particular policy initiative is the only chance of legislating active water protection in the mining sector. Euromines (and the ODPM) also argued that "*the subject of voids do* [sic.] *not fit the scope of the directive as dealing with waste*". The fight for the scope of a Directive is a critical issue. As soon as it was labelled as a "waste" issue, parties with an interest in minimising legislation try to use legalistic

arguments to confine the proposed Directive as much as possible. According to the UK representative (Tom Simpson, *personal communication*), the ODPM opinion was based on the need to have consistent and clear waste legislation. By this time the rationale of the legislation is already blurred; although the Explanatory Memorandum of the final version proposed Directive by the Commission (CEC 2003a) acknowledges that the origin of the initiative is the Commission Communication entitled "*Safe operation of mining activities: a follow up to recent mining accidents*" (CEC 2000c), it goes on to state that the two main environmental objectives associated with the industry are water pollution and stability (i.e. not waste *per se*).

After the written comments from ERMITE for Working Document No. 3 were sent to the Commission there was a period of approximately half a year of low-level communication with Unit A.2. ERMITE partners were themselves submerged in the production of the deliverables of the project (amongst many other things). Meanwhile, the ERMITE JRC-IPTS partner kept disseminating ERMITE outputs directly to the EC officers and attending DG Environment events in the name of the Consortium. In that period, the A.2 officers were busily trying to generate a new version of the text that would be released internally within the Commission for inter-service consultation, at which point the doors previously open to external actors start to close. From now on, influence would be exerted through direct lobbying to the Commission services. In some sense, it could be said that the proposed Directive goes "underground" to resurface only as the final proposal adopted by the Commission. As explained in Chapter 1, in this phase there is more chance of involvement from the management board of DG Environment and the *cabinet* of the Commissioner. It is difficult to ascertain what were the movements in the background that shaped the final version of the text, even having access to some insider information through the JRC-IPTS. It seems that pressure from the industry exerted via other DGs and direct lobbying from Member States found an easy target in a DG Environment that was very willing to co-operate with them. What is clear from the ERMITE perspective is that although the desk officers at A.2 privately acknowledged their agreement with most of ERMITE's key propositions, they were not receiving much support on these views from senior management. Here it should be acknowledged the very important role of the environmental NGOs WWF and EEB (European Environmental Bureau) as the only voices that were waving the environmental flag at that level.

In **February 2003**, Unit A.2 sent around the text for **Inter-service consultation.** Both our partner at JRC-IPTS and the desk officer at DG Research responsible for ERMITE received copies, which were promptly sent to the Co-ordination team at UNEW. ERMITE had developed a very good working relationship with the desk officer at DG Research, who had been present at the first ERMITE Inter-service Meeting and had always supported and encouraged ERMITE's policy-impact orientation. Discussions with the ERMITE partner at JRC-IPTS showed that the best way of influencing this step of the process would be to submit the comments of the Technical Directorate of ERMITE as the official input from DG Research to the inter-service consultation; a suggestion that the RTD officer was willing to accept. This was an exceptional measure that, nevertheless, should be singled out as an example of best practice on the part of DG Research.

In the first instance, the ERMITE comments (collated and phrased by the author) expressed satisfaction with some aspects of the text sent for inter-service consultation, which reflected the previous comments sent by the project streamlining technical aspects of the text on the general management of waste facilities. However, regarding the three key policy points identified by the project (inert waste, voids and abandoned mines) it was clear that lobbying from industry and Member States was gaining the upper hand:

- The Art. 2 "Scope" excluded unpolluted soil and non-hazardous inert waste,
- there was no reference to voids,
- paragraph 13 (5) had disappeared,
- Article 19 entitled "Inventory of closed waste facilities" had been reduced to "*The Commission... shall ensure that there is an appropriate exchange of technical and scientific information between Member States, with a view of developing methodologies relating to... the drawing-up of inventories...the rehabilitation of ...closed waste facilities*".

Accordingly the three principal comments from ERMITE were:

1. Particular care needed to be taken in defining and regulating for "inert and non-hazardous waste". The definition proposed in Art.3(2) would exempt them from the safety controls proposed in the rest of the Directive. It was proposed that at least they should be subject to pollution control and safety provisions.

2. In concerning itself almost exclusively with regulating the management of mine waste outside of mine voids, the proposal was creating a loophole which in many sectors will result in the bulk of the mine waste being exempted from the controls that the Directive seeks. It was proposed to introduce a new Art. 11 with specific requirements for voids (and non-hazardous inert waste).
3. The current draft talks of acid and alkaline drainage as pH less than 5 or greater that 9 but the vast majority of polluted leachates associated with mine wates have a pH between 5 and 9 (e.g. Younger et al. 2002). It was proposed to use the more general term "polluted drainage".

At this stage the co-ordination team thought that it was not worth addressing the serious deficiencies of Art. 19. It was clearly a very political point with great opposition from Member States (paradoxically also from the UK which has one of the few working examples of a rolling remediation programme), although other Member States favoured it, and most of the environmental specialists would agree that abandoned sites constitute the major problem.

A key issue at this moment was that, together with general comments, a full revision of the very text of the proposal with alternative wordings in many sections was also included. To the surprise and delight of the ERMITE team, most of those comments were incorporated in the final draft and appeared in the version adopted by the Commission. The main ones are listed in Table 7-9. A few comments were not incorporated, for instance, significant amendments of Art. 22 "Transitional provisions" and paragraph deletions in Annex 1.

Thus it was that ERMITE finally managed to have a proven influence in the proposal adopted by the Commission. Of the three key policy issues championed by the project, two (treatment of non-hazardous inert waste and mine voids) were partially incorporated in the text. Abandoned mines were included but with a very unsatisfactory treatment (exchange of information). Achieving this 2/3 score had become possible only through the links that ERMITE had developed within the Commission, and the skilful use of all feasible 'pressure points' within the institutional context, thanks in no small part to the inside knowledge provided by the partner at JRC-IPTS. At this stage, the officers of A.2 were well acquainted with ERMITE views and trusted the recommendations of the Technical Co-ordinator, who had proved to be a very fast and

accurate editor of technical texts. The fact that ERMITE could submit very detailed constructive written comments at a moment when there were fewer comments of that type around probably increased the impact of the recommendations. In other words, ERMITE managed to talk clearly to understanding ears when there was much less background noise.

Table 7-9 ERMITE contributions to COM (2003) 319 final

- Multiple text corrections in the Explanatory Memorandum,
- Art. 2 (Scope)

  New paragraph 2(3) enumerating the provisions to which non-hazardous inert waste would be subjected.
- Art. 3 (Definitions)

  ERMITE suggestions for the definitions (4) "mineral resources" or "minerals"; (6) "tailings"; the elimination of the definition of "acid drainage" or "alkaline drainage"; and amendment of (18) rehabilitation.
- Art 4 (General Requirements)

  Amendment of 4(1) and a new paragraph 4(2) about which technical considerations should be taken into account in the measures to reduce the impact of the waste facilities.
- Art. 6 (Major-accident prevention and information)

  New wording of 6(2) and 6(3) and 6(4).
- Art. 8 change of title to (Public Participation).
- New Art. 10 (Excavation voids) requiring appropriate measures to secure stability, prevent pollution of surface and groundwater and monitoring.
- Art. 13 (Prevention of water and soil pollution)

  Final version of subparagraphs 13 (1) with measures to prevent pollution.
- Art. 14 (Financial guarantee and environmental liability)

  Elimination of former paragraphs 14(3) and (4).
- Art. 16 (Inspection by the competent authority)

  Elimination of former paragraph 16(1).
- Art. 17 (Obligation to report)

  New paragraph 17(2) requiring Member States to inform on events notified by the operators.

7.3.4 2nd ERMITE European Stakeholder Meeting

After the publication of the proposal on the 02.06.2003, the initiative went to the European Parliament, which had to proceed with the 1st reading (see the diagram of the co-decision procedure in Figure 1-2). At this stage the ERMITE group at UNEW was working very closely with WWF supporting their interactions with the European Parliament.

The ERMITE Co-ordination Team now considered it feasible and opportune to organise a second Inter-service Meeting. This time the objective was to present the findings of the project directly to policymakers. For that purpose a project meeting was organised and managed by the author in September 2003. The meeting was devoted to analysing the policy recommendations of the project and how they matched with different policy areas of the Commission. The process of how these recommendations were translated into policy briefs is described in Section 8.1. Similar to the process followed for the 1st Inter-service Meeting, the ERMITE partner at the JRC-IPTS and the author were working together for months on the slow process of gathering support for the meeting amongst the Commission services. By this time, ERMITE had once more developed excellent links with the Unit A.2 team, and the Greek policy officer agreed immediately to co-organise the meeting. Bearing in mind the key policy areas (see Table 8-1) identified for project dissemination, the JRC-IPTS tried to secure the participation of as many senior staff as possible.

The meeting on **"Mining, Water and EU Policies"** was formally co-organised by DG Environment, DG RTD and JRC-IPTS and held at DG Environment on the **14.11.03.** It was presented as an initiative of ERMITE. The aim was for JRC and DG RTD to support the Commission services in the process of developing EU policy initiatives regarding mining activities. While ERMITE had this time much more control over the agenda, it had to very carefully follow formal procedures to invite senior management. For instance, the letter of invitation had to come directly from the Head of Unit of Technologies for Sustainable Development at JRC-IPTS marked as a "Note for the Attention" of the Heads of all the Units that were invited to attend. Table 7-10 shows the final attendance list for the meeting. The IPPC Bureau sent their apologies, as the meeting nearly clashed with a working group meeting for the BAT document (which by now had evolved sufficiently for it to be clear that it contained little of interest to

ERMITE). One remarkable coincidence was that the person representing DG Enterprise was the former UK ODPM officer who had been now seconded to the Commission, and who was now following this dossier for that DG. He, the two Unit A.2 officers and the author had met two weeks before in the consultation meeting organised by the *rapporteur* of the European Parliament presented in Section 7.4. The ERMITE Inter-service Meeting provided a more relaxed environment where the arguments discussed in the Parliaments could be revisited in confidence.

Table 7-10 Participants in the 2nd ERMITE EC Inter-service Meeting

2nd ERMITE EC Inter-service meeting (14.11.2003)	
DG ENV A.2	Proposal for a mining waste directive
DG ENV B.1	Water Framework Directive
(HoU, WFD, Groundwater)	Research input to water policy
DG ENV A.3 (HoU)	Environmental Liability
DG RTD I.3 (HoU)	FP5 Sustainable management and quality of water
DG Enterprise E.2	Non-energy extractive industry
DG TREN B.4	Energy extractive industries
JRC Ispra	PECOMINES
JRC-IPTS, UNEW, UNIOVI NIOO, UNEX, KTH, UF, HEI	ERMITE
USA Department of Energy, NETL/ EST Division (Director)	ERMITE invited USA expert

The day was divided into four topics (waste, water, environmental liability and technology). For each topic, there would be one presentation by an EC officer and one presentation by ERMITE. The ERMITE presentations were carefully co-ordinated to convey a particular policy message to particular officers present in the meeting. Before the meeting different ERMITE partners had been given the task of carefully reviewing several aspects of the current policy initiatives (the WFD in particular) that could possibly be relevant to the discussions. The project team had to show both technical and policy proficiency, being able to debate policy issues at the level of the desk officers. By this time, the project partners had become a very efficient policy-oriented team. The ERMITE policy briefs were distributed at the beginning of the meeting and referred to

by the ERMITE partners when appropriate. The thematic discussions were complemented with three other presentations:

- *The situation of mine water in the USA and Europe* by R. Kleinmann from the National Energy Technology Laboratory (a world-expert invited by the ERMITE project)
- Update of the project PECOMINES
- *Research needs in support of water and policies* by the Unit B.1 officer involved in the Groundwater Directive (and previously employed at DG RTD).

Involving three Heads of Unit in one meeting was in itself a great success. Senior staff are very busy and would only spend a limited time in a meeting. Moreover, they are fully aware of their hierarchical position and entangled in a web of internal political sensitivities and personal animosities. In this case, in order to have the Heads of Units B.1 and I.3 opening the day, our JRC-IPTS partner had to use all her convincing powers (even on the very morning of the meeting). However, her extraordinary efforts provided a crowning moment for ERMITE when both Heads of Units decided to stay for the first topic presentations and participated in the discussions.

The author and the Technical Co-ordinator had discussed at length the strategy that the latter would follow in the discussions taking into account the information available from the work with WWF and the meeting at the European Parliament. They had also reflected on the lessons from the 1st Stakeholder Meeting. The difference this time was that the Head of the Water, Marine and Soil Unit was chairing the discussions and the A.2 officers were well aware (and convinced) of the arguments. Critical was also the presence of the B.1 officer who was now in charge of the CIS for the Water Framework Directive (no longer the same officer who had attended the 1st Inter-service Meeting). Two important issues to bear in mind here are that Unit B.1 would not naturally interfere with a dossier led by Unit A.2 and that the message that the Head of Unit (HoU) B.1 was receiving from the WFD group was that there wasn't any problem with the proposed Directive from the water perspective.

In his opening address the HoU B.1 gave a quick review of the main policy initiatives in his Unit (WFD, Groundwater Directive and Soil Strategy) and acknowledged that the issue of the meeting was right at the cutting edge of the current policy challenges. After that, the first talk was an update on the proposal for the Mining Waste Directive by the

A.2 policy officer. This was followed by the key presentation by the Technical Co-ordinator on *Water in the proposal for the mining waste Directive* which was specifically designed (by the author and the Technical Co-ordinator) to convey to the Water Unit, as powerfully and unambiguously as possible, the three policy messages expressed in the ERMITE policy brief No.1 (see Section 8.1): abandoned mines, mine voids and inert waste. These three messages were later fully supported by the presentations given by the other ERMITE partners and by R. Kleinmann from the USA perspective.

The discussion that followed the presentations went to the heart of ERMITE policy proposals. It involved mainly the HoU B.1, the key officer of Unit A.2, the UK officer seconded to DG Enterprise (who knew well the positions of the industry and Member States), prompted by the ERMITE Technical Co-ordinator conveying well-rehearsed messages agreed with the author. Regarding the issue of inert waste, the A.2 officers were of the opinion that the current proposal was already addressing this issue (partly thanks to the amendments to the scope suggested by ERMITE). Although the ERMITE team begged to differ, the question was laid aside. Regarding the legacy of abandoned mines, the HoU B.1 asked A.2 whether the Directive would cover historical sites. The answer was: "very lightly"; whereupon the HoU expressed his concern that the WFD seems to be considered a panacea for all, quoting similar problems with the Common Agricultural Policy, and saying that he didn't like everything being pushed to the WFD. The A.2 officers replied that they agreed, but that this issue and the issue of mine voids should be discussed with the Member States who opposed both ideas. The UK officer (DG Enterprise) commented that the Member States saw this proposal strictly as a daughter of the Waste Framework Directive. At this point the Technical Co-ordinator explained clearly the author's arguments (presented in Section 6.3) regarding the lack of complementary instruments for preventative water management in the mining sector. He pointed out that the procedures built in the WFD fell short of what was required; and that even with their best will the Water Authorities would not have the capacity to identify this threat in time to enforce preventative action. The HoU B.1 acknowledged that this would be a problem; if the mine voids were not included in the Mining Waste Directive the entire burden would fall again on the WFD. His opinion was that this could not be dealt with solely through providing detailed guidelines because they would not have legal weight. The UK officer (DG Enterprise) asked whether it was legally possible to extend the scope of the Directive. The opinion of the A.2 officers was that it

was, because the legal basis of the proposal was directly Art. 175 (1) of the Treaty which would definitely allow for a wider definition of the scope; and that there was in any case the legal precedent of other waste legislation that covered issues that were not strictly waste (e.g. packaging legislation). At the end of the discussions the HoU B.1 repeated his view that these issues should have legal backing in the new Directive. This opinion was supported by the HoU of DG RTD I.3, who had now understood how the MWD would be the appropriate instrument to act at the operator level.

From the ERMITE perspective, that was it; finally the project had achieved the policy objective of raising the profile of mine water issues in Unit B.1, the very home of the Water Framework Directive. However, the author was fully aware at that moment that to transform the newly gained insights by the HoU B.1 into political capital would require following the same slow process of trust building and long-term argument as with the A.2 officers. ERMITE was coming to an end and would cease to function as a platform to connect RTD in mine waters and policy. So although this meeting was a clear success for the project, it came too late to produce long-term outcomes for this particular policy objective. But, as the argument developed in this section has shown, a policy-oriented project has to choose where to concentrate its limited efforts during its short life span. In this case, influencing a legal document looked like a much more important gain than trying to obliquely influence Unit B.1 by the production of *ad-hoc* WFD guidelines for mine water (which they might never read, let alone adopt). In any case, ERMITE did produce these guidelines (ERMITE Consortium 2004), so there would always be a chance for other actors (e.g. WWF) to undertake the task of promoting them within CIS circles.

These views were confirmed by the events in the rest of the meeting. The main event of relevance for this dissertation was the long discussion that the project team maintained with the B.1 WFD officer. The team had already gathered intelligence about his likely views and potential reactions (which was fully confirmed in the meeting). His presentation was scheduled for the second period when the HoU of B.1 and DG RTD I.3 had left (the HoU of A.3 only attended the third session). His plan was to give his presentation and leave but due to the importance of the discussions in the first session and the solid arguments posed by the ERMITE team he did his best to return in the afternoon session and take part in the final discussions. Remarkably his presentation started with apologies because he was going to give us the standard talk on the Common

Implementation Strategy when it was obvious that the team already knew all about it (the Swedish partner and the NIOO partner demonstrated this proficiency in the following presentation and discussions). He also said that he would not contradict the HoU B.1, implicitly acknowledging that his views were not (or had not been) the same. When challenged by the ERMITE team about the difficulties we had experienced in trying to bring mine water to the attention of the WFD team, his opinion was that this meeting showed how seriously B.1 was now taking the issue. When asked specifically how ERMITE guidelines could be part of the CIS, the answer was more vague. His view was that at this stage the guidelines being developed were more general, and perhaps this was an issue that should be revisited two years down the line. However, he encouraged ERMITE to disseminate the findings with external partners and to contact the Working Groups on River Basin Planning and Pressures and Impacts. This was worthless advice for the project, because it would mean having to convince the officers of the Member States leading those groups, which time now precluded. In any case, ERMITE could now achieve more in the brief time remaining by contacting WWF, who had already worked hard to introduce as many mining issues as possible into the *Analysis of Pressures and Impacts* document (CIS 2003). Not completely by coincidence, the B.1 officer in question happened to receive during the day a WWF position paper on the 1st reading of the proposed Directive by the European Parliament. He was pleasantly surprised to see that WWF was raising exactly the same issues as ERMITE, and that the project was quoted in the document. He congratulated the project and encouraged us again to reach actors outside of the Commission, and even the European Parliament (which we were by then already doing). Similar views were expressed at the end of the discussion by the Unit A.2 officers, who were thankful for the unremitting pressure that we had exerted to raise these issues, and hoped that the team would be still available for consultation in the future.

This meeting marked the end of the interface activities with the Commission by ERMITE as an active project. By this time, this interface had come where ERMITE wanted it to be, working directly with A.2 and B.1 to ensure that the voice of RTD was heard in the policy process. However, this final meeting had also some important lessons for policy-orientation. It showed clearly how the desk officers, who have so many responsibilities in the development of the dossiers, saw themselves as hostages to the pressures from inside and outside the Commission, in particular from Member States. In the case of the WFD, a handful of staff was for the first time trying to co-

ordinate the implementation of a Directive at European level. It is somehow understandable that they would not like to be distracted by what they consider "side issues" (although the ERMITE team's opinion was that it was not peripheral at all given the scale of mine water impacts). The opening assumption of the WFD officer was that he was going to be confronted by yet another WFD-related RTD project run by academics who lacked understanding of policy requirements and were ever ready to proclaim the need for more research. It was in some ways a pity that it took him the whole day to allow himself to admit that ERMITE was perhaps a different type of animal. The experience is symptomatic of the problem that officers feel they are working in a management vacuum, with senior management being so overwhelmed by heavy workloads and intense political pressure that they do not have the chance to think strategically, and do not charge anyone to take responsibility for cross-cutting issues.

7.3.5 Evaluation of the EC policy interface

The successful development of the ERMITE/EC interface is the single greatest achievement of the work reported in this dissertation, and indeed of the ERMITE project as a whole. As described above, it required extreme diligence from the ERMITE team to get the right policy messages across to the right actors. It was above all a team effort, in which the author played the role of strategic coordinator. It would not have been possible without the dedication of the JRC-IPTS ERMITE partner to the project, and her commitment to the belief that the Commission should work with more open lines of communication. It would also not have been possible without the figure of the Technical Co-ordinator, who was receptive to the author's briefings, became the bearer of the evidence, was able to deal in depth with technical questions, and had the necessary communication skills to get the message across and participate in the policy debate.

Key virtues of ERMITE were the capacity of the project to adapt to the rapidly-changing political context and to use efficiently the possibilities provided by the institutional framework. The decision to transform the European Stakeholder Meetings into internal Inter-service Meetings proved to be a shrewd move. The two Inter-service Meetings provided ERMITE with the platform from which to influence the opinion of the Commission at two critical moments: the beginning of the policy process within the EC and the beginning of the second step of the co-decision procedure (1st reading at the

EP). In the meantime, ERMITE used all possible occasions to get its main messages across. This underlined the importance of networking and promotion of the project findings. A critical issue was the capability to submit written comments to the lead Unit as an independent voice. In the end, the agreement of DG RTD to submit ERMITE comments as their official comments in the Inter-service Consultation turned out to be the critical moment in relation to impact on the policy text.

7.4 WWF and the European Parliament

The original thinking behind the European Stakeholder Groups was to mix EC officers with some critical actors at European level. WWF and Euromines had been identified as the main candidates. However, after Euromines refused to engage with ERMITE (see next Section) and the policy process gathered momentum, it was decided to interface directly with WWF, which was a very active (and vocal) political actor, through the link already established by the UNEW team. For internal political reasons, it was very important to keep watertight the interactions with WWF so that they would not jeopardize the slow work of trust building that the JRC-IPTS partner was undertaking within the Commission. The involvement with WWF would not have disturbed the relationships with A.2 or B.1, who as seen above welcomed this engagement and saw it as a sign of credibility of the project, but it could potentially affect the attitude of other sectors of the Commission such as DG Enterprise.

The WWF was one of the few environmental NGOs that were following closely the policy process and actively influencing EU policymakers. This dossier was being pursued by the WWF European Freshwater Programme based at the European Policy Office. The leading officer was a Spanish national with considerable policy experience (amongst others gained by the negotiation of the WFD), thorough knowledge of the ways of Brussels, access to all key policy actors, an incredible amount of political energy, and an established profile with DG Environment. WWF had taken a very pro-active role in shaping the process as a consequence of the Aznalcóllar accident described in Section 6.4. They had raised awareness at EU level mainly via supplying questions which the European Parliament asked of the Commission. They had also joined the expert group advising DG Enterprise on mining and environmental issues. This work would eventually lead to the *Communication on Promoting sustainable development in the EU non-energy extractive industry* DG Enterprise (COM (2000)

265f). WWF also participated in the discussions with DG Environment that would shape the Baia Mara policy process. According to internal WWF documents, they see themselves as the initiators of the concrete proposals for legislative changes later followed by the Commission. WWF was then working very closely with both DG Enterprise and DG Environment. An important consideration is the degree to which WWF shaped the political agenda. WWF was well aware that the Irish proposal to follow the IPPC route to regulate mining (as had already been done by Ireland at the national level when they transposed the IPPC Directive) was technically sound; but they would prefer to see a waste initiative because IPPC would rule out straight away the chance of incorporating the issue of abandoned mines. Paradoxically, WWF was well aware of and involved deeply in the implementation of the WFD; but probably because of that they were conscious of the impossibility of pushing any new legislation from the water side.

The Technical Co-ordinator of ERMITE (Prof. P. Younger) had previously met some key WWF officers in meetings related to the Aznalcóllar disaster in Spain. In September 1999, WWF was looking for a technical expert who could further detail the WWF's technical recommendations. So Younger was approached by WWF to fulfil that role. From that moment on Prof. Younger, and the rest of the UNEW team, became the main source of technical advice for WWF. This was exactly the time at which ERMITE was being created by the author and Prof. Younger. So as explained in the previous section, the Technical Co-ordinator of ERMITE was at the same time the key technical advisor to WWF. As such, he was able to attend consultative meetings organised by the Commission; and the UNEW ERMITE co-ordination team had access to all the WWF internal communications about the evolution of the Directive. This gave us an extra reference point to add to the information that we were receiving directly from the Commission.

The WWF European Water Policy Office is a very professional organisation. They prepare briefings and position papers for each and every step of the process; and take care that all the key actors (which they will contact directly if necessary) receive and use them. The UNEW team contributed to all the briefings prepared by the WWF during the policy process. WWF would prepare the first draft versions and pass them to UNEW for corrections and comments. In essence, the briefings were representing WWF opinions about the diverse options in the policy process, while UNEW was taking care

that the content was technically sound. One consequence of this engagement was that the technical recommendations coming from WWF were very similar to ERMITE's recommendations. At the same time, WWF gained confidence on the soundness of their proposals and their capability to match industries' inputs. If one compares the ERMITE comments to the Working Documents and the WWF briefings there is a clear difference in style. ERMITE concentrated on a selected number of basic technical issues; meanwhile WWF consistently takes a "maximalist" position, always arguing all the aspects of all the points in the policy texts. "Going for all, all the time" is WWF's strategy for ensuring that their policy bargaining power remains high throughout the whole process. The WWF Policy Officers are always refining the presentation of the different policy comments and calculating the chances of success for each of them.

From the point of view of this dissertation, the interface ERMITE/WWF became critical when the proposal entered the second phase of the co-decision procedure with the 1st Reading at the European Parliament. As explained in Section 1.3.1, the EP, and in particular the Environment Committee, have traditionally played the role of defending environmentalist positions within European policies. WWF has a very fluent relationship with many MEPs and it is fully aware that this is the step of the policy process at which they can have maximum impact. While the hard work of lobbying the Commission is influential, it doesn't pay such high political dividends. The work of lobbying the different Member States through the WWF country officers is quite haphazard, depending on the interests and contacts of the local WWF office and their capability to understand the details of the policy discussion.

In this particular case, WWF had a very good relationship with the Swedish *rapporteur* (already in contact with the Swedish ERMITE team) and worked very closely with him in all the steps of the process (see Table 6-3). The objective was to shape the amendments to the European Commission text in the *rappoteur's* draft report and the subsequent adoption by the Environment Committee of the amendments that would be presented to the 1st Reading Plenary vote by the EP. There are two key contributions of the UNEW team to this operation: the drafting of the WWF Position Paper on the European Commission proposal for the European Parliament and the participation in the roundtable discussion organised by the *rapporteur* to inform the draft report for the Environment Committee.

The Position Paper (WWF 2003)[6] acknowledges the contributions of Prof. Younger and the author, mentions specifically the ERMITE project as one of the bases to support their arguments and quotes ERMITE reports. This is a document specifically designed to inform and influence the opinion of MEPs. Most of the MEPs would have very little knowledge (or none at all) of the background to the Directive, so this type of document has to provide enough contextual reference to position the initiative. An important issue here was to remind the MEPs the important role that the Parliament had played in the revision of the Seveso II Directive. In spite of the declarations of intent in the Commission Communication "*Safe operation of mining activities: a follow-up to recent mining accidents*" (CEC 2000c), the Commission and the Council had tried to restrict the scope to only certain mining operations. It was only thanks to the inclusion of the Parliament in the 1st and 2nd Reading of all mining activities using dangerous substances that this option finally prevailed during conciliation. The document also provided key general comments on the main issues of the proposed Mining Waste Directive and specific comments, with 58 proposed amendments to the text, each with its own full justification. This last item is very important because it provides the MEPs the exact information needed to present their own amendments to the text. The position paper had an annex with a summary of the most important amendments, signalling whether they were included or not in the draft report prepared by the *rapporteur*.

The Position Paper was ready just in time for the meeting organised by the *rapporteur* (MEP Jonas Sjöstedt) at the **European Parliament** on the **03.11.2003** for an **Exchange of views on the management of waste from the extractive industries (COM (2003)319)**. The author attended this meeting as the technical expert invited by WWF, representing UNEW. This meeting, together with the 2nd Inter-service Meeting at the Commission two weeks later, was the top policy engagement of this thesis and the ERMITE project as a whole. A clear proof that at this stage the aim of this thesis had been partly fulfilled was the fact that in the introduction of the WWF team, the WWF officer gave as credentials of the author the management of the EC ERMITE project, confirming the role of ERMITE as a platform to influence European policy-making. Table 7-11 provides the list of participants in the exchange of views.

[6] This was the document received by the EC WFD officer during the 2nd ERMITE inter-service meeting.

Table 7-11 Participants in the Meeting at the European Parliament

EP Exchange of views on Mining Waste Directive (14.11.2003)	
European Parliament	ENVI secretariat
	ENVI PPE MEP and staff
	ENVI PSE MEP and staff
	ENVI ELDR MEP and staff
	ENVI GUE/NGL MEP (rapporteur) and staff
	ENVI EDD MEP
	ITRE MEP (draftperson)
European Commission	DG ENV A.2
	DG Enterprise
European Council	Italian presidency
	Irish presidency
	Council Secretariat
Invited Organisations	WWF (ERMITE)
	EEB
	Euromines
	UEPG

The meeting was chaired by the *rapporteur*. It was attended by MEPs of the parties represented in the Committee on the Environment, Public Health and Consumer Policy (ENVI) and the MEP of the Committee on Industry, External Trade, Research and Energy (ITRE) in charge of the drafting the opinion of ITRE on the proposal (see Abbreviations and Acronyms for the names of the parties). The Commission was represented by the two policy officers of the Waste Unit (A.2) who co-organised two weeks later the 2nd ERMITE Inter-service Meeting, and two officers from DG Enterprise (one of them being the UK officer seconded from ODPM). The Council was represented by the secretariat, the Italian presidency and the representatives of the future Irish presidency. As external organisations, there were members of Euromines and the European Aggregates Association representing the Non-Energy Extractive Industries Panel on one side and the WWF/EEB team on the other.

The WWF officer and the author had rehearsed in advance the WWF presentation based on a selection of critical points from the Position Document. This reflected WWF's

opinion, which included the main policy points raised by the ERMITE project. Table 7-12 shows the 7 critical issues identified by WWF:

Table 7-12 Main weaknesses in the proposal for a Mining Waste Directive, as identified by WWF

1. Scope is too limited with the exclusion of non-hazardous waste from some (main) provisions and ignoring excavation voids.
2. Safety of waste facilities should be improved by ensuring that their design is implemented throughout their constructional life.
3. No inventory of closed waste facilities and no obligation to remedy their environmental impacts.
4. No deterioration of water conditions from existing facilities should be allowed during the transitional period.
5. Need to assess risk of pollution from voids before closure and act accordingly to prevent pollution from new ones, as well as to inventorise existing ones.
6. Direct discharges of wastes to water should be prohibited.
7. The location of waste facilities should not affect protected areas

At the beginning of the meeting the *rapporteur* presented his views, which already incorporated some of WWF main points, such as the need for restoration of abandoned sites, better closure and after-closure procedures and the location of waste facilities. Interestingly, the WWF/EEB and the Non-Energy Extractive Industries Panel interventions were the main elements of the meeting. Euromines and the UEPG concentrated on the issue of the scope. First, the need to leave out top soil and overburden; and second the fact that after the AvestaPolarit ruling (see Section 6.3) backfilled material was to be considered as a residue and as such should be left out of the scope of the Directive. In the discussion that followed, the Commission answered to both side's comments and the author was in charge of defending the technical arguments behind WWF comments. The main interventions were about the three key ERMITE issues: scope, voids and abandoned mines. Regarding scope, industry was reminded of the dangers to the aquatic environment of non-hazardous materials and the possibility of generation of leachates by topsoil. On mine voids, there was an evident degree of frustration amongst the DG Environment officials who clearly agreed with

WWF comments. The UK officer asked the author the question whether mine voids would be covered by the WFD, which gave occasion to explain to the whole audience the policy points about this issue, as presented in Section 6.3 (and later also explained to the Commission in the second Inter-service Meeting). Finally, concerning abandoned mines, in which the *rapporteur* had a special interest, three points were made:

- The review work within the ERMITE project has shown that abandoned mines are by far the main environmental problem, especially in Eastern Europe.
- Art. 19 of proposal from the Commission only asked for exchange of information with a view to developing methodologies for the drawing-up of inventories of closed waste facilities and the rehabilitation of facilities with negative impacts. The audience was reminded that these methodologies already exist and are being applied in remediation programmes in the UK, Czech Republic and Portugal.
- The Commission in its Communication "*Promoting sustainable development in the EU non-energy extractive industry*" (CEC 2000a, p. 9) had expressed the stronger opinion that "*...inventories should be made of these sites and of the environmental problems they cause, which should make it possible to identify corrective measures in close coordination with the Member States*".

All in all, the evaluation of the WWF team was that the intervention in the meeting had been very successful. The WWF officer would not have been able to present such a strong position without the support of the UNEW team and the input from the ERMITE project, a fact that was openly acknowledged by the organisation. For example, after the meeting WWF shared with the *rapporteur* the author's analysis of the industry's position, pointing out that leaving voids out of the Directive would in fact expose industry to prosecution for water pollution failures from voids based on the Environmental Liability Directive without the protection of having fulfilled existing legislation.

The ERMITE team had still one more opportunity to support WWF work on the Parliament in a meeting at their Brussels office two weeks later. At that meeting, several team members, including the author, helped WWF discuss some questions on the draft report presented by the *rapporteur* prior to its presentation to the Environment Committee. Arguments about the need for long-term care of closed facilities were rehearsed. The importance of using the term "*site*" in the new proposed Art. 18a (which

Table 7-13 Key WWF/ERMITE amendments in the EP 1st Reading text

- Art. 2 (Scope)

  2(1) Specification of waste as tailings, waste rock, overburden and topsoil;

  2(3) More provisions for non-hazardous inert waste.
- Art. 5 (Waste Management Plan)

  5(2ba) Considering short and long term management during operation and after closure already in the design phase.
- Art. 7 (Application and permit)

  7(2ba) Information on the type of mineral and the nature of any overburden and/or gangue materials that will be displaced.
- Art. 10 (Excavation voids)

  Adding the words "*and other production residues*" to the introduction;

  10(2) Prevention of pollution in accordance with new Art. 13.4(a).
- Art. 11 (Construction and management of waste facilities)

  11(2ca) Validation of design, location and construction by an independent expert.
- Art. 12 (Closure and after-closure procedures of waste facilities)

  12(5ba) Passive or active water treatment facilities are set up when necessary.
- Art. 13 (Prevention of water and soil pollution)

  13(1) Specific reference to the need to prevent the deterioration of water status according to the WFD;

  13(4a) Provisions to prevent deterioration of water status from the flooding of underground voids and back-filled surface mine voids and requirement to provide information similar to that requested by The Mines (Notice of Abandonment) Regulations 1998 (see Appendix 3).
- New Art. 18 (Inventory of closed sites)

  Requirement to produce inventories of closed *sites* and to start restoration of the upper tier four years after the entry into force of the directive

asks for an inventory and remediation of abandoned facilities) was also emphasised. The definition of "*site*" in the proposed Directive as "*all land at a distinct geographical location under the management control of an operator*" meant that usually that would encompass both waste facilities and voids. Another important issue was the addition of

the words "*and other production residues*" when talking about backfilling of waste in excavation voids (Art. 10) to take into account the AvestaPolarit ruling.

The collaboration with the *rapporteur* and the heavy lobbying of MEPs by WWF was very successful, and the final draft report with 78 amendments included many of the WFD recommendations to which UNEW had contributed (EP 2004a). Finally, on the 16.03.04 the Environment Committee adopted the report by 26 votes to 5, with 9 abstentions. This was a crucial step because that meant that there was cross-party support for the report and most probably the MEPs from those parties would vote for the Committee recommendations in the plenary. And so it happened, in the session of 31.03.04 the Parliament approved in 1st Reading the Commission proposal with 74 amendments most of them from the Environmental Committee report (EP 2004b). Key amendments for which the author's inputs from the ERMITE perspective are responsible are listed in Table 7-13.

Evaluation of the WWF/EP interface

The interface with WWF was not planned as such in the original project but grew organically during the lifetime of the ERMITE. The interaction with WWF added a complete new dimension to the policy strengths of the project, which became more important as the process moved from the Commission to the European Parliament.

In summary:

- It provided a source of immediate intelligence on the evolution of the policy process.
- It gave a complementary pathway to influence the interaction with the Commission.
- It increased the kudos of the project in the eyes of some key actors within DG Environment.
- It proved to be extremely efficient as a way of influencing the European Parliament.
- It guaranteed that the messages from ERMITE would continue to influence the policy process after the end of the project.

Two important points need to be made about this type of interface:

(i) Firstly, the collaboration with an organisation such as WWF entails supporting a particular political option, which could jeopardize the interactions with other stakeholders. However, in this particular case WWF (together with EEB) played a very important role as the only independent champion of the environment in the discussions of the Directive and as such it was a natural ally to the ERMITE policy enterprise. Moreover, the organisation paid particular attention to the correctness of their technical arguments and was very keen on being led on those issues by a team with impeccable science/engineering credentials. Regarding the interactions with other stakeholders, at no point did any other parties view the links with WWF as a problem. On the contrary, the dialogue with WWF empowered the position of the UNEW team and the ERMITE project.

(ii) Secondly, this interaction is very time demanding. The extreme professionalism of the WWF policy officers means that the pace of activity is very high. The requests for information come always in real-time and with very tight deadlines as the organisation has to react to every single step of the process and try to influence as many stakeholders as possible. The existence of the ERMITE project allowed the UNEW team more space to nurture the WWF interface. It was a conscious resource allocation decision that proved to pay worthy dividends when the European Parliament produced the 1st Reading Document.

7.5 Euromines

The UNEW team has a strong ethos of collaboration with industry and regulators. Within the UK, it is highly regarded by the main independent operators and the R&D organisations supporting the industry. The team also works with multinationals based in the UK, in particular, with Rio Tinto. Globally, the ERMITE Technical Co-ordinator is a key member of the industry's 'Global Alliance' combating acidic drainage.

Euromines is the European Association of Mining Industries, Metal Ores and Industrial Minerals. The association has an office in Brussels and acts as one of the main lobbyist for the non-energy extractive industry in the EU. As such, Euromines played a critical role in the Baia Mare policy process, making a strong representation to the Commission.

It was particularly involved with the development of the BAT guidance document in collaboration with the IPPC Bureau.

Euromines was the first organisation contacted by the UNEW team to join the Stakeholder Group, following on from a recent interaction of Prof. Younger with the Director of the organisation. The organisation replied that they didn't see any benefit to them from joining the project. However, this opinion was destined to change during the lifetime of the project. The prominent presence of ERMITE in the policy process described in this chapter was soon noticed by Euromines representatives. The first sign of change was the very positive interactions with the Euromines environmental advisor during the Lake Orta workshop organised by the Commission. He was personally keen to join the Stakeholder Group, but by then the dynamics of the project had evolved in way in which it was difficult to accommodate their input, partly due to time limitations. At the same time, Rio Tinto was a member of the UK ERMITE Stakeholder Group and an active member of Euromines. Rio Tinto staff also recommended that Euromines should talk to the ERMITE project. As a consequence, ERMITE was invited to join a meeting of the Task Force on Water of Euromines on 29.09.03. However, the short notice given to the invitation (one week) and problems to accommodate the timing of the next meeting in the agenda prevented this participation.

In summary, ERMITE did make some impact on Euromines. At very least, the organisation had to acknowledge the role of the project as an active actor in the water and mining discussions. However, taking into account the positions taken by Euromines during the policy process, most probably the discussions with Euromines would have been a poor use of resource from the point of view of influencing the policy process. Euromines has a rather "old-fashioned" pro-industry stance that does not always reflect the opinions of the more advanced companies among its own membership. Furthermore, they view themselves as the proper "experts" in the field and are not very open to technical advice from academic partners.

7.6 Conclusion: policy interfaces and policy impact

This Chapter has provided a detailed account of the interfaces through which the ERMITE project interacted with the EU policy process on the environmental regulation of mining activities. It has shown that, without the active establishment and operation of

these interfaces within a framework of strategic policy orientation, an RTD project cannot expect to have much impact on an "alive" policy process such as the one described here. It was only through careful planning, sheer determination, active gathering of intelligence, strategic use of resources and adaptation to emerging opportunities that the policy interfaces came to produce the desired objectives.

The dynamics of policy impact had two major aspects. First, a broad action of promotion and dissemination of key policy messages amongst a wide variety of policy actors. Second, accurate interventions in particular moments (*windows of opportunity*) of the process where it was possible to influence directly the wording of key policy documents. The Chapter has demonstrated how the aim of this thesis was achieved, by tracing the pathways in which particular elements of the current proposal for Mining Waste Directive have been influenced by the work of the ERMITE project.

A key element has been the simultaneous use of several policy interfaces. The National Stakeholder Groups provided the backbone for this strategy. *Per se*, they would not have achieved much at the level of European policy. But they gave the project a network of contacts with other policy actors with a presence at that level. The functioning of the EU as a union of Member States results on policy processes mainly staged in Brussels but with ramifications in all these States. Some of the contacts established through the NSGs came to have an important role at European level, for instance the UK ODPM officer later seconded to DG Enterprise and the Swedish MEP who acted as *rapporteur* in the European Parliament. The interface with the EC was the frontline of the policy work during most of the lifetime of the ERMITE projects. This was an interface in permanent evolution. However, good teamwork using mainly the strategic position of the JRC-IPTS partner and the kudos of the Technical Co-ordinator was able to maintain the necessary interactions, bringing issues into the policy agenda and, critically, suggesting amendments to the Commission policy texts. It was a rewarding experience for the ERMITE team to hear from the DG Environment policy officers involved with the Directive their appreciation of the hard work put into this interface. Finally, the collaboration with WWF brought the ERMITE project to a completely new dimension of policy interaction in a symbiotic relationship with the advocacy operations of the organisation. WWF found in UNEW the technical partner that it required to give solid foundations to the very successful policy work initiated in the wake of the Aznalcóllar disaster. Through UNEW, the ERMITE policy objectives

found in WWF a very powerful and resonant platform, able to speak loudly in the cacophony of voices involved in the policy discussions. Both members of the partnership were delighted to see the impact of their work in the 1st Reading of the European Parliament. Because ERMITE was a finite enterprise, it was not able to act any longer as platform to influence the policy process. But hopefully, the continuation of the collaboration WWF/UNEW could help to sustain the ERMITE policy objective until the final version of the Directive reaches the statute books.

8 EU: POLICY RECOMMENDATIONS AND CONCLUSIONS

8.1 ERMITE policy briefs

One of the tasks of this thesis was the facilitation of the process of condensing the findings of the ERMITE project in the format of policy briefs targeted at the European Commission. Facilitation included task definition, steering of the working groups producing each of the policy briefs and edition. Well-tested guidelines for policy brief writing from the DFID Natural Resources Research Programmes were used for this purpose. These guidelines require:

- clear identification of the recipients of the recommendations
- 1 or 2 sides of A4 per brief
- short statement of key policy recommendations; if possible referring to specific changes in policy documents
- justification for the recommendations

These guidelines are similar to the practices for internal policy briefing within DG Environment (A. Kroll, *personal communication*) and the briefings produced by WWF for policymakers in Brussels.

The policy briefs were designed to be presented at the 2nd EU Stakeholder Meeting. So they were targeted at particular areas of policy-making within the Commission (shown in Table 8-1), and in particular DG Environment, which could benefit from the findings of the projects. The following areas were identified:

Table 8-1 Policy areas and Commission Units targeted for policy briefing

Policy Areas	Target Commission DG/Units
Mining Waste Directive	DG ENV A2
Water Framework Directive (water resources, ecology and economy)	DG ENV B1 (Water)
Conservation Policy (Habitats and Birds Directives)	DG ENV B2
Soil Policy	DG ENV B1 (Soil)
Environmental Liability Directive	DG ENV D2 & A2
Environmental Technology	DG ENTERPRISE, DG TREN, DG ENV
Enlargement (Environmental Policy)	DG ENV E1, B1, A2

These are the key policy recommendations of the ERMITE project in relation to mine water for each of these areas of EC policy making:

1. Water and the proposed directive on management of waste from the extractive industries

- To require EU Member States to launch national 'rolling programmes' of remediation for pollution problems associated with abandoned mine sites.
- To ensure that the strong links between mine wastes and the mine voids from which they arose are taken fully into account in the design of management strategies.
- To ensure that so-called "inert" wastes (such as sludges composed of carbonate or silicate minerals) are prevented from causing siltation of natural water bodies.

2. Mining and the Water Framework Directive

2.1 WFD Water Resources

- To coordinate general water management plans and action programmes with remediation decisions for old and new mined ground and mine wastes, and individual permits for new mining projects.
- To ensure that water management authorities have the necessary competence and resources to appropriately lead mine water pollution prevention and remediation programmes.
- To develop generally accessible, coordinated, transparent and reproducible water information systems, necessary for specific pressure-impact assessment of mine water pollution and general integrated water management.

2.2 WFD Ecology

- To include specific operational linkages to the proposed Directive on the management of wastes from the extractive industries in the guidance documents on best practices in river basin planning.

- To include an additional category in the priority substances list, making explicit reference to metal mixtures so that case–specific limits and standards are produced for such mixtures
- To include a specific category of Heavily Modified Water Bodies for highly contaminated mining areas, including downstream areas of influence.
- To incorporate the extractive industries into the list of priority areas of action for the integration of water policy into other Community policies.

2.3 WFD Economics

- To ensure that coordination of policy programmes for mine water pollution abatement is based on economic principles aimed at making the best use of society's scarce resources for water quality protection and improvement.
- To ensure that strategic steps for economically optimal management programmes are taken in mine water pollution abatement programmes.

3. Mine water and conservation policies

- To include a provision requesting that the renewal of a license to operate mining sites likely to affect conservation sites is treated as regards Article 6 of the Habitats Directive as a new project
- To introduce a specific link to the Habitats Directive (Article 6) within the Guidance document on the analysis of pressures and impacts of the Water Framework Directive, requesting the joint assessment of the impacts of projects affecting water quantity and quality on Natura 2000 sites.
- To introduce a specific link to the Habitats Directive (Article 6) within the Guidance document on Heavily Modified Water Bodies (HMWB) and Artificial Water Bodies (AWB) of the Water Framework Directive, demanding specific risk analysis as an additional requirement for the declaration of HMWBs and AWBs situated in the vicinity of Natura 2000 sites.
- To indicate in future updates of the document "Managing Natura 2000 sites" that Natura 2000 sites situated in areas affected by extractive activities should make use of the information [about existing and abandoned sites] generated by the proposed Directive on the management of wastes in the extractive industries.

4. Mine water and soil policy

- To take into account the special requirements of mining, where large amounts of soil are inevitably disturbed, some of which have naturally elevated background concentrations of potentially toxic elements.
- To recognise that water draining from mine sites can come from a wide range of different sources e.g. tailings, waste rock piles and / or mine voids, and should be managed appropriately.
- To ensure that a European Soil Protection Strategy will not undo positive elements of existing national-level mining laws in which sector-appropriate soil protection measures are already in force.

5. Mining waste and civil liability

- To streamline the definition of "operator" to close potential loopholes in the liability regime by adopting a Community-wide definition with no discretion for the Member States.
- To guarantee clean-up of environmental damage caused by ongoing mine water pollution where no active mining takes place any longer.
- To connect liability to loss occurrence rather than to industrial activities (temporal scope of the regime to include ongoing damaging events).

6. Water technology and the mining industry

- To foster the adoption of 'hydrologically-defensive' measures throughout the entire life-cycle of mining operations, with a strong emphasis on early planning for post-closure management, favouring 'passive' remediation technologies to deal with post-closure water legacies.
- To establish the use of mine system hydrological and solute mass-balances as key operational measures for evaluating the environmental performance of mining and mineral processing operations.
- To develop policy instruments which favour use of non-potable sources of water in mining and mineral processing, and/or seek to minimise mining-induced salinisation of natural fresh waters.

7. Environmental regulation of mine water and enlargement

- To support institutional reorganisation and capacity building for the environmental regulation of mine water and remediation of abandoned sites.
- To support the development of regional and national policies and legal frameworks for achieving sustainable use of mineral resources.
- To integrate the environmental remediation and socio-economic development of mining areas into the Country Strategy Papers and related EU programmes.

8.2 Conclusions on European policy and mine water

The key policy question addressed in this thesis is the degree to which European policy covers mine water issues. In Chapter 6 a thorough analysis of the coverage by existing policies was provided, as well as a first evaluation of the issues that should be covered in future policy development. Chapter 7 has examined in detail how the ERMITE project interfaced with the drafting of the proposal for a new Mining Waste Directive, and how some mine water issues have entered the policy documents under discussion.

At the start of 2005, this is the state reached by new European policies affecting the environmental regulation of mine waters.

Environmental Liability

The Environmental Liability Directive (2004/35/CE), which entered into force in 2004 with national implementation three years later (and which was actually being developed before the Baia Mare report), makes mining operators liable for the clean up of contaminated sites. The regime applies to (2.) waste management operations and all discharges into the (3.) inland surface water or (4.) groundwater that require a permit, authorisation or registration in pursuance of the Water Framework Directive. However, the operator will not bear the cost if the emission fully complies with the permit conditions (Art. 8.4(a)). From the operators perspective this means that it should be in their interest to have a wider scope in the proposed Mining Waste Directive, including a clear framework for the management of voids in closure and post-closure, as long as the conditions set by the Directive are reasonable according to best practice.

Seveso II

In its original proposal the European Commission [COM (2001) 624f] amended the Directive to include only chemical and thermal processing of minerals and related storage operations and tailings disposal facilities, as long as they involve dangerous substances regulated by the Directive. The European Parliament introduced new amendments calling for an extension of the scope to all mining activities. Under the final agreement, the Directive covers chemical and thermal processing operations and storage related to those operations plus operational tailings disposal facilities containing dangerous substances, when used in connection with both chemical/thermal and mechanical/physical processing of minerals. The Directive 2003/105/EC of 16 December 2003 amending the Directive 96/82/EC was published in the Official Journal on 31 December 2003. Members States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive before 1 July 2005.

BAT for Management of Tailings and Waste-Rock

The IPPC Bureau established a Technical Working Group (TWG) in June 2001 to develop a technical document that would contribute to the knowledge available to prevent accidents from tailings and waste-rock disposal facilities and provide technical support for legislative activities of the European Commission (e.g. proposed Directive on mining waste). Usually, TWGs are organised to facilitate the exchange of information between the European Union's Member States and industry under the IPPC Directive but this TWG was set up with the only legal basis of the Communication of the Commission after the Baia Mare Task Force [COM (2000) 664f]. The TWG works at the level of technical experts, though it is fair to say that many of the individuals involved lacked comprehensive, up-to-date sector specific expertise. This meant that the preoccupations of particular national mining sectors (especially Sweden) have managed to impose their particular perspective on the document (as evidenced by the preponderance of Swedish examples cited) with little independent challenge. The TWG decided that the scope of the work were activities related to mineral processing, tailings and the waste-rock management of ores that have the potential for a significant environmental impact or that can be considered as examples of good practice. The document covers 14 metals, 10 industrial minerals, coal only if processed (lignite is not covered) and oil shales. The issue of abandoned mines is not addressed in the work. The final draft reference document on BAT for management of tailings and waste-rock from

mining activities (IPPC Bureau 2004) was published in March 2004 (http://eippcb.jrc.es).

Proposed Directive on the management of waste from the extractive industry

After the European Parliament approved its 1st Reading, the proposal followed the next step of the co-decision procedure (see Figure 1-2). First the Commission gave its opinion about the amendment of the Parliament. In summary the Commission agrees with 1/3 of the amendments, partially agrees with another 1/3 and disagrees with the rest. Although this is an improvement from the original proposal, there is partial or total disagreement on the amendments of scope, prevention of pollution from mine voids at closure and remediation of abandoned voids. The European Council has also discussed the proposal reaching a "Political agreement on a Common Position" made up of the text proposed by the Dutch presidency and compromise package with 4 changes adopted in the Environment Council meeting of 14.10.04. The Council should formally adopt the position 5-6 months after the political agreement. Once the Common Position is official it will go to the EP which will have up to 4 months to produce their 2nd Reading. After that, most probably there will be a Conciliation between EP and the Council under the UK presidency in the second half of 2005.

The Common Position of the Council (CEU 2004) is quite close to the Commission proposal and does not include most of the amendments from the Parliament. The scope is still reduced, with inert waste and unpolluted soil excluded from Articles 7, 8, 11(1) and (3), 12, 13(4), 14 and 15 unless they are in a Category A (higher risk) facility, which is an improvement from the Commission's position. Article 10 (*Excavation voids*) is kept nearly with same contents as in the Commission's proposal, which practically guarantees that this ERMITE contributions will appear in the final version of the text. Article 11 (*Prevention of water status deterioration, air and soil pollution*) is also very similar to the Commission's version. So it maintains the strong water status deterioration wording introduced in the first versions of the working documents but it doesn't include that paragraph with the provisions of The Mines (Notice of Abandonment) Regulations 1998. Regarding abandoned waste facilities, a new Article 18a (*Inventory of closed waste facilities*) goes further than the Commission and makes mandatory to draw up and maintain inventories of closed facilities (including abandoned facilities) which cause a serious impact or have the potential to cause it. Article 19 (*Exchange of information*) only requires exchange of information with a view

to developing methodologies relating to the fulfilment of Article 18a and the rehabilitation of closed facilities, falling short of requiring any remediation at all.

Most probably the final negotiations will occur under the UK presidency, which means that the opinion of Government of the UK will be critical when steering the conciliation between the Council and the Parliament. The role of the UK government in the development of the Commission's proposal has been thoroughly analysed and criticised in Chapters 4, 5 and Appendix 3 of this thesis. According to the internal communications from the UK negotiators that are received by the Environment Agency, the UK team is very pleased with the political agreement. Most probably their satisfaction is related to the treatment of non-hazardous waste in Article 2 (*Scope*), which has been one of the main issues pursued by the delegation from the very beginning of the project. All in all, the main driver of the UK negotiators has been to reduce as much as possible the need to introduce any changes at all in the UK regime. From the point of view of this thesis and the ERMITE project, it is indeed revealing how "unenlighted" the UK position has been in this process. First of all the Environment Agency has not shown any real interest in influencing the environmental content of the proposal. The only concern of their management has been to avoid at all costs any new responsibility. However, this is the very same agency that has to prosecute operators because of pollution by siltation of natural bodies. It is also the same agency that contributed to the establishment of The Mines (Notice of Abandonment) Regulations 1998 as a tool to help them prevent pollution from abandoned mines. And also the same organisation that has to deal with the water status failures from abandoned metal mines due to the lack of any national programme of remediation. It is clear that the interests of the Agency would be much better served if the proposed Directive were to require a programme of remediation of the worst sites, which in the case of the UK could be very easily dealt with by allowing the coal remediation programme to cover all types of mines. Secondly, the UK Ministers have been unable to realise that they could contribute, with very low cost to the country, to a solid piece of legislation which could bring about considerable benefits at continental and even global scale, taking into account the increasing internationalisation of the mining industry. Unfortunately, in this case the environmental and internationalist rhetoric of the Labour Government has proven to amount to empty words.

The overall picture at the European level is that the policy framework for mine water management has improved considerably since the Aznalcóllar and Baia Mare disasters. The combination of the four policy developments described above guarantees a much higher degree of environmental protection. However, the resulting framework is still quite patchy from the perspective of mine water management. The strong waste bias of the main policy initiatives has prevented the emergence of a more comprehensive regulatory regime. The outcomes of the policy process can be analysed using the criteria set at the end of Chapter 6.

1. **The integration of the energy and non-energy mining activities which up till now have been treated by the EC as being independent, in spite of their commonality in terms of process and management techniques of mine water.**

The outcome has been quite satisfactory in relation to overcoming the artificial segregation of mining activities. The scope of all initiatives includes both energy and non-energy activities. However, the energy lobby did succeed to win the exception of including coal only if processed (lignite is not covered) in the BAT document.

2. **The desirability of taking a full life-cycle approach to the environmental regulation of mining activities, as opposed to concentrating exclusively on accidental pollution (e.g. dam breaks) and management of waste facilities.**

This is one of the main failures of the current approach. With its focus on the management of waste facilities it has created a regulatory regime that does not correspond to current best practice in the industry, where the whole site is treated in an integrated manner with preparation of the post-closure phase from the very beginning of the design. Attention to full life-cycle management of waste facilities did improve during the discussions of the proposed Mining Waste Directive. However, it is only the version arising from the 1st Reading of the European Parliament that presents a satisfactory framework.

3. **The scope of the draft BAT document should be expanded to encompass key mine water issues as well as wastes.**

The BAT document (IPPC Bureau 2004) does include techniques for the prevention of emission to water with, amongst others, sections on seepage management (4.3.10) and techniques to reduce emissions of water (4.3.11). However, the treatment of these subjects is very parsimonious (passive treatment is covered in one page and a half) and

does not provide enough operational information. This is partially compensated with the inclusion of practical examples in the Section 3 (Applied Processes and Techniques). The main problem with the BAT is its very focused scope, which only covers the following topics in active mines (although some examples of recently closed mines are discussed):

- Waste-rock management
- Mineral processing relevant to tailings management
- Tailing management
- Topsoil and overburden if they are used in the management of tailings.

This is very far from providing a comprehensive BAT framework for the management of mine water in mining operations.

4. The inclusion of mining voids in the mining waste initiative.

Thanks to the efforts of ERMITE, Article 10 of the Mining Waste Directive will cover excavation voids. However, the necessary measures for the prevention of pollution at closure are only included in the version arising from the 1st Reading of the European Parliament.

5. The key environmental issue in the mining sector is pollution from abandoned mines.

Together with the scope this is the big remaining open issue. Only the version of the Parliament includes the duty of restoration of abandoned sites (not only waste facilities). As it stands, the version of the Council will only force countries to draw lists of abandoned waste facilities and not actually to do anything about them. This entails three major mistakes. Firstly, drawing lists only of abandoned waste facilities will miss the main source of pollution which are the mining voids, as the UK experience has demonstrated. Secondly, only the duty to start a programme of remediation will guarantee that something is actually done about the worst cases. Thirdly, the WFD will force anyhow to restore some of these sites. The UK experience has shown that the most cost-effective way of doing it is with national remediation programmes which can harness the necessary expertise and bring economies of scale and not with the ad-hoc remediation of independent sites

6. The degree to which the present policy initiatives take into account the scale of the river basin unit defined by the WFD, and the need for the implementation plans of the WFD to incorporate specific guidance on the management of mine water pollution.

One of the successes of the ERMITE project has been the cross-referencing of the WFD with the proposed Mining Waste Directive. However, the implications of this connection have not been yet appreciated by any of the policy actors, except for WWF. As shown in Chapter 7 the WFD team at the Commission is too busy with the implementation strategy to champion the river basin perspective in the discussions about the environmental regulation of mining, and they lack the expertise to appreciate the implications. ERMITE has produced thorough guidelines to minimise the mining impacts in the water environment (ERMITE Consortium 2004). The Common Implementation Strategy working groups should produce a similar document.

9 CRITICAL DISCUSSION: HARMONISATION OF POLICY AND TECHNOLOGY IN EUROPEAN ENVIRONMENTAL POLICY MAKING

9.1 Critical issues in the ERMITE project

The harmonisation of policy and technology is directly linked with the degree to which RTD efforts are taken into account in policy development. The previous chapters have shown how difficult it is to establish an interface between an EC DG Research supported RTD project and on-going policy-making within DG Environment. However, as has been demonstrated in Chapter 7, the ERMITE project did achieve a degree of success in influencing the letter and spirit of the proposed Directive on mining waste. It is thus relevant to undertake an analysis of the factors that contributed to this success and to identify lessons that can be learned for improving the broader technology / policy interface at the level of European policy-making.

Chapter 1 provided some theoretical background on the interface between RTD and policy. The "Context, Evidence, Links" model proposed by the ODI RAPID project presented in that Chapter will be used here as the theoretical framework within which the experience of the ERMITE project will be analysed. A new category called "Project Management" has been added to the framework by the author. This category allows the examination of the purposeful design and steering of the project, which rendered it a successful human activity system suited to purpose. The next Section of this Chapter progresses the analysis, comparing the ERMITE experience and the lessons from the theoretical background with the current thinking in DG Environment on how to improve the RTD / policy interface in that DG.

9.1.1 Political context

This category has been identified by the RAPID project as the most critical variable in affecting the uptake of research into policy. The key dimensions in this category are:

- Macro-political context
- Specific context of policy formulation
- Decisive moments in the policy process
- The way policymakers think

The **macro-political context** in the European Union should be in theory quite conducive to a good interface between RTD and policy. The Member States of the European Union are all well-established democracies with acceptable standards of governance, including accountability, transparency and responsiveness. Democratic contexts imply the existence of more entry points into the policy-making process. However, there is a common perception, particularly in the UK, that the European Union is a project led by unaccountable eurocrats in the European Commission. The complicated (not to say Byzantine) policy-making process of the EU described in Chapter 1, tends to reinforce this impression. The experience of the ERMITE project is that the macro-political context does provide enough entry points to make the process permeable to the influence of lessons from research; however the number of institutional actors (see Figures 1-1 and 1-2) is so large that the research voice is easily drowned out amidst the cacophony of political interests. Moreover, there are no institutionalised mechanisms to ensure that RTD lessons are fully taken into account, so that interventions from researchers are at best *ad hoc* at present.

The existence of three very distinctive key institutional actors (the European Commission, the European Parliament and the Council of Ministers) means that research lessons have to reach each of them in order to ensure a fair hearing in the process. As discussed in Chapters 1 and 7, the policy process in the European Commission has several mechanisms for internal and external consultation. Internally, compulsory consultations between DGs, through inter-service meetings and informal interchanges, provide the main openings to influence the work of DG Environment. In practice, unfortunately, it is always the more powerful DGs aligned with the interests of influential industries that take the upper hand in these consultations. DG Research, which controls 80% of Community investment on RTD (Moussis 2002), seems to see itself simply as a system to distribute funds rather than as a potential source of intelligence for policymakers. Accordingly, it is not geared up to play an important role in specific inter-service consultations. The ERMITE experience has shown that a different institutional model is possible and indeed desirable. First, it was through the active participation of a member of the JRC-IPTS, who was willing to use all feasible institutional mechanisms to facilitate interface activities, and through the openness of the desk officer at DG Research, that ERMITE managed to establish links with DG Environment. The JRC is strictly an autonomous department of the Commission which acts as a science and technology reference centre for the Union, and undertakes research

with an European dimension directly funded by the Community (Moussis 2002). In theory, the mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of Community policies. In the policy process on mining waste led by the unit A.2, the JRC Institute for Environment and Sustainability based at Ispra played a policy-making support role through the PECOMINES project. The objective of PECOMINES was limited to the involvement of Candidate counties in a research action on the environmental impact of mining waste, in collaboration with DG Research and the European Environment Agency (Hámor 2002). In the case of ERMITE, the JRC-IPTS (Seville) played the role of connecting an indirect RTD action funded by DG Research with the core policy-making process. However, this was an exceptional development which (notwithstanding its compatibility with the stated JRC mission) encountered considerable institutional resistance within JRC-IPTS management. The role of the IPTS as *connector* (cfr. Gladwell 2001) is discussed later in the category Links. What should be noted here is that, as described in Section 7.3, ERMITE access to the inter-service consultation mechanism through JRC-IPTS and DG Research was a critical success factor, with a proven impact on the content of the final proposal for a Directive that came out of the Commission (CEC 2003a).

The current format for external consultation in the form of expert committees and consultative committees does not provide an adequate forum for RTD input. In this case, the expert committee had a mixture of civil servants from Ministries (e.g. ODPM in the UK) and designated experts from Member States' technical institutes (e.g. Instituto Geológico y Minero of Spain). The opinions expressed by the members of this committee in the consultation organised by Unit A.2 usually reflected State positions based on the opinions of national industry representations, which were often not even fully informed by the RTD lessons of their own countries! (At least this was the case with the UK, as discussed in Chapter 7 (see also Appendix 3)). The consultative committee was mainly formed by representatives of industry and the WWF. Accounts of the discussions of some of the meetings (P.L. Younger *personal communication*) report that, paradoxically, WWF opinions, informed by the technical advice of UNEW, were quite close to the opinions expressed by environmental experts from some of the big multinational companies (e.g. Rio Tinto). The same could not be said of the opinions expressed by mining industry associations, who generally adopted uncritically reactionary positions. In the phases of preparation of the Directive under control of the

Commission there is, at least, the opportunity to prepare technical reports to support the work of the policy officers. While these reports could easily include open-minded appraisal of the evidence from RTD, in practice they are mainly limited to particular aspects already determined by the *frameworks of possible thought* of the officers. For instance, in this case it was only the active promotion of agenda items by ERMITE that allowed the issue of mine voids to gain consideration.

It should be said the ERMITE was actively encouraged by the DG Research desk officer to promote and disseminate the results of the project in the EP. However, there are no active institutional mechanisms to support RTD feedback to the Parliament and ERMITE had to find its own ways, firstly by direct contact with MEPs (e.g. the Swedish group and the *rapporteur*) and secondly by indirect contacts via WWF. In this case, the *advocacy coalition* between WWF and UNEW (reflecting ERMITE opinions), allowed some ideas from RTD to reach key members of the Parliament, and have a demonstrable impact on the 1st Reading (European Parliament 2004b).

The Council of Ministers is the most difficult institution to reach. The expert committee provides a first taste of what the country positions will be when the real negotiations start. In the case of the UK, the ERMITE experience reflected this country's tradition of policy-making by close policy communities in which producers are strongly represented (Carter and Lowe 1995). Although the project did contact ODPM and provided strong arguments for its technical arguments (Appendix 3), based on RTD efforts supported by the Environment Agency and the Coal Authority, we neither received feedback nor observed any change of position. It is difficult in such circumstances to sustain credulity in the *bona fide* nature of supposed consultations.

The **specific context of policy formulation** was a key issue in this case. If the active policy process started by the Baia Mare report had not already been underway (in particular, the work on the proposed directive on mining waste), there would have been no chance that ERMITE would have had any demonstrable impact. Even with the environmental impact of mining high on the political agenda in the Waste Unit (A.2), it proved really difficult to get the message across to the Water Unit (B.2) of the same DG Environment, where mining was very low in the policy agenda relating to implementation of the WFD. Moreover, ERMITE had to deal with a very high degree of political contestation. Given the strength of evidence presented, it was not particularly

difficult to convince EC officers (once we had their ear) of the importance of the findings of ERMITE, but it was a long struggle to keep the three key ERMITE issues (voids, abandoned mines and inert waste) as headline items in the agenda. The sources of resistance were multiple, ranging from the initial disinterest of the Water Unit, through active lobbying by (ill-informed) industry associations, to the negotiation positions of Member States (which as often relate to horse-trading over votes on other issues as to real national concerns). In that sense, it is really remarkable that the article about mining voids introduced in first drafts of the proposal reached the text accepted by the Council. The resistance from industry (inert waste) and Member States (abandoned mines) meant that only the WWF-influenced text of the European Parliament paid enough attention to those issues. Another important point is that in this case the demand from policymakers was about general technical guidance, but not on guidance about the particular topic of mine water. ERMITE had to generate its own demand for it. At the end, the close working relationship with the EC A.2 Unit policy officers was one of the most rewarding aspects of the ERMITE project.

ERMITE (thanks in large measure to the work developed in this thesis) was particularly successful at reacting in **decisive moments of the policy process**, adapting to the constraints and opportunities of each step as they arose. The critical factors here were active application of a detailed knowledge of the policy process (timing, actors, policy contents) and a deep understanding of institutional environments and structures. These were acquired by intense collaboration between the author and the partner at JRC-IPTS (who was an insider and had worked in DG Environment before) and the parallel collaboration with WWF policy officers. This work was truly demanding, but necessary in order to keep track of the evolution of the politics of the process. This supports the observation by Nutley (2003) that researchers have to learn to work "with the political grain of the policy process". Timing was a key issue. It was only thanks to the early interactions with the Commission that ERMITE managed to influence *agenda setting*. Contacting the EC policy officer at the very beginning of the project was, indeed, a critical success factor. Otherwise ERMITE would have missed the train of the policy process. Later, it was important to accommodate and react swiftly to the evolution of the process and unhesitantly use the *windows of opportunity*. For instance, there was a period in the middle of the project in which it was not politically feasible to organise an inter-service meeting, but the project managed to maintain the required *sustained interactivity* by other means.

Finally, it was very important to take into account **the way policymakers in the EC think.** Here, the direct experience of the JRC-IPTS collaborator and her ability to judge situations in the Commission was critical. One of the key "invisible" efforts in the project were the lengthy discussions between the author and the JRC-IPTS partner, trying to make sense of the on-going thinking within the Commission with the available (and always incomplete) information. The JRC-IPTS collaborator had a very well developed network within the Commission, and in DG Environment in particular, to which she could refer for information and advice. One very important aspect of this effort is to understand the pressures under which policy officers operate. Usually, policymakers cannot handle simultaneously all the issues facing them; they engage in selective problem definition and agenda setting on the basis of the perceived salience of an issue, judgement over which is determined by a combination of preferences and political context. Working with and not against the Waste Unit policy officers was the only way to give mine water issues the relevance that was lacking due to the disinterest of the Water Unit. Active efforts to develop mutual trust helped to make Unit A.2 officers appreciate that ERMITE was a resource that they could very well use to navigate through the technical complexities of a field in which they were not experts. The ERMITE experience also shows how the balance of power with a DG affects the work of the policy officers. From the evolution of the drafts of the Commission it can be implied that convincing policy officers is not enough when the management is ready to accommodate the views from other DGs or external interests.

In summary, this case study confirms the recommendations of the RAPID project that researchers need to get to know policymakers, their agendas and the constraints they operate under. They need to identify potential supporters and opponents. They have to keep an eye on the horizon and prepare for opportunities in regular policy processes; and they have to look out for, and react to, unexpected policy windows.

9.1.2 Evidence

The category **Evidence** refers to the relevance and credibility of the research and how it is communicated. The message from ERMITE was highly relevant to the policymakers in the Waste Unit, but was originally perceived to be vaguely relevant by policymakers in the Water Unit. This may explain the paradoxical situation in which waste officers become internal champions of a water issue. However, ERMITE ideas were challenging

the *frameworks of possible thoughts* of all the officers involved. As described in Chapter 7, the importance of mine voids came as a surprise to all the officers participating in the 1st Inter-service Meeting. This was an issue that none of them had thought of before. Even, after the 2nd Inter-service Meeting the resistance of the key Water Unit officer to change his opinion about the importance of this issue was remarkable, given his own lack of knowledge on the matter. In the end, what swung his support was the observation that WWF had adopted this issue as a prominent element within their agenda.

ERMITE managed quite early to establish its credibility. One of the key ideas behind the core thesis of this dissertation, i.e. that an European RTD project can serve as a platform to influence policy-making, is based on the assumption that the existence of the project *per se* is a credibility asset that needs to be exploited. The ERMITE team was carefully selected to boost this asset. This paid early dividends when the project was presented in the 1st Inter-service Meeting. Firstly, the project was logically constructed as a platform to gather evidence from experienced groups covering a good variety of disciplines and geographical backgrounds. The latter is a very important point when dealing with pan-European initiatives. Secondly, all the partners together amassed a demonstrable collective know-how second-to-none in the relevant fields. Thirdly, the technical co-ordinator at UNEW (Prof. Paul Younger) was presentable as leader of the most successful mine water RTD group in Europe, with a long track of excellence in this field. This was carefully stressed in the presentations given in the 1st Inter-service Meeting. The credibility of UNEW was further enhanced by its active role as technical advisor to WWF, which enjoys widespread respect within DG Environment. Another important factor was the *chain of legitimacy* provided by the existence of a network of National Stakeholder Groups. The ERMITE experience confirms the notion that the source of information and the identity of the presenters are of paramount importance.

As important as relevance and credibility is communication. ERMITE's technical co-ordinator was a gifted communicator, able to master simultaneously technical depth and oratorical skills, who played the role of *salesman* when necessary. This is a critical issue for scientist and engineers willing to become *policy entrepreneurs*. One has to be able to discuss the nitty-gritty of all the technical aspects of the policy problem, and provide well-grounded solutions. In Chapter 7 it was shown how important it was that ERMITE commented directly on the policy texts, providing suitable amendments. At the same

time, one has also to be able to communicate simple key messages packaged in the appropriate way to impact the target audience. So in the presentations to the inter-service meetings surprising and simple stories were the preferred media of communication. In the meeting in the European Parliament, it was important to keep the message focused on the essentials and backed by one or two real life examples. Here it was also important to have a good knowledge of the evolution of the policy process and refer to it as necessary.

The weight of the evidence factor was particularly important in the interaction with WWF. WWF is a professional political EU lobbying organisation, which has mastered all the tricks of the business. What they needed from the UNEW team was support to check and back their technical statements. So UNEW read and commented on all the policy documents produced by WWF. In the key "Position Paper on the European Commission proposal for a Directive on the management of waste from the extractive industries" (WWF 2003), ERMITE was quoted as the source of evidence for WWF policy proposals. The in-depth understanding of the UK case, with its relatively advanced mine water management system, was very important when supporting WWF, as was access to information from a variety of sources and countries.

9.1.3 Links

The category **Links** refers to the relationships between researchers and policymakers. The need to develop these links was already engrained in the design of the ERMITE project and was put into practice as soon as the project started. The project worked with an extended network at national and EU levels. As described in Chapter 7, ERMITE policy interfaces grew organically, to match the particular *policy network* involved in the proposed mining waste directive. It was clearly understood by the project management team that active *policy entrepreneurship* was necessary to connect what the Multiple Streams Framework calls "problem, policy and politics streams". The project actively presented policy solutions to policy actors at the EC level and, through WWF, linked with the politics stream when the proposal reached the European Parliament.

The JRC-IPTS provided the active link (institutional and personal) with the European Commission. The JRC-IPTS partner acted out of her personal conviction that the

Commission should practice more communication between services, and between DG Research and DG Environment in particular. She was also a natural *connector*, promoting and disseminating the project through the Commission network. Her personality helped as well, as a great deal depends on personal contacts. It was very important to build trust and respect relationships amongst both groups (researchers and policymakers) to listen, integrate the viewpoints of each group and exchange information. The connection JRC-IPTS / DG Research / DG Environment was key for the organisation of the inter-service meetings. It also played a critical role when ERMITE was allowed to submit in the name of DG Research official comments on the draft proposal to the inter-service consultation. In the end, this proved to be a decisive step in shaping the final text sent by the Commission to the Parliament. All in all, the *sustained interactivity* with the Waste Unit officers was what really mattered. One important hurdle to maintain this interactivity was the rapid turnover of staff in DG Environment. People leave the Commission or change jobs within and between services with surprising frequency. Thus, the proposed directive on mining waste had three different leading policy officers during the 3-year lifetime of the ERMITE project alone!

The other key link was the relationship with WWF. This link amplified the promotional capabilities of the project allowing the key ERMITE message to reach all key MEPs in the Parliament. It also allowed the voice of ERMITE to be heard on equal terms with the representatives from industry, the Commission and the Council in the consultations organised by the EP *rapporteur*. This link was also a critical source of intelligence. WWF compiles all the documents produced by all the policy actors during the process, sometimes even obtaining copies before they are made public. They also maintain a continuous conversation win the key actors in the Commission, the Parliament and, to a lesser extent, the Council. They are usually aware in detail of the evolution of the policy process.

One important lesson from ERMITE is that it is very important to engage with as many actors as possible as a way of propagating the message and increasing the mediational capacity of the project. However, there is neither enough time nor resources to follow all the links. For instance, ERMITE could not follow up and participate in the development of the BAT document led by the IPPC Bureau. It was judged not worth devoting many resources to that process because: (i) it was only producing a

consultative document and not primary legislation; (ii) it was controlled by experts from industry (as is common in the ethos of the IPPC); and (iii) it debated few issues of direct relevance to protection of the water environment.

9.1.4 Project management

This is a category not included in the original RAPID framework, but which proved to be very important in the ERMITE experience. Policy impact does not occur by chance. It requires constant purposeful action to steer a project in that direction. ERMITE maximized its chances by an *ad-hoc* project design oriented at this aim. As soon as the project started, the project management team worked hard to steer the process and content of the project appropriately.

One of the challenges was to work with the project team to promote *policy entrepreneurship*. It was not easy to steer a group of engineers and scientists (including social scientists) towards policy research and stakeholder engagement. Each of the project meetings had elements of education in policy issues; explaining the policy process so that the project team could understand what was going on and what we were up to. The evolution of the policy texts was discussed to familiarise the team with the key issues from the EC policy perspective. At the beginning the group was reluctant to move beyond what they considered their normal duties as researchers. For instance, it took a while to get the National Stakeholder Groups concept implemented, and some groups never used them efficiently. The most recalcitrant scientist and engineers had won their spurs by Year 3 of ERMITE. Thus at the end of the project, the team was a fully-fledged policy machine, able to co-ordinate the preparation of targeted policy briefs and organise a team presentation to very senior policy officers in the European Commission.

The author played a key role as the overall project manager steering the evolution of the project to achieve both objectives: delivery of the contractual obligations and achieving policy impact. This required working both as *connector* and *maven* (Gladwell 2001), accumulating and distributing information across the project and ensuring that independent actions worked towards a common goal. In that role it proved very important to "learn as you go". Steering a project to follow the grain of the policy process requires flexibility, resourcefulness and the capability to adapt to a changing

landscape. Part of the success of the project in reaching the Commission was based in the agreement between the author and the JRC-IPTS partner that, although it was not in the project specifications, this was an occasion to demonstrate how to interface indirect RTD actions, supported by DG Research, with policy development in DG Environment. Accordingly, resource allocation decisions took this objective into account, besides ensuring prosaic fulfilment of the agreed work programme.

One key problem in project management was timing. The lifetime of the project is limited and you need to start the policy work even before the outputs are ready. By the time the project team becomes an efficient policy machine the project is over. This reflects one of the big challenges in bridging RTD and policy, i.e. the different time scales of both processes. This also means than one has to take hard choices on where to concentrate efforts within its short life span. This was illustrated by the decision to focus on the Waste Unit and not on the Water Unit of DG Environment (in spite of the original intentions of the project) and the decision not to follow up so closely the BAT work.

The analysis exposed in this Section has shown how the success of the ERMITE project was thoroughly grounded on what is theoretically considered as best practice on the interface between RTD and policy. However, the theoretical background to the project came practically as an *a posteriori* input, as both the work of the RAPID project and the UK Evidence Network ran in parallel to the development of the project.

9.2 Interface of RTD and policy in the EU framework programmes

Chapter 1 presented some ideas from initiatives researching the interface between RTD and policy at the UK and international development levels. Interestingly (and revealingly) there is no comparable specific body of expertise available to support the interface of RTD and the development of EU environmental policies. However, there is an increasing realisation within the relevant DGs within the Commission that this is an issue that should be addressed. During the second Inter-service Meeting organised by

the ERMITE project, one of the sessions was devoted to a presentation by a DG Environment (ex-DG Research) officer on precisely this topic.

Quevauviller et al. (2005) provide an introduction to some of the issues. They acknowledge that, in many instances, the lack of communication and of clear coordination mechanisms leads to research outputs not being used (or even known) by policymakers, and to policy research needs not being communicated to the scientific community in a timely fashion. Researchers don't have the means to reach policymakers. The latter often don't have the time and the capacity to translate research results into policy; indeed they lack ready access to specific scientific publication outlets. Other problems are the use of different jargons in both communities; the different time scales (short or medium term in policy, long term in research); and the lack of career incentives for scientists to integrate outputs with policy development. The paper also admits that policymakers are often not sufficiently *entrepreneurial* with respect to the selection and use of state-of-the-art research projects that could directly feed policy objectives. In the best case, policymakers are able to define a list of open questions, which can be compared with actual research needs, or the results of past research. However, most frequently the results of RTD projects are not presented in the form of "science-digested" policy briefs that policymakers can easily use.

According to Quevauviller et al. (2005), the problem is more acute at the starting phase of thematic strategies, such as the ones defined by the 6th Environment Action Programme. Implementation platforms, such as the WFD Common Implementation Strategy, offer the opportunity to build strong partnerships of policymakers, implementers and researchers. However, the consideration of research results by the policy-making community is not straight forward, mainly for political reasons, and this hinders efforts to incorporate the latest research developments into legislation.

Quevauviller et al. (2005) reviewed the existing RTD mechanisms within the EC and the science-policy interface in the WFD. Their discussion concentrates on the identification of the levels of information interchange required and the institutional mechanisms of the Common Implementation Strategy (CIS) (i.e. Working Groups and Expert Advisory Groups involving representatives of Member States, industrial associations, NGOs, scientific associations and others). Finally, Quevauviller et al. (2005) propose the creation of a pro-active web-portal which would allow streamlining

information on RTD projects most relevant to WFD implementation. An example of this mechanism is already under development through the HarmoniCA initiative, a large scale concerted action supported by the DG RTD under FP5.

The general diagnosis of the problems in the RTD/policy interface presented in Quevauviller et al. (2005) resonates with the ERMITE experience and the lessons from the literature presented in Chapter 1. The active use of the innovative institutional mechanisms provided by the CIS represents the best opportunity to demonstrate how the interface can be improved at the implementation level. However, the solution of attendant problems will require much more than the development of a web-based information exchange mechanism. While such a web-portal would be a considerable improvement regarding accessibility of the information, as Quevauviller et al. (2005) have themselves recognised, this is only one of the barriers limiting an effective interface. The political nature of the process, the multiplicity of actors and the limited usefulness for policy development of most RTD requires a more radical review of the RTD/policy interface in the European Commission.

Institutional resistance to any major change in the ways in which the Commission works, and the alleged transactional cost of any reform, could conspire to turn any effort in this direction into a waste of scarce resources. However, as shown in Chapter 1 efforts in understanding how to improve the RTD/policy interface are being supported by, amongst others, the UK research councils, UK government departments and a number of governmental and non-governmental organisations working in international development. It would make a lot of sense to allocate EC RTD resources to applied research on the improvement of the RTD/policy interface within the European institutions, concentrating on environmental policy, an area where this need has been identified by the EC policymaking community. This applied research should look at the three aspects identified by Nutley (2003): issues relating to research, issues relating to the policy-making process and issues about the interactions between these two worlds.

DG Research needs to identify and promote best practice in communication from research to policy (in which category ERMITE would fit). Researchers can improve considerably the ways in which they conceive and communicate their research efforts to maximise policy impact, and this can be helped with clear guidelines and requirements from research funders. Researchers should also realise that policymaking is going on all

the time and that, if they do not get involved with it, somebody else with much less knowledge of the issues will unhesitatingly do so. This one was a key lesson learned by all the partners in the ERMITE project. Unfortunately, this seems to be a worthless effort from the point of view of career development for any scientist. It is, thus, very important that policy impact be recognised as a performance indicator at the national and EU level.

Regarding issues related to research, FP 5 introduced a strong policy oriented emphasis but provided neither mechanisms nor guidelines for RTD/policy transfer. FP6 has relaxed the FP5 policy requirements introducing at the same time the so-called Priority 8 "Policy-oriented research". Priority 8 projects are tailor-made to respond to direct policy needs expressed by the various DGs. This is an encouraging development. However, the topics included in the environmental area of Priority 8 are focused on highly specific requirements, leaving little scope for mould-breaking RTD activities that expand the *frameworks of possible thought*. ERMITE is a good example of a policy relevant project that would have never been commissioned under a Priority 8 heading. Meanwhile most of the outputs of the large Integrated Projects (IP) will still be unusable for policy development. IPs, and to a lesser extent the Specific Target Research Projects (STREPs), should include modules specifically addressing the RTD/policy interface as exemplified by the activities of the project ERMITE. These modules should evaluate the political context of the research area, identifying relevant policy areas and processes and the prevailing policy discourses amongst policymakers and the wider policy community. They should provide intelligence reports on the knowledge-base of the policy areas and how they relate to current RTD, and communicate in a digested manner the policy implications of the project. This "digested" information is the one that would be more useful in a web-based portal. An adequately managed IP or STREP should constitute a credible platform for policymakers, and it should work hard on establishing this credibility. Accordingly, web-based information is only one of the activities for promotion and dissemination. ERMITE has demonstrated how a project can actively establish links with relevant actors in the policy networks and the importance of involving a wide variety of stakeholders. These activities have to start from the beginning of the project and not be relegated to a post-project "Technology Implementation Plan" that nobody in fact will implement.

Regarding the policy-making process, as shown in the previous Section the EU is really poor at incorporating RTD into policy. All three institutions (Commission, Parliament and Council) seem to be oblivious to this requirement. This can be contrasted with the strong role played in the USA by the National Academy of Science (NAS) (http://www4.nationalacademies.org/nas/nashome.nsf) as a provider of science and technology advice to legislators. Since 1863, the function of the NAS has been to "investigate, examine, experiment, and report upon any subject of science or art" whenever called upon to do so by any department of the government. The NAS provide a public service by working outside the framework of government to ensure independent advice on matters of science, technology, and medicine. They enlist committees of the nation's top scientists, engineers, and other experts, all of whom volunteer their time to study specific concerns. The Academy's service to government has become so essential that Congress and the White House have issued legislation and executive orders over the years that reaffirm its unique role.

In theory, the JRC should be playing a comparable role in Europe. "*The mission of the JRC is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies. As a service of the European Commission, the JRC functions as a reference centre of science and technology for the Union. Close to the policy-making process, it serves the common interest of the Member States, while being independent of special interests, whether private or national.*" (http://www.jrc.cec.eu.int/). In practice, it is more devoted to execute in-house funded research than to supporting policy-making. However, ERMITE has proven that the JRC can indeed play a critical role as a hands-on intermediary between RTD and policy, in spite of the surprising reluctance of some JRC-IPTS managers to be seen "dabbling in policy". Initiatives aiming at the realisation of the European Research Area (http://europa.eu.int/comm/research/era/index_en.html) (which is regrouping all Community supports for the better coordination of research activities and the convergence of research and innovation policies at national and EU levels) should provide some of the building stones of institutional arrangements able to play a role equivalent to that of the National Academy of Science in the USA. But unless this aim is specifically agreed by the Commission, the Parliament and the Council, it will never be realised. It is strongly recommended that applied research on improving the RTD/policy interface should include the design of institutional capabilities to provide science and technology backing for all the European institutions (and not only the

Commission), taking particularly into account the need for a pan-European perspective. European research funds should be available to support medium and long term RTD efforts identified by this institution. At a more immediate level, it is recommended that the Commission includes a systematic synthesis of the RTD knowledge-base as a compulsory step in all new policy initiatives (similar recommendations can be found in Quevauviller et al. 2005)

Regarding the interaction between researchers and policymakers, the key issue is to facilitate *sustained interactivity*. The ERMITE experience shows how a long period of interaction allows mutual trust and understanding to develop. The problem is that policymakers in the European Commission seem to have neither the time (real) nor mental space for these interactions. It was only thanks to the actuality of the environmental impact of mining that EC officers were ready to devote so much time to the contacts with ERMITE. This capacity bottleneck is even more acute amongst higher level managers. However, it is of critical importance that DG Environment finds ways to facilitate interactivity beyond the current practice within the Commission. The EU policy process will always be very political but it is possible to improve the evidence-base of environmental policy if more attention is paid to the input from RTD. It is impossible and not justifiable to expect that policy officers will interact directly with all the ongoing relevant RTD projects. However, the role played by the JRC-IPTS in ERMITE shows one possible way forward, in which one intermediary organisation, or designated elements of DG Environment, acts as the connector with research and organises closer interactions where it is of direct relevance to policy-making. Scientific officers in DG Research should be able to identify promising projects and provide briefs to DG Environment. There should be at least three levels of organised interactivity; interactions to provide a general background to policies (especially strategic documents), inputs to particular policy processes; and implementation support as in the CIS. In the context of the European Research Area these interactions should have a pan-European character and not be monopolised by national networks, as is frequently the case in the Commission.

9.3 Conclusions

An analysis of the ERMITE project with the "Context, Evidence, Links, Project Management" model shows how success was thoroughly grounded on what is

theoretically considered as best practice on the interface between RTD and policy. The experience of the ERMITE project proved that the macro-political context in the EU does provide enough entry points to make it permeable to the influence of lessons from research; but the numbers of institutional actors is so large that the voice from research can easily go unheard. If it had not been for the active policy process started by the Baia Mare report, in particular the work on the proposed directive on mining waste, there would have been no chance for ERMITE to have such a big impact. In this case, it was only the active promotion from ERMITE that allowed issues such as mine voids to come into the policy agenda. Confirming the basic thesis of this dissertation, the project served as a platform to establish credibility with policymakers. ERMITE had amongst the team members *connectors, salesmen and mavens* working very closely towards the objective of policy impacts. Deep knowledge of the institutional environments and structures was mobilised to react swiftly to windows of opportunity and build up a relationship of mutual trust with policy officers. One of the findings of this thesis is that Project Management is another important category to be considered in the RTD/policy interface. Policy impact does not occur by chance; constant purposeful action is required to steer a project in that direction. One important lesson for the members of the ERMITE consortium was the realisation that there was no match for their expertise amongst policymakers: if researchers don't get involved other people with less knowledge will produce policy. However, by the time the project team had become a confident and efficient policy-oriented group the project was close to its end. This reflects one of the big challenges in bridging RTD and policy: the different time scales of both processes.

The need to improve the interface between RTD and policy-making has been recognised by a number of officers in DG Environment, DG Research and the Joint Research Centre. Their diagnosis of the problem matches the lessons from the literature and the experience of the ERMITE project. While the possibilities to improve the interface opened by the innovative implementation of the WFD and the activities of the HarmoniCA project must be exploited, there is a clear need for yet more radical changes. The overall input of RTD to the European policy process is minimal. Institutional arrangements must be developed to ensure that RTD know-how is available and is used by all three key European institutions: the Commission, the Parliament and the Council. A first step should be that the Commission includes a systematic benchmarking of RTD in all new policy initiatives. It would be productive to allocate

EC RTD resources to applied research on the improvement of the RTD/policy interface within the European institutions, concentrating on environmental policy, an area where this need has been identified by the EC policy-making community. This applied research should look at the three aspects identified by Nutley (2003): issues relating to research, issues relating to the policy-making process and issues about the interactions between these two worlds. DG Research needs to identify and promote best practice in project management and communication from research to policy, as exemplified by the ERMITE project. This best practice must be a compulsory element of the large IP projects and, to a certain degree, of the more focused STREPs. Projects need to undertake the task of translating project findings into policy-oriented outputs, and promoting them in the appropriate fora. It is also argued that the EU needs some institution supporting the legislators in the same way that the National Academy of Science does in the USA. This could be a component of the structure of the European Research Area. In any case, the Commission needs to increase the sustained interactivity of policy officers with researchers. The ERMITE experience has shown how the JRC could act as a filter for relevant research, steering sustained interactions in a way compatible with the heavy agenda of the Commission and the inherently political nature of the European policy process.

10 CONCLUSIONS

10.1 Summary of main findings

10.1.1 Restatement of aims and objectives

The stated aim and objectives of this thesis were:

Aim

- **Demonstrate how a European RTD project can be used as a platform to influence European environmental policy-making**

Objectives

1. **Analyse best practice in mine water policy and practice by reference to the UK, by involving key UK stakeholders in critical discussions of both UK and European level policies which influence mine water management.**
2. **Analyse the development of European policies in relation to mine water management.**
3. **Develop interfaces between the project ERMITE and ongoing European policy-making initiatives.**
4. **Propose improvements for European policies.**
5. **Reflect on the interface between technology and policy in the context of the EC funded research.**

10.1.2 Realisation of objective 1

The findings related to the first objective were detailed in Chapters 3, 4 and 5. This objective has been achieved involving key UK stakeholders in a number of group discussions and one-to-one semi-structured interviews as shown in Appendix 1.

Chapter 3 gave a general overview of the institutional environment of mine water management in the UK. Mine water problems were classified according to the scheme presented in Chapter 1. It was found that pollution caused by discharge of untreated water after flooding is complete is the most environmentally- and economically-damaging form of mine water impact in the UK. Seepage of contaminated leachate from waste rock piles and tailing dams is also a significant problem. The environmental

impact of mine water pollution is affecting more than 600 Km of water courses and is a potential threat to water resources for supply. Mine water pollution is a long term problem for mining communities, adding to the already heavy burden of severely depressed areas. However, it is really difficult to assess the total economic impact of mine water pollution. The cost-benefit analysis of treatment options in particular examples has shown how critical mine water pollution can be when it affects the use of water as a resource for supply. The main expenditure on mine waters in the UK is incurred by the Coal Authority, which spends in excess of £2.5 M per annum on strategic pumping schemes to prevent pollution and £4 M per annum (2001) in capital works establishing treatment systems for the backlog of abandoned mines discharges. The main policy question in mine water management in the UK until recently was the existence of a clause in the legislation that exempted waters flowing from abandoned mines voids from the general prohibition of permitting polluted drainage to enter controlled waters. The Coal Authority has taken over the legacy from coal mines caused by this legislative gap but there is no organisation in place to pick up the liabilities from metal mines. There are also severe problems with several thousand spoil heaps in diverse ownership. The technical experience gained dealing with these problems over the last decade has made the UK one of the most advanced countries in Europe in the application of mine water remediation technologies.

Chapter 4 provided an original review of the institutional structures (law, policy and administration) of mine water management in the UK and an analysis of unresolved issues. The institutional research shows how the management of mine waters from active mines can be controlled if adequate regulations are properly enforced at each stage of the life cycle of a mine. In particular, the problems of stability of waste structures that prompted the proposed Directive on mining waste have been successfully resolved with the Regulations introduced after the Aberfan (Wales) disaster in 1966. The introduction of The Mines (Notice of Abandonment) Regulations 1998 provided a clear framework for mine water management during closure. The key issues in mine water management in the UK presently centre around dealing with the legacy of abandoned mines (as mines abandoned before 31.12.99 were exempted from the obligation to treat mine water). The fear of the scope and scale of the problem caused by abandoned mines acted as a deterrent for action; with hindsight it turned out to be cheaper and simpler than was feared beforehand. Now the Coal Authority is in charge of a very successful national programme of remediation addressing the legacy from the

National Coal Board and British Coal. There is a still a problem with the promotion of remediation initiatives through re-mining or redevelopment of old sites. Although the creation of the Land Restoration Trust is starting to address some of these issues, there is still a need for EA / SEPA to develop an "enabling" approach to regulation of voluntary remediation initiatives, rather than blind application of the last letter of the law. There is also a need for a proper national strategy for metals mines and one in which the EA engages fully, rather than being afraid to be part of a problem-solving consortium. Much has been learned with the development of the national mine water programme for abandoned coal mines. However, there is still a need for capacity building and further development of understanding. In general there should be better use of local knowledge for the management after closure. National water policy should embrace the mine water issue, not pretend it does not exist, as it is a major cause of pollution in many northern and western catchments.

Chapter 5 gave a summary of the existing 'gaps' in mine water management in the UK, an overview of the position of the UK government in relation to the proposed Directive on mining waste and a table of policy recommendations. The UK government has taken a positive stance in the consultations organised by the European Commission on the proposed Directive on the management of waste from the extractive industries. However, on some key issues there are profound mismatches between the findings of the ERMITE project and the official UK position, as exposed in Appendix 3. The key points are that the UK government should support the approval of the Directive and seek the inclusion of excavation voids and abandoned mines in it. So far the government (as well as the European Commission) has failed to grasp the policy implications of the Directive within the current framework of European water policy, i.e. that although this is a waste initiative it is the only foreseeable chance to include mine water protection provisions in EU legislation. The UK Government has played a less positive role as a Member of the European Council in the subsequent phase of the process for the development of the Directive. The key recommendations for mine water policy in the UK are:

1. Provide specific guidance for the management of mine waters in the implementation of the Water Framework Directive.
2. Support the proposed Directive on mine waste and seek to include excavation voids and abandoned mines.

3. Improve the existing framework for the management of large closed coalfields with particular attention to groundwater issues.
4. Develop and fund a national programme for remediation of metal mines based on the example of the existing coal mines programme.
5. Develop a national framework to facilitate the voluntary remediation of abandoned sites.
6. Increase research and capacity building in the EA, SEPA and the CA to fulfil their regulatory roles.
7. Improve the performance of industry (preventative measures, groundwater and silts).

10.1.3 Realisation of objective 2

The analysis of the development of European policies in relation to mine water management was presented in Chapter 6. This analysis constitutes a new in-depth understanding of the policy context at European level. Firstly, an overview was provided of mine water problems in Europe based on published data and the findings of the ERMITE project. It was found that there is so far no comprehensive inventory of mine water problems in Europe, but the heavy pollution of a number of streams is well documented. ERMITE research showed all EU Member States (in 2002) had a degree of awareness of mine water problems, whereas this only applied to a few non-EU member states (where the most severe cases of pollution were recorded). National mine water remediation plans were only found to be in force in the UK, Portugal and the Czech Republic. Secondly, the results of a thorough review of EU legislation relevant to mine water issues were presented. The review covered the following Directives:

- Waste Framework Directive
- Landfill Directive
- IPPC Directive
- Seveso II Directive
- Environmental Impact Assessment Directive
- Habitats Directive
- Environmental Liability
- Dangerous Substances Directive
- Groundwater Directive
- Water Framework Directive

A key finding of the review was that due to the exception of mining from the IPPC Directive there is no relevant Community legislation addressing the preventative control of mine water pollution. By any standards, this amounts to a very privileged treatment of that particular sector by the regulator. The fact that mining is precisely the sector in which early decisions in the design of a site can have an impact for decades (or more) after closure (ERMITE Consortium 2004) seems to have been missed by everybody involved in the development of European water policy. The requirements of Art. 3 (f) of the IPPC Directive which says, "*the necessary measures are taken upon definitive cessation of activities to avoid any pollution risk and return the site of operation to a satisfactory state*" do not apply to mining. This, in practice, leaves the whole burden of control to the expertise of the water regulator, which in most cases lacks appropriate knowledge of mining operations upon which any remedial measures must be based if they are to be effective. Chapter 6 also examined the European policy process initiated after the reports of the Baia Mare Task Force in 2000, which recommended three key actions:

1. Amendment of the Seveso II Directive,
2. A document on Best Available Techniques (BAT) similar to those produced under the IPPC Directive and
3. An initiative on the management of mining wastes.

Conspicuously, the Task Force, with its narrow focus on tailings dam safety, failed to identify the need for a water related initiative (Kroll et al. 2002). Thus, the Baia Mara Task Force report defined the policy agenda within the European Commission constraining the policy discussions to mining waste, management of certain type of waste facilities and accidents. A very important consideration is that the key policy initiative, the development of a new directive, was labelled as a waste initiative and as such became the domain of particular unit within the Commission, DG Environment Unit A2. From the perspective of the findings of the ERMITE project, a number of issues were defined that should be taken into account in the policy context described above.

1. The integration of the energy and non-energy mining activities which up till now have been treated by the EC as being independent, in spite of their commonality in terms of process and management techniques of mine water.

2. The desirability of taking a full life-cycle approach to the environmental regulation of mining activities, as opposed to concentrating exclusively on accidental pollution (e.g. dam breaks) and management of waste facilities.

3. The scope of the draft BAT document should be expanded to encompass key mine water issues as well as wastes.

4. The inclusion of mining voids in the mining waste initiative.

5. The key environmental issue in the mining sector is pollution from abandoned mines.

6. The degree to which the present policy initiatives take into account the scale of the river basin unit defined by the WFD, and the need for the implementation plans for the WFD to incorporate specific guidance on the management of mine water pollution.

10.1.4 Realisation of objective 3

Chapter 7, which is the core of this thesis, addresses the development of interfaces between the project ERMITE and ongoing European policy-making initiatives (objective 3). Chapter 7 provides a detailed account of the interfaces through which the ERMITE project interacted with the EU policy process on the environmental regulation of mining activities. The dynamics of policy impact had two major aspects. Firstly, a broad action of promotion and dissemination of key policy messages amongst a wide variety of policy actors. Secondly, accurate interventions in particular moments (*windows of opportunity*) of the process, when it was possible to influence directly the wording of key policy documents. Chapter 7 demonstrated how the aim of this thesis was achieved by tracing the pathways in which particular elements of the current proposal for Mining Waste Directive have been influenced by the work of the ERMITE project.

A key element has been the simultaneous use of several policy interfaces. The National Stakeholder Groups provided the backbone for this strategy. *Per se*, they would not

have achieved much at the level of European policy. But they gave the project a network of contacts with other policy actors who have a presence at that level. Chapter 7 presented the recommendations for mine water management in Spain, Sweden, Germany, Slovenia and Bosnia-Herzegovina, based on the interactions with the National Stakeholder Groups. The interface with the EC was the frontline of the policy work during most of the lifetime of the ERMITE projects. This was an interface in permanent fluctuation. However, good teamwork, taking advantage of the strategic position of the JRC-IPTS partner and the kudos of the Technical Co-ordinator, was able to maintain the necessary *sustained interactivity*, bringing issues into the policy agenda and, critically, suggesting amendments to the Commission policy texts. Particularly significant is the inclusion in the final text proposed for the Directive by the Commission of a new Art. 10 (Excavation voids) requiring appropriate measures to secure stability, prevent pollution of surface and groundwater, and ensure monitoring, all in line with ERMITE recommendations. Finally, the collaboration with WWF brought the ERMITE project to a completely new dimension of policy interaction in a symbiotic relationship with the advocacy operations of that organisation. This collaboration had a demonstrable impact in the text for the proposed Directive approved in the 1st Reading of the European Parliament, which include all three of ERMITE's key policy points: mine voids, abandoned mines and inert waste.

10.1.5 Realisation of objective 4

Chapter 8 presented the findings related to objective 4, which is the proposition of improvements for European policies. The Chapter included the recommendations presented in policy briefs developed by the ERMITE team as stipulated by the author, covering the following topics:

1. Water and the proposed directive on management of waste from the extractive industries
2. Mining and the Water Framework Directive
   - 2.1 WFD Water resources
   - 2.2 WFD Ecology
   - 2.3 WFD Economics
3. Mine water and conservation policies
4. Mine water and soil policy
5. Mining waste and civil liability

6. Water technology and the mining industry
7. Environmental regulation of mine water and enlargement

The Chapter also analysed the outcome of the Baia Mare policy process from the point of view of the 6 issues identified in Chapter 6. The outcome has been quite satisfactory regarding the artificial segregation of mining activities in the energy and non-energy sectors. The scope of all initiatives includes both energy and non-energy activities. However, the energy lobby did succeed to win the exception of including coal only if processed (so that lignite is not covered) in the BAT document. The lack of attention to the full life-cycle of mines is one of the main failures of the current approach. With its focus on the management of waste facilities it has created a regulatory regime that does not correspond to existing best practice in the mining industry, where the whole site is treated in an integrated manner with preparation of the post-closure phase from the very beginning of the design. Attention to full life-cycle management of waste facilities did improve during the discussions of the proposed Mining Waste Directive. However, it is only the version of text resulting from the 1st Reading of the European Parliament that presents a satisfactory framework. The BAT document (IPPC Bureau 2004) does include techniques for the prevention of emissions to water. However, the treatment of this subject is very parsimonious and does not provide enough operational information. The main problem with the BAT is its very focused scope, which only covers the following topics in active mines (although some examples of recently closed mines are discussed):

- Waste-rock management
- Mineral processing relevant to tailings management
- Tailing management
- Topsoil and overburden if they are used in the management of tailings.

This is very far from providing a comprehensive BAT framework for the management of water in mining operations.

Thanks to the efforts of ERMITE the Article 10 of the Mining Waste Directive will cover excavation voids. However, the necessary measures for the prevention of pollution at closure are only included in the 1st Reading of the European Parliament. Together with the scope, the treatment of abandoned mines is still a key unresolved issue in the proposed Directive. Only the version of the Parliament includes the duty of restoration of abandoned sites (not only waste facilities). As it stands, the version of the

Council will only force countries to draw up lists of abandoned waste facilities and not actually do anything about them. The UK experience has shown that the most cost-effective way of dealing with abandoned mines is with national remediation programmes which can harness the necessary expertise and bring economies of scale, rather than with the *ad hoc* remediation of independent sites. One of the successes of the ERMITE project has been the cross-referencing of the WFD by the proposed Mining Waste Directive. However, the implications of this connection have not yet been appreciated by any of the policy actors, except for WWF. As shown in Chapter 7 the WFD team at the Commission is too busy with the implementation strategy as to champion the river basin perspective in the discussions about the environmental regulation of mining, and they lack the expertise to appreciate the implications. ERMITE has produced thorough guidelines to minimise mining impacts on the water environment (ERMITE Consortium 2004). The Common Implementation Strategy working groups should produce a similar document.

10.1.6 Realisation of objective 5

Chapter 9 addressed objective 5 with a reflection on the interface between technology and policy in the context of EC funded research. An analysis of the ERMITE project with the "Context, Evidence, Links" model introduced in Chapter 1 showed how the success of the project was thoroughly grounded on what is theoretically considered as best practice on the interface between RTD and policy. The experience of the ERMITE project proved that the macro-political context in the EU does provide enough entry points as to make it permeable to the influence of lessons from research; but the numbers of institutional actors is so large that the voice from research is easily unheard. If had not been for the Baia Mare process, and in particular the work on the proposed directive on mining waste, there would have been no chance for ERMITE to have its reported impact. Confirming the basic thesis of this dissertation, the project served as a platform to establish credibility with policymakers. ERMITE had amongst the team members *connectors, salesmen and mavens* working very closely towards the objective of policy impacts. Deep knowledge of the institutional environments and structures was mobilised to react swiftly to windows of opportunity and build up a relationship of mutual trust with policy officers. One of the findings of the project is that Project Management is another important category to be considered in the RTD/policy interface. One important lesson for the members of the ERMITE consortium was the

realisation that there was no match for their expertise amongst policymakers. If researchers don't get involved other people with less knowledge will produce policy. However, by the time the project team had become an efficient policy oriented group the project was close to its end. This reflects one of the big challenges in bridging RTD and policy: the different time scales of both processes.

The need to improve the interface between RTD and policymaking has been recognised by a number of officers in DG Environment, DG Research and the Joint Research Centre. Their diagnosis of the problem matches the lessons from literature and the experience of the ERMITE project. The input of RTD to the European policy process is minimal. Institutional arrangements must be developed to ensure that RTD know-how is available and is used by all three key European institutions: the Commission, the Parliament and the Council. A first step should be that the Commission includes a systematic benchmarking of RTD in all new policy initiatives. It would be productive to allocate EC RTD resources to applied research on the improvement of the RTD/policy interface within the European institutions, concentrating on environmental policy, an area where this need has been identified by the EC policymaking community. This applied research should look at the three aspects identified by Nutley (2003): issues relating to research, issues relating to the policy-making process and issues about the interactions between these two worlds. DG Research needs to identify and promote best practice in project management and communication from research to policy, as exemplified by the ERMITE project. This best practice must be a compulsory element of the large IP projects and, to a certain degree, of the more focused STREPs. It is also argued that the EU needs some institution supporting the legislators in the same way that the National Academy of Science does in the USA. This could be a component of the structure of the European Research Area. In any case, the Commission needs to increase the sustained interactivity of the policy officers with researchers. The ERMITE experience has shown how the JRC could act as a filter for relevant research, steering sustained interactions in a way compatible with the heavy agenda of the Commission and the inherently political nature of the European policy process.

10.2 Evaluation of the methodological approach

The evaluation of the methodological approach can be divided in three components: theoretical framework, use of a project as a research platform and the action research approach.

Chapter 1 presented three different levels of theoretical frameworks. First, the classification of mine water problems provided by Younger et al. (2002) was adequate for the purpose of the thesis. Its emphasis on the full life-cycle supported very well the critical examination of the reductionist approach followed by policymakers. Second, the understanding of the structure and processes of the European Commission described in Nugent (2001) was clear enough to map the interaction of the ERMITE project with the European policy process. Third, the Context, Evidence, Links gave the structure to analyse the interaction between ERMITE as an R&D activity and policy-making. This theoretical framework had to be modified with the inclusion of a new category (Project Management) to give a full account on this interaction.

The use of a project as a research platform had both high risks and potentials. The success of the ERMITE project was due both to skilful management and a series of circumstances, in particular, the existence of a high profile policy process. Taken this assumed risk into account, this was the only possible pathway to prove the key hypothesis of this thesis, i.e. that a European R&D project could function as platform to influence policy-making. Similarly, only an action research approach engaging with real life policy-making could be used to reflect and draw lessons from the experience.

10.3 Contributions of the work

The findings of this thesis have so far been presented in the following publications:

- AMEZAGA J.M., KROLL A. (2004) European Union policies and mine water management. In "Contemporary reviews of mine water studies in Europe, Part I". Wolkersdorfer C., Bowell R. (eds.) *Mine Water and the Environment*, 23, 4, 162-182.
- AMEZAGA J.M., YOUNGER P.L. (2004) Mine water policy in the UK and the proposed Directive on mine waste. In A.P. Jarvis, B.A. Dudgeon, P.L. Younger (eds.) *Proc. International Mine Water Association Symposium Mine*

Water 2004- Process, Policy and Progress, Newcastle upon Tyne 19-23 September 2004. University of Newcastle upon Tyne, p 11-16.

- AMEZAGA J.M., YOUNGER P.L. (2004) ERMITE: supporting European policy making on mine wastes and waters. In A.P. Jarvis, B.A. Dudgeon, P.L. Younger (eds.) *Proc. International Mine Water Association Symposium Mine Water 2004- Process, Policy and Progress*, Newcastle upon Tyne 19-23 September 2004, University of Newcastle upon Tyne, p 41-46.
- ERMITE CONSORTIUM (listed contributor) (2004) Mining Impacts on the Fresh Water Environment: Technical and Managerial Guidelines for Catchment-Focused Remediation. In Younger PL, Wolkersdorfer C (eds.). *Mine Water and the Environment*, Suppl. Issue 1. Berlin: Springer: ca. 80.
- KROLL A., AMEZAGA J.M, YOUNGER P.L., WOLKERSDORFER C., (2002) Regulation of mine waters in the European Union: The contribution of scientific research to policy development. *Mine Water and the Environment*, 21, 4, 193-200.

This thesis has also produced contributions to the institutional system of mine water management in the UK:

- The UK National Stakeholder Group was during its existence the prime forum for open inter-institutional discussions on mine water issues, and several member organisations have requested its continuation.
- The reports from ERMITE were quoted in internal policy documents within the Environment Agency.
- The rationale for the EA establishing a National Mining R&D fellow in UNEW cited ERMITE.
- Out of the participation in the UK NSG, SEPA requested Prof. Younger to produce guidance on opencast mining and Groundwater Regulations (1998) (Younger and Sapsford 2004).
- Participation in the UK NSG raised awareness of UK mine water legislation in the ODPM. The finding of this thesis informed the submission of the HERO group to the ODPM consultation on the proposed Mining Waste Directive.
- The Coal Authority used the ERMITE reports when lobbying to expand its remit to include metal mining.

The thesis had also an impact at European level:

- The ERMITE project is mentioned in the p. 30 of the Explanatory Memorandum of the proposal for a Directive on the management of waste from the extractive industry (CEC 2003a); "*Relevant scientific and technical advice has also been provided by the project 'ERMITE' (Environmental Regulation of Mine waters In The EU), funded under the 5th Research Framework Programme...*"
- ERMITE is quoted in WWF's Position Paper on the European Commission proposal for a Directive on the management of waste from the extractive industries (WWF 2003).
- The author took part in the meeting organised by the *rapporteur* MEP Jonas Sjöstedt at the European Parliament on the 03.11.2003 for an exchange of views on the management of waste from the extractive industries (COM (2003)319).
- UNEW was invited to join a meeting of the Task Force on Water of Euromines on 29.09.03 to present the ERMITE project.

The ERMITE case study on interface RTD / policy was presented in:

- AMEZAGA, J.M. (2004) Can scientists manage to interface with EU policy-making? Lessons from the ERMITE experience. Presentation at Workshop 8: The science-policy interface in *Linking community and ecosystems ecology: recent advances and future challenges,* LINKECOL Final Conference, European Science Foundation, 18-21 May, Palma de Mallorca, Spain.

10.4 Directions for further research

The findings of this thesis have illustrated the need to improve the way in which RTD is taken into account with the UK. In particular, it is advised that the EA investigates how to improve the interface between its Science and Policy functions and the how RTD is taken into account in the interactions at policy level with Ministries. New research could also provide some light on the best institutional arrangements to integrate mine water remediation of coal and metal mines and spoil heaps.

At the EU level, the policy outcomes of the Baia Mare process have left a very patchy coverage of mine water issues. It is highly recommended that further research follows

the impact at national level in the Member States and propose measures for integration of a full life-cycle approach at least at the level of management guidelines. It would also be desirable to investigate the real capacity of the River Basin Administrations to deal with mine water issues and produce targeted guidelines and recommendations.

The European Commission should support a programme of applied research on how to improve the RTD input into environmental policy-making able to promote best practice and inform future RTD programmes. The research should include an evaluation of how best to serve the RTD intelligence requirements of all European institutions with the minimum transactional cost from the current institutional set up.

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APPENDIX 1 UK NATIONAL STAKEHOLDER GROUP

FIRST UK ERMITE Stakeholder Workshop

Newcastle University, 26th June 2001

Participants:

• Norman Jackson	Institute of Mining and Metallurgy (IMM)
• Jan Ketelaar	Department for International Development (DFID)
• Adrian England	IMC Consulting Engineers
• David Griffiths	Environment Agency (EA)
• Stuart Rolley	Coal Authority (CA)
• Chris Cross	Rio Tinto
• Eric Fretwell	UK COAL
• Steve Peace	UK COAL
• Joan Dixon	Coalfield Communities Campaign (CCC)
• Paul Younger	Newcastle University (NU)
• Jaime Amezaga	Newcastle University (NU)
• Charlotte Nuttall	Newcastle University (NU)

SECOND UK ERMITE Stakeholder Workshop

Newcastle University, 22nd August 2002

Participants:

• Tom Simpson	Office of the Deputy Prime Minister
• David Griffiths	Environment Agency
• Dave Holloway	SEPA
• Tracey Barnes	The Coal Authority
• Chris Cross	Rio Tinto
• Steve Peace	UK COAL
• Norman Jackson	Institute of Mining and Metallurgy (IMM)
• Adrian England	IMC Consulting Engineers
• Paul Younger	Newcastle University/ERMITE
• Jaime Amezaga	Newcastle University/ERMITE

- Aidan Doyle Newcastle University/ERMITE

THIRD UK ERMITE Stakeholder Workshop

Newcastle University, 7th August 2003

Participants:

- Hugh Potter Environment Agency
- Keith Parker The Coal Authority
- Joan Dixon Coalfield Communities Campaign
- Klaus Eppinger Rio Tinto
- Ted Watkins UK COAL
- Adrian England IMC Consulting Engineers
- Mark Harrison MIRO
- Paul Younger Newcastle University/ERMITE
- Jaime Amezaga Newcastle University/ERMITE
- Heather McGrath Newcastle University/ERMITE

List of interviewees for Chapter 4.

- Tom Simpson Office of the Deputy Prime Minister
- Dave Brook Office of the Deputy Prime Minister
- Dave Holloway SEPA
- Graham Tate EA
- Keith Parker The Coal Authority
- Joan Dixon Coalfield Communities Campaign
- Adrian England IMC Consulting Engineers
- Steve Peace UK COAL
- Norman Jackson Institute of Mining and Metallurgy (IMM)

APPENDIX 2 OTHER NATIONAL STAKEHOLDER GROUPS

Spain

- Repsol YPF
- Hullera Vasco Leonesa
- Hunosa
- Norcontrol
- Río Narcea Gold Mines
- Instituto Nacional del Carbón (CSIC - INCAR)
- GEHMA Geología y Geotecnia S.L.
- Instituto Geológico y Minero de España (IGME)
- FRASA Ingenieros Consultores S.L.
- Lignitos de Meirama S.A. (LIMEISA)
- Puentes de García Rodríguez – ENDESA
- Asociación Nacional de Productores de Áridos
- Private Consultants
- Universidad Politécnica de Madrid (UPM)
- Universidad de Oviedo

Sweden

- Naturvårdsverket (Swedish Environmental Protection Agency)
- Miljödepartementet (Ministry of the Environment)
- Bergsstaten (Mining Inspectorate)
- Sveriges Geologiska Undersökning (Swedish Geologic Survey)
- Svenska Gruvföreningen (The Swedish Mining Association)
- Boliden Mineral AB
- Advokatfirman Åberg & Co. (Law firm)
- Bergab (Consulting company)
- Royal Institute of Technology (KTH):
- Swedish University of Agricultural Sciences (SLU):

Germany

- Sächsisches Landesamt für Umwelt und Geologie (LfUG)
- Bezirksregierung Arnsberg:Abteilung 8 – Bergbau und Energie in NRW-Dezernat 86
- Deutsche Steinkohle AG (DSK)
- Wirtschaftsvereinigung Bergbau e.V. (WVB)
- Steuerungs- und Budgetausschuss für die Braunkohlesanierung– Geschäftsstelle (GS StuBA)
- Gesellschaft für Bergbau, Metallurgie, Rohstoff- und Umwelttechnik (GDMB)
- Lausitzer Braunkohle Aktiengesellschaft (LAUBAG)
- Mitteldeutsche Braunkohle mbH (MIBRAG)
- MG Vermögensverwaltungs AG
- Deutsche Montan Techonolgie GmbH (DMT)
- Hydroisotop-Piewak GmbH
- Umweltforschungszentrum Leipzig Halle GmbH (UFZ)
- BBG Bauberatung Geokunststoffe GmbH & Co. KG
- Technical University and Mining Academy Freiberg (UF)

Slovenia

The Slovenian stakeholder group was never properly constituted. However, the reports of the project were disseminated amongst the following institutions:

- Minister responsible for Education, Science and Sports (MSZS)
- Officer responsible for 5th Framework programme at MSZS
- Minister responsible for Environment and Physical Planning (MOP)
- State Secretary responsible for Environment and Environmental regulation (also Water Law and related regulation) and for approximation of environmental regulation with EU
- Director of the Slovenian Environmental Agency (ARSO)
- Minister of Economy
- Director of the Directorate of Mineral Resources
- Head of the Office for Mining
- Director of Velenje Colliery

- Chamber of Economy, Department of Mining and Energy

Personal discussions were undertaken with the Minister of Environmental and Physical Planning, Director of Mineral Resources, Head of Mining and staff from the Slovenian Environmental Agency.

Bosnia and Herzegovina

- Austrian Environmental Agency- consultants on PHARE programme- Preparation of Environmental Legislation in BiH
- EC- European Commission- Delegation in BiH
- Environmental Steering Committee (ESC) of BiH
- Faculty of Civil Engineering, University of Sarajevo
- Faculty of Geology and Mining, University of Tuzla
- Federal Ministry for Agriculture, Water Management and Forestry
- Federal Ministry of Industry, Energy and Mining
- Federal Ministry of Physical Planning and Environment
- Institute for Public Health of Republika Srpska
- Institute for Urbanism Republika Srpska
- Institute for Water Management Republika Srpska
- METOHA, company for production of ore processing chemicals, Yugoslavia
- Mine "Srebrenica"
- Ministry of Environment of F BiH, co-chairman and members of ESC
- Ministry of Environment of RS, co-chairman and members of ESC
- Ministry of European Integration of BiH
- Ministry of Foreign Trade and Economic Affairs BiH
- Ministry of Industry, Energy and Mining, Kanton Tuzla
- Ministry of Industry, Energy and Mining, Republika Srpska
- Ministry of Physical Planning and Environmental Protection- Kanton Zenica – Doboj
- Ministry of Urbanism, Communal Affairs, Construction and Ecology of Republika Srpska
- Independed expert, member of ESC
- NEAP Directorat, co-director from RS

- NGO- Bor, Serbia
- NGO- Centre for Environmentally Sustainable Development of BiH
- NGO- Zletovica, Macedonia
- OHR- Office of the High Representative
- Regional Environmental Center for CEE, REC CO BiH
- Technical Faculty, University of Belgrade, Yugoslavia
- University of Denver- Student of Faculty of Law
- USAID Agency
- Water Steering Committeė of BiH
- WB- World Bank

APPENDIX 3 ERMITE COMMENTS TO ODPM CONSULTATION

UNIVERSITY OF
NEWCASTLE UPON TYNE

Prof. Paul L. Younger

Mr. Jaime M. Amezaga

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9th January 2004

Brian Freeland

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London SW1E 5DU

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Dear Sir

Consultation on proposed EU directive on the management of waste from the extractive industries

Thank you for the opportunity of commenting on the proposal and contribute to the Regulatory Impact Assessment (RIA) for the UK.

The Hydrogeochemical Engineering Research and Outreach (HERO) unit of the University of Newcastle is one of Europe's leading centres of mine water research. HERO works extensively with regulators and industry in the UK in problems related to

the management of waste and water from active and abandoned mines. In the last years, HERO has been the co-ordinator and technical co-ordinator, respectively, of two large European Commission funded projects: PIRAMID and ERMITE. PIRAMID (Passive In-situ Remediation of Acidic Mine/ Industrial Drainage) has evaluated the use of passive remediation systems for mine waters in Europe and developed engineering guidelines for their application at new sites. ERMITE (Environmental Regulation of Mine Waters in the EU) has produced integrated policy guidelines supporting European legislation and practice in relation to water management in the mining sector, with particular attention to catchment scale issues. ERMITE has been deeply involved in the development of the proposed directive on the management of waste from the extractive industries, interfacing with the European Commission during various phases of the process to date.

General Considerations

We would like to comment first on the UK position thus far in the development of the proposed mineral wastes Directive, as reflected in the responses to the EC consultations on the series of working documents which have led to the current formal proposal. We will also offer some comments on a number of issues raised in your Partial RIA.

Our concerns primarily relate to the management of the water environment which, together with stability issues, is posed in the Explanatory Memorandum of the proposed Directive as the main environmental impact associated with waste from the extractive industries. From our point of view the evaluation of the proposed Directive for the UK has to take into account three main criteria: safeguards to the environment, establishment of a level playing field in Europe and the viability of proposed measures for the industry.

We agree that in the UK the industry generally works according to the highest standards and is controlled by a tight regulatory systems based on Health and Safety, Country Planning and Environmental legislation. However, the role of national legislation and regulation as described in sections 84. and 85. of the Partial RIA require some comments:

First, the success of the Mine and Quarries Regulations (including the Quarries Regulations 1999) in preventing operational failure leading to major damage is linked to its comprehensive approach to tackle stability issues that now covers a wide range of structures. It would be desirable that these characteristics appear also in the proposed Directive.

Second, the control of water pollution corresponds to the Water Resources Act 1991 and Environment Act 1995 in England and Wales and equivalent legislation in Scotland and Northern Ireland. The Environment Agency (EA) and SEPA play key roles, as acknowledged in planning guidance documents. The key issue is that until the entry into force of the provision in the Environment Act 1995 which finally removed the long-standing exemption relating to permitting pollution from abandoned mines (which was present in the Water Resources Act 1991, but inherited from legislation dating back to 1963) UK legislation permitted polluted water to flow from abandoned mines. In removing this exemption, a duty of information provision was imposed on mine operators and/or owners, in the form of the Mines (Notice of Abandonment) Regulations 1998 (and parallel legislation in Scotland), to the wording of which we contributed via support which we provided to the Environment Agency. The consequences are that after 31.12.99, all operators must take appropriate action to avoid pollution when abandoning a mine, accepting the corresponding costs and liabilities. They must also make clear to the EA or SEPA (as appropriate) what they expect to happen in relation to polluted waters following mine closure, and their plans for preventing any anticipated deleterious impacts.

Third, the picture describing the impact of mining on the water environment is not complete if we don't take into account the mines abandoned before 31.12.99. Historically, the environment is a recent addition to legislation governing mines and quarries and their attendant waste tips. All modern planning permissions have adequate environmental operating and restoration conditions attached, but this has not always been the case. There is indeed a gap of legislation covering the impact of these mines. In the UK, the government has expressed its political will to take over the legacy of the nationalised coal industry, although unwilling to become statutorily responsible for it. The result has been the establishment of a successful natural remediation programme managed by the Coal Authority in agreement with the EA and SEPA. The willingness of the government to establish such an approach in relation to abandoned coal mines

presumably reflects the fact that the coal industry was formerly in public ownership, for no analogous commitment has been made in relation to metalliferous mines (which were never nationalised *en masse*). A substantial legacy of pollution from such mines remains largely un-addressed: with the exception of the Wheal Jane site in Cornwall, where a combination of pressures from the EU and unplanned assumption of some liabilities by the former National Rivers Authority conspired to require remedial action, only local, largely 'voluntary' remedial efforts are so far being proposed for any other abandoned metal mine sites. (The Environment Agency's recent 'National Metal Mine Strategy for Wales' seeks to deliberately encourage such voluntary initiatives, but even this rather weak policy instrument is not replicated in Scotland or England).

UK position in the EC consultations on the proposed Directive

We applaud the constructive position maintained by the UK representatives during the consultations organised by the European Commission. They have had an important influence on the evolution of the text of the proposed Directive from the first working document, which drew heavily (but inappropriately) on the wording of the Landfill Directive, towards the current proposal which is far more in accordance with industrial and regulatory practices in the extractive sector. This constructive engagement has certainly helped to make many of the requirements of the proposal reflect existing good practice in the UK. However, we would like to comment on three key issues developed during the Commission consultations.

1. Are water issues related to mining already adequately covered by the Water Framework Directive and associated instruments?

As the proposed mineral wastes Directive will be a daughter of the Waste Framework Directive (75/442/EC as amended by 91/156/EEC) the UK has viewed the proposal as strictly a waste management issue. Based on this position, the UK commented negatively on the inclusion of a clause (**Article 10(5) in the working document number 3**) that was finally not included in the **Article 13** ***Prevention of water and soil pollution*** of the proposal. This clause read:

"Member States shall ensure that appropriate measures are taken to prevent water and soil pollution from voids left to flood after closure. In order to do this, the operator shall provide the competent authority with information on the following elements:

(a) layout of the working that will be allowed to flood;
(b) quantity and quality of water encountered in the workings during the last two years;
(c) prediction of the impact of any future pollution discharges to groundwater and plans for mitigation;
(d) proposal for flood monitoring;

The elements in subparagraphs (a) to (d) shall provide sufficient information to enable the competent authority to evaluate the operator's compliance with the requirements of Directive 2000/60/ECC"

These provisions are almost *verbatim* reflections of the content of The Mines (Notice of Abandonment) Regulations 1998, which all UK companies have to fulfil. Their earlier inclusion in fact reflected the success of lobbying on our part. An opportunity to further level the European playing field is being missed by opposing the inclusion of this clause.

In the written comments on the third working document sent by your office to the Commission, it was stated that "..while the prevention of water pollution left to flood after closure is an important issue (probably more so in relation to environmental protection that the management of mineral waste), it is not a waste management issue and should not be included in this Directive. I understand the matter is already covered by provisions within the Water Framework Directive [2000/60/EC], and will be covered by daughter Directives".

We know from recent, direct discussions with the DG Environment officers belonging to the Water Framework Directive implementation team that it is highly improbable that this matter will be ever covered by a daughter Directive of the Water Framework Directive. This is because daughter directives are not meant to address complementary 'pollution prevention' activities. Rather, for these sorts of provisions the Water Framework Directive is designed to be complemented by other Directives which specifically address the prevention of pollution from particular activities, such as:

- Urban Waste Water Directive
- Nitrates Directive
- IPPC Directive

The logic is that the Urban Waste Water Directive covers pollution prevention in sewage management, the Nitrates Directive at least partially covers pollution prevention in relation to farming, while the IPPC Directive covers pollution prevention in relation to industrial activities. However, mining was excluded from the coverage of the IPPC Directive (which is itself a tribute to the long-standing success of the mining industry's lobbying activities in Europe), so that within the logic of the Water Framework Directive, mining is almost alone amongst the major potentially-polluting activities in Europe in having no 'pollution prevention' provision analogous to those for sewage handling, farming and all other industries. The reality is that the water provisions of the proposed Directive on the Management of Waste from the Extractive Industries are likely to represent the only opportunity that will ever exist to close this loophole in EU legislation. This would not be incompatible with the legal basis of the current proposed Directive.

Thus, taking into account the stated criteria of improved safeguards to the environment and establishment of a playing level field in Europe, we would encourage the UK government to support the current **Article 10** ***Excavation voids*** and to seek in future negotiations the inclusion of a new and improved **Article 13 (5)** that would read:

"Member States shall ensure that appropriate measures are taken to prevent water and soil pollution from voids left to flood after closure. In order to do this, the operator shall provide the competent authority with information on the following elements:

(a) Layout of ***mine*** *workings to be allowed to flood* ***and geological details (with particular reference to any sulphide minerals);***

(b) quantity and quality of water encountered in the workings during the last two years;

(c) prediction of the ***locations, quantity and*** *impact of any future pollution discharges to groundwaters* ***and surface waters*** *and plans for mitigation;*

(d) proposal for ***monitoring the process of flooding of the voids, to provide early warning of the need to instigate mitigation measures;***

The elements in subparagraphs (a) to (d) shall provide sufficient information to enable the competent authority to evaluate the operator's compliance with the requirements of Directive 2000/60/ECC"

2. Are existing provisions for abandoned mine sites adequate?

Similar reasoning can be applied to the issue of **abandoned and 'orphaned' sites.** In this case, the Water Framework Directive does impose a duty of preventing further deterioration of the status of all bodies of surface water and groundwater; and establishment of a programme of measures to achieve the environmental objectives of this Directive. This seems incompatible with the position of the UK government of not having a duty to restore orphan sites. This refusal is flagrant in the case of metal mines abandoned before 31.12.99. Currently, there is no official framework to deal with these mines in the UK (see section 5.1.2 in http://www.minewater.net/ermite/D3-2_GreatBritain.doc). Indeed, even the rolling programme which has been established by the Coal Authority with the full support of DTI is often represented as an utterly 'voluntary' activity. This stance was publicly re-iterated by the Coal Authority as recently as 22nd October 2003, in a meeting with councillors from a number of North East local authorities held at Durham County Hall. The argument is that the Coal Authority's actions to prevent mine water pollution are 'voluntary', since they are not part of the remit which it was given in its vesting legislation. In relation to the Coal Authority itself, this is of course true. Nevertheless, the UK government as a whole has a clear obligation to prevent the pollution of public supply aquifers by rising mine waters. This obligation originally arose from the European Commission's specific admonishment of the UK government in 1995, in relation to official complaint no. 95/4020, which arose from adjudication on the conduct of previous governmental agencies (British Coal and the National Rivers Authority) in relation to a long-standing mine water pollution and flooding incident at Brusselton Farm, County Durham. (We have been closely involved with this case on the ground). This ruling effectively prohibited the UK government from allowing any further deterioration in the quality of controlled waters due to uncontrolled outflows from any mines abandoned after enactment of the EU Dangerous Substances Directive in 1982, irrespective of previous domestic legislation which sought to limit liability for mines closed after 31st December 1999. The power of this ruling was clearly manifest in decision-making by the EA and DETR in relation to the closure of South Crofty mine, for instance, where compliance

with the 'no deterioration' criterion had to be demonstrable, albeit the definition of 'no deterioration' required recourse to historical data concerning the status of the local watercourses in 1982. Since the enactment of the EU Water Framework Directive's 'no deterioration' rule, the implications of this 1995 adjudication have passed into statute with exactly the same effect. It is therefore beyond dispute that if the UK Government did not charge the CA with managing this issue, it would have to allocate the task to another (probably less appropriate) governmental agency. It is important that this be clearly understood, as it profoundly affects the parameters of the debate: the local population, through their elected representatives, need not be asked to be grateful for charity on the part of the national government, but rather to participate in helping national government to find a sustainable solution to a very real and urgent threat to public water supplies and the wider environment.

The current proposed Directive provides the best opportunity for establishing a rational and not especially onerous programme of remedial measures for abandoned mine sites at the European level, following the model of the national rolling programme managed by the Coal Authority. This would certainly bring about improvements to the environment in Europe and offer chances for exploiting the UK expertise in the field as a business opportunity (witness next week's JEMU trade mission to Portugal on abandoned mine remediation, co-sponsored by DTI and DEFRA).

The current proposal has watered down unacceptably the provisions proposed in previous working documents. The current **Article 19** ***Exchange of information*** would only force the Commission to ensure that there is an exchange of information about drawing-up inventories of closed facilities and about methodologies to restore closed waste facilities. Working document no. 3 had a better defined Article 15- *Inventory of closed management facilities* with elements of a risk based rolling programme exclusively of waste management facilities. Working document no. 2 had an Article 16 – *Inventory of closed mines and quarries* with a more comprehensive approach, which in our view is the correct position in this matter. Focusing exclusively on abandoned waste management facilities would miss most of the main sources of pollution. Moreover, in the restoration of abandoned sites it is frequently difficult to discriminate between voids and waste facilities.

Taking into account the foregoing arguments, we would encourage the UK government to pursue the establishment of a rational European framework for dealing with abandoned sites beyond the current version of **Article 19**, thereby reducing the uncertain situation in relation to mining which currently attends the Water Framework Directive.

3. A level playing field in relation to stability of mine and quarry tips etc

To date the UK has sought to limit the **scope** of the Directive in relation to the temporary storage of waste that will be used to re-contour, landscape and rehabilitate the excavation void. As mentioned in the general considerations, the Mine and Quarries Regulations now include all kind of structures regardless of size or their permanent or temporarily character. It is only this strict treatment of stability issues that guarantees absence of operational failures. Accordingly, and in order to ensure a playing level field in Europe, the UK should seek to ensure that the proposed Directive includes an equivalent level of safeguards regarding stability for all structures as currently exists in UK legislation and related codes of practice.

Currently, **Article 11** ***Construction and management of waste facilities*** is only applicable to waste facilities, defined as any area designated for the accumulation or deposit of waste for a period of more than one year. Moreover, the recent Avesta-Polarit ruling of the European Court of Justice (ECJ case C-1140/01 of 11 September 2003) has introduced a distinction between waste and residues that will be re-used without any further processing in the extraction site. The interpretation of this ruling by some sectors of the European industry is that this would leave residues out of the scope of the Directive. It is our view that, at least, the provisions of the Directive related to the control of stability and the prevention of water and soil pollution (**Article 13**) should apply to all structures regardless of their temporary character or their labelling as waste or residues.

Specific issues in the Partial RIA

Inert waste

As currently formulated, the proposed Directive rightly emphasises regulating most stringently those mine waste operations which involve reactive waste materials, such as

sulphide minerals which tend to decay in the presence of the atmosphere to release ecotoxic metals and acidity to solution. The proposed Directive provides sweeping exemptions from regulations for operations dealing only with "inert wastes". In doing so, the Directive runs the risk of over-looking the hazards posed by fine-grained silts of any mineralogical composition (including geochemically 'un-reactive' carbonate and/or silicate minerals). Where silt is released en masse to receiving watercourses, it tends to clog stream-beds, cutting off light penetration to benthic algae and thus halting primary production. Vigilance must therefore be maintained at any mine waste operation which involves handling fine-grained materials, whatever their composition.

This is one issue where most of the industry has still to improve its performance. Stricter regulation of the handling of fines would indeed improve the safeguards to the environment.

Financial Guarantees

The financial guarantees should cover the whole site. As stated in your s. 52 this is already normally the case for those sites in the UK where financial guarantees are in place. This is consistent with good practice during and after closure, which treat the site as a single entity. Moreover, it is the only means of attempting to avoid restoration costs being eventually borne from the public purse.

The conclusion of your commissioned study to the effect that failure to restore due to insolvency is a marginal problem in the UK is not supported by the recent example of the closure of the Longannet Mine (near Alloa, Scotland) in March 2002. The mine had to close suddenly due to an unanticipated in-rush of water, forcing the company into liquidation. Last year, receivers for the liquidated company were reported by SEPA to be refusing to transmit to them the information stipulated in The Mines (Notice of Abandonment) Regulations, making planning for post-closure virtually impossible. The consequences of this breakdown in polity have the potential to give rise to just the kind of unanticipated, highly visible pollution incident which the government has been seeking to avoid ever since the Wheal Jane outburst in 1992.

Specialist teams

According to the Partial RIA the specialist teams established in the Mineral Planning Authorities (MPA) and the Health and Safety Executive may have to be expanded in

order to meet the Directive's obligations. We would like to draw your attention to the role played by the Environment Agency and SEPA in the planning process, in the control of active mines, and in closure and after-closure procedures. Mineral Planning Guidance requires the involvement of the competent authority for the water environment in all the relevant steps. However, both organisations have a clear shortage of expertise on mining related issues (see section 5.2.2 in http://www.minewater.net/ermite/D3-2_GreatBritain.doc). The Environment Agency is currently trying to address this issue through the efforts of the national Air, Soil and Water science group, which has established a Fellow on Mining and Mine Wastes (to be located in our team, as it happens). The involvement of the EA and SEPA with the Coal Authority in the development of national remediation programme for coal mines has helped to increase the UK's expertise on this issue. Nevertheless, all of these organisations are by their own admission too heavily dependent on the uncritical acceptance of the views of a handful of external consultants, who are thus effectively driving policy on issues of critical importance. The environmental regulators lack sufficient trained staff to fulfil adequately their strategic role in their interactions with the MPAs and the Coal Authority. It is, therefore, necessary to build up the capacity of the EA and SEPA and create better links between them, the MPA and the Coal Authority.

Thank you again for giving us the opportunity to comment on these matters. We hope our comments are helpful, and will be happy to discuss any of the points raised in further detail should you desire.

Yours sincerely

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