Guidelines on Financial Guarantees and Inspections for Mining Waste Facilities

Final Report

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EXECUTIVE SUMMARY

Directive 2006/21/EC on the management of waste from extractive industries (variously referred to in this report as "the Mining Waste Directive", "MWD" and "Directive 2006/21/EC") was adopted by the Community in March 2006. According to Article 22 of the MWD the Commission shall adopt, among other points, technical guidelines for the establishment of a financial guarantee, in accordance with the requirements of Article 14, and for inspections, in accordance with Article 17.

MonTec supplies the European Commission with the necessary technical information that will be used as an input to prepare technical guidelines on financial guarantees and inspections. The objective of the study is to give recommendations for calculating the financial guarantee and for carrying out inspections on mining waste facilities, in accordance with the provisions of the MWD. The recommendations presented reflect the views of the extractive industry and competent authorities (with the duty of controlling and enforcing the permit conditions), and the expectations of the civil society (often represented by the different non governmental organisations).

The European Union Member States have the obligation to bring into force legislation necessary to comply with MWD before 1 May 2008. From this day on, a waste management plan, including a closure plan has to be submitted to and approved by the competent authority (Article 5 MWD). In order to ensure that the appropriate closure and rehabilitation work of the waste facility is carried out, it will also be obligatory for the mine operator to provide a financial guarantee (e.g., in the form of a financial deposit, including industry-sponsored mutual guarantee funds) or equivalent. It is important that the amount of the financial guarantee is sufficient to compensate costs for site rehabilitation and suitable for post closure monitoring and maintenance in case of bankruptcy of the mining company.

In order to check the compliance with the permit conditions inspections have to be carried out by the competent authority prior to the commencement of operations and at regular intervals during mining activities and in the after-closure phase of the mine site. The mine operator is further requested to keep records on the construction and further development of the waste facility, and to ensure their appropriate handover in the event of a change of the mining title (Article 17 of the MWD).

In Part I of the study, the existing schemes of financial guarantees are reviewed and assessed largely based on the results from questionnaires sent to several mine operators in a variety of countries, and on the direct consultation of the relevant stakeholders. The contacted extractive industry covers companies from the EU Member States as well as from other selected countries with traditional mining like the United States, Canada, Australia and South Africa. As Part I provides a range of considerations, which helps to prepare technical guidelines for the calculation of financial guarantees this report only gives recommendations concerning the applicability and cost-effectiveness of the different methods and approaches that have been assessed with regard to the specific requirements of the MWD, and will not recommend a particular financial instrument.

Based on questionnaires, Part II of this report evaluates the international practice of inspections of mine waste facilities. The survey covers the main categories of the extractive industries and of the mine waste facilities (heaps, tailings ponds, etc.) from different countries (EU Member States, USA, Canada, Australia and South Africa). The questionnaires have been designed in order to gain information about the existing legal framework for inspections in various countries. The MWD and the environmental legislations have been reviewed in order to compare and evaluate the legal framework of the various countries.

As a result of the survey on financial guarantees and inspections for mining waste facilities it is recommended that, in selecting the adequate amount and financial instrument, the site specific conditions of the particular waste facility as well as the possible environmental impact are taken into account. In order to accurately estimate the costs for the rehabilitation and of the after-closure phase of the waste facility it is further important to understand the scope of the financial guarantee, which may include third-party costs, long-term liabilities and after-care commitments. The evaluation of the received questionnaires points towards the necessity for competent authorities to provide a more detailed documentation to assist companies in establishing accurate estimates for the financial guarantee. In addition to that, it is proposed that the extractive industry improves the reporting and disclosure of information regarding their records related to the waste facilities.

With regard to the data maintenance, the survey on inspections revealed that the supervision of extractive waste facilities is necessary to ensure the compliance with the permit conditions, respectively the waste management plan or equivalent. Comparing the different countries there are still some uncertainties regarding the procedures. The frequency and scope of the inspections which fall under the responsibility of different national competent authorities should be orientated on the environmental risk and possible impact of the considered waste facility.

Cooperation between competent authorities and mining companies is seen as essential in order to achieve the common goal of implementation of the MWD provisions, and in particular those related to the waste management plan.

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1 INTRODUCTION AND OBJECTIVES

1.1 Objectives

The increasing recognition of possible environmental and associated economic impacts of mining operations results in a common interest of the stakeholders, e.g., mining and insurance companies, banks and other financial institutions, non governmental organizations (NGOs) and competent authorities. This coincides with the development of environmental legislation in the majority of jurisdictions around the globe, taking into account the often negative influence on the environment of operations involving the accumulation or deposit of extractive waste and continued pressure from stakeholders.

Directive 2006/21/EC recognises the importance of guaranteeing that the taxpayer is not left with the financial burden of environmental cleanup and rehabilitation of mining liabilities, as has often been the case in the past and thus, requires a financial guarantee to be lodged by the mine operator prior to the commencement of deposition operations in the waste facility. The size of the financial guarantee can be periodically adjusted thereafter (Article 14, Directive 2006/21/EC).

According to Article 22 of the MWD the Commission shall adopt, among other points, technical guidelines for the establishment of a financial guarantee, in accordance with the requirements of Article 14, and for inspections, in accordance with Article 17. The European Union Member States have the obligation to bring into force legislation necessary to comply with MWD before 1 May 2008. From this day on, a waste management plan, including a closure plan has to be submitted to and approved by the competent authority (Article 5 of the MWD). In order to ensure that the appropriate closure and rehabilitation work of the waste facility is carried out, it will also be obligatory for the mine operator to provide a financial guarantee (e.g., in the form of a financial deposit, including industry-sponsored mutual guarantee funds) or equivalent. It is important that the amount of the financial guarantee is sufficient to compensate costs for site rehabilitation and suitable for post closure monitoring and maintenance in case of bankruptcy of the mining company.

In order to check the compliance with the permit conditions inspections have to be carried out by the competent authority prior to the commencement of operations and at regular intervals during mining activities and in the after-closure phase of the mine site. The mine operator is further requested to keep records on the construction and further development of the waste facility, and to ensure their appropriate handover in the event of a change of the mining title (Article 17 of the MWD).

In view of the serious accidents of Aznalcóllar and Baia Mare of the recent years the Commission indicates that a strong enforcement regime is necessary if serious negative consequences on the environment are to be avoided.

The purpose of this report is to provide the European Commission with the necessary information that will be used as an input to prepare technical guidelines for the establishment of financial guarantees and for carrying out inspections on mine waste facilities, in accordance with the provisions of the MWD. The technical recommendations provided in this report are intended to ensure support and enough flexibility for the competent authorities when implementing the provisions of MWD related to financial guarantees and inspections in their national laws.

The study excludes aspects related to radioactivity which are covered by the Treaty establishing the European Atomic Energy Community (Euratom). The study does, however, refer to waste produced through the mining of uranium. With regard to Article 14 of the MWD, the emphasis of the survey is clearly on financial guarantees for waste and mine waste facilities, which are the direct product of the mining and extractive industry but excludes waste stored underground or backfilled in open excavation voids.

In order to avoid confusion, and especially taking into account the vast amount of different waste types and their associated regulations, the report commences by defining the terminology used. The main aspects of the MWD which form the basis of this study are also described.

1.2 EU legal framework

In the following, the provisions of Directive 2006/21/EC (see Ref. 7) relevant for the financial guarantees and inspections for mining waste facilities are summarized in brief.

Directive 2006/21/EC on the management of waste from extractive industries was adopted by the Community in March 2006 and will be implemented by the Member States by 1st May 2008. From then on it will not be allowed to start any operations involving the accumulation or deposit of extractive waste without a waste management plan, including a financial guarantee. Waste facilities that have already obtained a permit prior to the 2008 date have to comply with the requirements set out in the MWD by 1st May 2012. This does not apply to waste facilities that will be closed by May 2008 (Article 24 (1) and (2); see Ref. 41).

The MWD (**Article 2**) focuses on the management of waste which is directly resulting from land-based extractive industries, respectively produced "…by the prospecting, extraction, treatment and storage of mineral resources and the working of quarries…". To define "waste" MWD employs the definition provided in Article 1(a) of Council Directive 75/442/EEC on waste (currently Directive 2006/12/EC).

Article 5 of the MWD states that a waste management plan considering "…the minimization, treatment, recovery and disposal of extractive waste…" (Ref. 7), is required from the operator and shall be reviewed by the competent authority every five years. As the main objectives of the waste management plan must be the prevention and reduction of the waste production and its harmfulness, the plan should describe in detail the category of waste and waste facility as well as estimate the expected environmental impact and the future use of land. A detailed closure

plan including rehabilitation, after-closure procedures and monitoring has to be submitted to the competent authority.

In **Article 7** it is underlined that before any deposition operations starts on site, respectively prior to granting a permit the competent authority has to verify the compliance of the waste management plan with the requirements specified in the MWD. The competent authority shall further be requested to periodically reconsider and update permit conditions.

Article 12 stipulates that a waste facility is considered as finally closed by the competent authority only after final on-site inspections, including the assessment of all reports submitted by the operator and verification that the land affected by a waste facility has been rehabilitated by the operator. “The operator shall be responsible for the maintenance, monitoring, control and corrective measures in the after-closure phase as long as may be required by the competent authority…”(Article 12 (4)).

The operator is obliged to fulfil the requirements of the MWD and to keep the competent authority informed about the status of remediation until the competent authority takes over the responsibility. The mine operator has to pay all costs for the measures of the waste facility until he does receive a certificate for successfully executed rehabilitation and mine closure by the competent authority. The amount of the financial guarantee shall take at any time into account the remaining rehabilitation work and therefore have to be reviewed periodically.

According to **Article 14** of the MWD the competent authority shall request a financial guarantee from the mine operator prior to the beginning of any deposition operations on site. The financial guarantee shall be “…in the form of a financial deposit, including industry-sponsored mutual guarantee funds or equivalent…” (Ref. 7). The financial guarantee has to be available at any given time and suitable for the rehabilitation of the land affected by the mine waste facility. It further has to include after-closure as well as possible third party costs.

The factors which shall be considered for the calculation of the rehabilitation costs are given under paragraph 2 of **Article 14** of the EU Directive:

(a) the likely environmental impact of the waste facility, taking into account in particular the category of the waste facility, the characteristics of the waste and the future use of the rehabilitated land;

(b) the assumption that independent and suitably qualified third parties will assess and perform any rehabilitation work needed.

Under **Article 17** it is requested that the competent authority shall inspect any waste facility prior the start of the deposition operations, at regular intervals during mining activities and in the after-closure phase of the waste facility to verify that the conditions of the permit are followed-up by the mine operator. To ensure the appropriate transfer of liabilities and to facilitate the supervision by the inspectorates the operator is obliged to “…keep up-to-date records of all

waste management operations…" (Ref. 7) and to make them available for inspections at any time. For further information on the EU regulations (see Ref. 7, 102 and 127).

1.3 Definition of waste types and scope of financial guarantees

1.3.1 Definition of terms

MWD covers the management of waste from extractive, land-based industries. However, not for all types of wastes in an extractive operation, a financial guarantee is required under Article 14 of the MWD. Table 1.3.1-1 looks at the types of wastes which are most relevant regarding financial guarantees for the extractive industry, and must be clearly defined in order to decide whether a financial guarantee is needed.

Table 1.3.1-1: Definitions of most relevant terms

Term (Source of Definition)	Definition
Waste Article 1(a) of Directive 2006/12/EC (Waste Framework Directive)	any substance or object in the categories set out in Annex I which the holder discards or intends or is required to discard
Hazardous waste Article 1(4) of Council Directive 91/689/EEC on hazardous waste	wastes featuring on a list of Annex Ia and Ib (generic types of hazardous wastes) of Annex II (constituents of wastes listed in Annex Ib which render them hazardous if they have properties listed in Annex III any other waste which is considered by a Member State to display any of the properties listed in Annex III, e.g., toxic, carcinogenic, inflammable
Inert waste Art. 3 (3) of the Directive 2006/21/EC (Mining Waste Directive)	waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the eco-toxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.
Unpolluted soil Art. 3 (4) of the Directive 2006/21/EC	Soil that is removed from the upper layer of the ground during extractive activities and that is not deemed to be polluted under the national law of the Member State where the site is located or under Community law
Extractive waste Art. 2 of the Directive 2006/21/EC	waste resulting from the prospecting, extraction, treatment and storage of mineral resources and the working of quarries but does not cover: • waste which does not directly result from such activities • waste which results from offshore activities • injection/re-injection of groundwater as defined by the Directive 2000/60/EC
Treatment of mineral resources Art.3 (8) of Directive 2006/21/EC	mechanical, physical, biological, thermal or chemical process or combination of processes carried out on mineral resources, including from the working of quarries, with a view to extracting the mineral, including size change, classification, separation and leaching, and the re-processing of previously discarded waste, but excluding smelting, thermal manufacturing processes (other than the burning of limestone) and metallurgical processes
Category A waste facility Annex III of Directive 2006/21/EC	A waste facility shall be classified under category A if: • a failure or incorrect operation, e.g., the collapse of a heap or the bursting of a dam, could give rise to a major accident, on the basis of a risk assessment taking into account factors such as the present or future size, the location and the environmental impact of the waste facility; or

Term (Source of Definition)	Definition
	• it contains waste classified as hazardous under 91/689/EEC above a certain threshold; or • it contains substances or preparations classified as dangerous under Directives 67/548/EEC or 1999/45/EC above a certain threshold.
Tailings Art.3 (9) of Directive 2006/21/EC	waste solids or slurries that remain after the treatment of minerals by separation processes (e.g., crushing, grinding, size-sorting, flotation and other physical-chemical techniques) to remove the valuable minerals from the less valuable rock
Heap Art.3 (10) of Directive 2006/21/EC	an engineered facility for the deposit of solid waste on the surface
Dam Art.3 (11) of Directive 2006/21/EC	an engineered structure designed to retain or confine water and/or waste within a pond
Pond Art.3 (12) of Directive 2006/21/EC	a natural or engineered facility for disposing of fine-grained waste, normally tailings, along with varying amounts of free water, resulting from the treatment of mineral resources and from the clearing and recycling of process water
Waste facility Art.3 (15) of Directive 2006/21/EC	any area designated for the accumulation or deposit of extractive waste, whether in a solid or liquid state or in solution or suspension, for the following time-periods: • no time-period for Category A waste facilities and facilities for waste characterised as hazardous in the waste management plan • a period of more than six months for facilities for hazardous waste generated unexpectedly • a period of more than one year for facilities for non hazardous non-inert waste • a period of more than three years for facilities for unpolluted soil, non-hazardous prospecting waste, waste resulting from the extraction, treatment and storage of peat and inert waste.
BAT (best available techniques) Article 2 (12) of Directive 2008/1/EC (IPPC Directive)	the most effective and advanced stage in the development of activities and their methods of operation which indicate the practical suitability of particular techniques for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emissions and the impact on the environment as a whole: • 'techniques' shall include both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned, • 'available' techniques shall mean those developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages, whether or not the techniques are used or produced inside the Member State in question, as long as they are reasonably accessible to the operator, • 'best' shall mean most effective in achieving a high general level of protection of the environment as a whole.
Rehabilitation Art.3 (20) of Directive 2006/21/EC	the treatment of the land affected by a waste facility in such a way as to restore the land to a satisfactory state, with particular regard to soil quality, wild life, natural habitats, freshwater systems, landscape and appropriate beneficial uses
Site Art.3 (28) of Directive 2006/21/EC	all land at a distinct geographic location under the management control of an operator

1.3.2 Waste types in extractive industries

Table 1.3.2-1 tries to cover the types of extractive wastes most commonly encountered in the various industry sectors. It should be specified that for non-hazardous non-inert wastes which are not stored in a Category A facility, Member States may reduce or waive the requirements of financial guarantees under Article 14 of the EU Directive (2006/21/EC). An example would be salt heaps which contain non-hazardous non-inert wastes. In general, salt is discussed separately as salt mining and its environmental impacts are different from any other mining activities. Same applies to other mining operations of industrial minerals.

Table 1.3.2-1: Wastes typically occurring in the extractive industry

	Sectors of the extractive industry					
Typical Waste	**Energy** minerals (Coal, lignite etc.)	**Metal ores** (gold, uranium, etc.)	**Industrial minerals** (clay, gravel, sand, etc.)	**Aggregates**	**Salt** (rock salt)	**Oil, gas**
Waste rock dumps and heaps	✓	✓	✓	✓		
Tailings ponds and heaps	✓	✓			✓	
Disposal facilities of water treatment sludge	✓	✓				
Heap leach pads		✓				
Sludge of the oil and gas industry						✓
Soil	✓	✓	✓	✓		

Some of the wastes may be acid generating, which leads to the production of seepage containing heavy metals and acidity, usually referred to as Acid Rock Drainage (ARD). In other cases, depending on the mineralogical composition of the wastes, the seepage water is circumneutral, but still contains elevated concentration of toxic metals. These wastes, which are possibly classified as hazardous waste due to their elevated content of toxic constituents in the seepage (and their negative impact on the environment) require special attention and may need long-term care and maintenance such as monitoring and treatment of the seepage. Metal ore mines (underground and open pit mines) may also produce acidic effluents (usually referred to as Acid Mine Drainage, or AMD) which must be monitored and treated, too, possibly over very long time scales. The water treatment waste results directly from the extractive process, and is therefore included in the waste list of Table 1.3.2-1.

The prediction of the quality and quantity of the effluents from mine waste facilities is a complex task which receives increasing attention. Mining wastes may continue to produce toxic and acid effluents over several decades, which have a strong impact on the financial guarantee for their closure and rehabilitation, and on the inspection regime. Further information on waste types is available in Ref. 77, 78, 79, 83, 125, 126 and 128.

Just for completeness, the following aspects concerning financial guarantees as defined in Article 2 (3) of the MWD should conceptually be taken into account:

Separation of extractive waste facilities from the entire mining operation: Financial guarantees for extractive waste facilities may be difficult to separate from guarantees for the entire operation. Financial guarantees required under the MWD, Article 14 should only cover the mine waste facilities from the land-based extractive industry.

Article 2 (3) of the MWD excludes from the scope of Article 14 those waste facilities, which contain non-inert and hazardous waste and are not Category A facilities. Inert waste and unpolluted soil are excluded from the requirement of a financial guarantee. Member States may also waive or reduce the financial guarantee requirement for non-hazardous non-inert wastes, unless deposited in Category A facilities.

The scope of financial guarantees covers in most of the cases the rehabilitation of the entire mining operation, including underground and open pit mines, plant areas, and provisions for water treatment, where applicable. Often wastes which fall under Article 14 are also partially used to backfill open pits or shafts, or to reshape the surface before a final cover is applied: the financial guarantees provided by mine operators should reflect this.

Some national legalisations, such as Austria, provide a clear separation of the financial guarantee for the entire operation and of those for the extractive waste facilities.

Exemption of certain wastes from Article 14 in case of premature closure: Wastes which are subject to the MWD are defined in Article 2 (1), which refers to the definition of "waste" in Article 1 (a) of the Waste Framework Directive 2006/12/EC. Relevant for the definition of "waste" in the context of waste from extractive industries is also the European Court of Justice ruling in the Case C-114/01, Avesta Polarit. On the question on residues placed back in the excavation voids, the Court ruled that leftover rock from mining operations that is used lawfully in the industrial mining process proper for the necessary filling of the galleries of that mine does not constitute waste if the mining operator can identify physically the residues and provides the competent authority with sufficient guarantees of that use

However, the intention of Article 14 of the MWD is to ensure that "all the obligations flowing from the permit will be fulfilled, including those relating to the closure and after-closure of the waste facility" (MWD, Recital 25). This includes also premature cessation of the operations. The limited scope of Article 14 is problematic, for example, if an open pit is only incompletely mined-out. In this case, most mining legislations require that the pit will not be backfilled as initially intended, but merely conserved. Non-inert soil and non-hazardous wastes placed on intermediate storage sites for the purpose of backfilling are covered by the MWD, in the case the deposition or accumulation exceeds a period of more than one year (Article 3 (15)). This issue should be resolved by ensuring that closure plans properly address premature closure. This will then be an issue that will need to be taken into account under those circumstances.

1.3.3 Closure objectives of extractive waste facilities

With respect to financial guarantees and inspections, a set of objectives are needed against which the operation and closure of extractive waste facilities can be judged. The BREF for the

Management of Tailings and Waste-Rock in Mining Activities (see Ref. 10 and 85) has been developed as a supportive document to the MWD. While this document does not set legally binding standards, it is meant to provide guidance for industry, EU Member States and the public on achievable performances, emissions, etc. The paragraph "Closure, rehabilitation and after-care of facility" of (see Ref. 10) states the following general principles for closure and rehabilitation of mining waste facilities:

- physical stability of constructions,
- chemical stability of tailings and waste-rock and,
- successive land use.

The extractive waste facilities should be stable under foreseeable design events such as floods, earthquakes and permanent natural forces (wind and water erosion) such that they do not impose a hazard to public health and safety or to the environment.

Table 1.3.3-1: Criteria for the closure of tailings and mine waste facilities (Ref. 10)

Issue	Closure Objectives
Physical Stability	All remaining anthropogenic structures are physically stable
Chemical Stability	Physical structures remaining after closure are chemically stable
Biological Stability	The biological environment is restored to a natural, balanced ecosystem typical of the area, or is left in such a state so as to encourage and enable the natural rehabilitation and/or reintroduction of a biologically diverse, stable environment
Hydrological and hydrogeological environment	Closure aims at preventing physical and chemical pollutants from entering and subsequently degrading the downstream environment - including surface and ground waters
Geographical and climatic influences	Closure is appropriate to the demands and specifications of the location, of the site in terms of climatic (e.g., rainfall, storm events, seasonal extremes) and geographic factors (e.g., proximity to human habitations, topography, accessibility of the mine)
Local sensitivities and opportunities	Closure optimizes the opportunities for restoring the land and the upgrade of land use is considered whenever appropriate and/or economically feasible
Land use	Rehabilitation is such that the ultimate land-use is optimized and is compatible with the surrounding area and the requirements of the local community
Socio-economic considerations	Consideration must be taken of opportunities for local communities whose livelihoods may depend on the employment and economic fallout of the mining activities. Adequate measures are made to ensure that potential socio-economic advantages associated with closure are maximized.

Table 1.3.3-1 summarizes the criteria for safe closure of tailings and mine waste facilities, which can be seen as a generic scope of closure and rehabilitation measures for which financial guarantees are required under Article 14, and for the inspections required under Article 17 of the MWD. Further information on this issue can be found in Ref. 69 and 71.

The number of contaminated sites in the Community, posing significant health risks and loss of biodiversity has dramatically accelerated over the last decades. The Directive 2004/35/EC focuses on the environmental liability with regard to the prevention and remedying of environmental damages. The mining industry has to consider both, the Directives 2004/35/EC and 2006/21/EC (for further details see Chapter 5.3).

1.4 Methodology

1.4.1 Financial guarantees

The review and assessment of existing schemes on financial guarantees includes the EU Member States as well as other selected countries, including traditional mining countries like the United States, Canada, Australia and South Africa. For 17 case studies (see Annex 3) the financial guarantees are presented in detail under consideration of the actual implementation context of the particular mines. The selection of the case studies considers a variety of countries, financial instruments and types of waste facilities.

The compilation of the case studies is largely based on the results from questionnaires sent to several mine operators in a variety of countries and on the consultation with relevant stakeholders, including the extractive industry, the financial sector and the competent authorities, which provided comments on the particular national legislation. We thus tried to ensure our findings are based on the practical experience of the various counterparts and represent a realistic assessment of the financial guarantees and calculation methods applied.

Important research sources for our report are the systematic literature screening, including collection of documentation and information from sources which are directly and actively involved in the management of waste from extractive industries, i.e. mining companies, competent authorities with powers related to the regulation and inspection of mining activities, and NGOs. Our research includes also the review and assessment of publications and reports from other policy areas and sectors related to financial guarantees. The literature, which is compiled in the list of references in Annex 1, has been selected accordingly to the following criteria:

- relevance to the project,
- availability and quality of the literature,
- diversity of information with regard to the main types of mine waste facilities, closure management, rehabilitation scenarios, country, etc.

Additionally, an evaluation table for the literature is elaborated to facilitate the quick search of useful information.
Furthermore, the applicability and cost-effectiveness of the different methods and approaches identified have been assessed with regard to the specific requirements of the MWD. Finally, the report provides a range of considerations, which help to prepare technical guidelines for the calculation of financial guarantees.

1.4.2 Inspections

In Part II of this report a survey on the international practice of the inspection of mine waste facilities is undertaken. The survey on inspections covers similar to the Part I of this study the main categories of extractive industries and of mining waste facilities as well as a variety of countries (see chapter 1.4.1).

To gain information about the existing arrangements for inspections which are in place in various countries questionnaires have been sent out to the competent authorities of the 27 EU Member States and the responses have been evaluated thereafter. Questionnaires on the subject of inspections received from mine operators are considered as well.

Furthermore, a selection of 10 case studies has been compiled considering a variety of countries, such as the USA, Canada, Australia and South Africa as well as the EU Member States, and different types of waste facilities (heaps, tailing ponds, etc.).

Finally, other relevant documentation and information sources including the BREF (see Ref. 157) are reviewed. A key report on the subject of inspections is the review of Recommendation 2001/331/EC providing for minimum criteria for environmental inspections (RMCEI) in the Member States by the European Commission (see Ref. 150). In the frame of the RMCEI, the EU Member States report on the details of environmental inspection mechanisms and their experience with the operation of the RMCEI.

2 BACKGROUND

The occurrence of significant environmental impacts due to the existence of abandoned mine waste facilities across the EU is the main reason for the introduction of more stringent and commonly binding legal requirements within the EU Member States. In the past, in some cases mine operators failed to restore mine waste facilities because of financial failure or because historically, society had not yet recognised mine closure as an environmental issue. With increased awareness of the environmental matters in the 1960s and 70s, international funding and donor-organizations were among the first to require clearly defined environmental and closure objectives. In order to reduce the risk-factors in their businesses, banks and insurance companies, as the institutions providing financial instruments, need to be clear in terms of the scope and level of financial guarantees, and detailed site information related to operational risks. Over the last decades, the World Bank and the United Nations designed proceedings and codes which aim to ensure a certain standard of work. Examples for these standards and codes are the “Equator Principles” which are specified in Ref. 84, 86 and 88. In the following, the general interests of the actors involved in on the establishment of financial guarantees for mine waste facilities are presented.
The implementation of the financial guarantees has to be controlled and inspected on routine basis by the competent authorities. Inspections are an important tool for verifying the compliance of the mine operator with the permit conditions prior to the start of the deposition operations and thereafter. Inspections may result in updating of permit conditions in accordance with Article 7 (4) of the MWD.

2.1 Competent authority

The competent authorities ensure that the obligations for the operator related to the mine closure and rehabilitation work are properly enforced. The examination of the closure plans, including compliance with the financial guarantee requirements, should provide the competent authorities with the necessary information to assess whether mining companies honour their responsibilities with respect to any damages caused to the environment.

2.2 Extractive industry

With regard to financial guarantees, the mining companies have a strong interest to ensure that the financial guarantee amount or equivalent is realistic as compared to the actual remediation requirements. [….]. Overly restrictive policies could unduly depress capital availability, damage the investment climate and cause some existing mines to shut down or immediately declare bankruptcy. Industry respondents have therefore asked that financial guarantees serve as far as possible to promote the efficient extraction of mineral resources and their associated economic benefits while achieving levels of environmental protection and future land use that are acceptable to society.

KPMG (Ref. 123) has carried out an international survey of mining companies with respect to their accounting practice, including the recognition of mine closure and rehabilitation liabilities in their balance sheets. The number of companies who recognize mine closure and rehabilitation liabilities in full at reporting date has strongly increased. 95 per cent of the surveyed companies by KPMG raised an asset for mine closure and rehabilitation, although the direct link between the asset and the associated liability was not always clear. Thirty-five of the 44 surveyed companies (i.e., 80%) disclosed mine closure and rehabilitation as a critical accounting estimate and judgment. Of those companies, 15 did not disclose details of how the mine closure and rehabilitation liabilities, such as discount rates and other key factors impacting liability calculations were calculated.

In a report by Deloitte (Ref. 131), the increased interest of mine operators in reducing any financial risk and hence, in the establishment of closure provisions as they become an important factor in the assessment of mining companies is pointed out. Ref. 131 underlines the uncertainties of the operators in calculating closures provisions are influenced by a wide range of factors and "management's associated assumptions", such as:

- "scope of liabilities defined by local legislation and internal policy which a company is required to address,
- methodology utilised to estimate the costs associated with discharging the obligations,
- approach to modelling decommissioning and rehabilitation expenditure, often over periods of decades, and
- calculation of present values utilising inflation and discounting factors".

As further reported by Deloitte, one important prerequisite of the closure provisions must be that the information disclosed is sufficient to allow the investor to fully understand the position of the mining company with respect to these liabilities. According to Ref. 131 there are currently extreme differences in the quality and consistency of disclosure of such information in the mine sector. It is desirable that the mining companies recognize the significance of establishing adequate closure provisions and improve the transparency in reporting. To put the vendor in a stronger position so that the value during the due diligence process is not endangered and at the same time to assist shareholders and wider stakeholders in their analysis and decision making it is further proposed to undertake the accurate reporting annually (for further information on the interest of the counterparts see also Ref. 76, 90 and 124).

Generally, mining companies should be encouraged to report how they will rehabilitate their environmental liabilities, including the extractive waste facilities, and how the guarantees have been calculated. In particular, the following information should be disclosed to the public:

- scope of the closure plan, most important closure and rehabilitation measures, including long-term liabilities,
- progressive closure and rehabilitation works completed in the reporting period,
- cost estimate for these measures including the long-term measures,

- financial instrument(s) used for the guarantee.

This information could be published in the Annual Report and/or in the Sustainable Development/Corporate Social Responsibility Report which have become a common tool for corporate communications of many mining companies.

2.3 The public

Financial liabilities generated by mine rehabilitation and closure procedures, which are left behind by insolvent mine operators represent supplementary financial burdens for the general public. Clearly defined positions and obligations of each of the stakeholders involved in the mine closure process are therefore in the interest of the general public as the taxpayer does not want to be charged with additional financial liabilities. To avoid the transfer of costs from the polluter to the public the MWD provides a guarantee that mining operations are carried out from the start of deposition operations (Recital 25).

PART I: FINANCIAL GUARANTEES

3 OVERVIEW OF FINANCIAL INSTRUMENTS

3.1 Remarks on terminology

Apart from a vast body of literature on financial guarantees for mine closure, covering both theoretical and practical viewpoints, there are at least 4 studies of significant scope and geographical coverage which have been devoted to the international practice of different financial instruments as possible guarantees for mine closure and rehabilitation (see Table 3.1 1). There is no point in repeating their findings in detail, but they form a valuable source for this project and have been evaluated to describe the current international practice. In case definitions or other fragments have been taken from other authors' work it has been indicated as "from/see Ref. …".
For clarity of the terminology it must also be noted that the term "financial guarantee" will be used synonymously to the expression "financial surety". The term "financial instrument" describes all available tools for the financing of financial guarantees.

Table 3.1-1: Overview of larger studies on financial instruments as guarantee for mine closure and rehabilitation

Author, Title, Year of Study	Scope
Campusano, Raul et al., Cochilco, Chilean Copper Commission for IIED; **Research on Mine Closure Policy**; January 2002 [Ref. 12]	USA, Australia/New Zealand, Canada, South Africa, Japan, Brazil, Bolivia, Ireland
Miller, G. C. for ICMM (International Council on Mining and Minerals; **Financial Assurance for Mine Closure and Reclamation**; February 2005 [Ref. 13]	22 countries worldwide with 29 sub-jurisdictions
Sassoon M. for the World Bank; **Guidelines for the Implementation of Financial Surety for Mine Closure;** September 2006 [Ref. 41]	USA, Canada, Australia, South Africa, Papua New Guinea and EU
Miller, G for ICMM; Environmental Resources Management for ICMM: **Financial Assurance for Metals Operations, Summary Paper**, 2007 [Ref. 56] (Note: this report focuses on smelter operations!)	Extension to 2005 ICMM study, 11 countries in Europe plus Japan, Brazil, Canada, Chile, China, Japan, South Africa, USA

The use of terms for financial instruments differs from country to country, and from author to author. As a first step, we have therefore attempted to create a consistent basis of terminology for the various instruments. The approach is as follows:

- The various financial instruments are grouped together according to more general categories. As categorisation, we have chosen the degree to which liabilities remain with the mine operator or are transferred to third parties. In our opinion, this is the most important variable for regulators to assess the suitability of a particular instrument.

- The number of terms is kept as small as possible, which means that various sub-variants of financial instruments are subsumed under a single heading. This leads inevitably to the loss of details by which the instruments are characterised, but this is overcompensated by the gain in conceptual clarity.

- The definitions of the various instruments are mostly taken from previous studies on the use of financial guarantees, to ensure consistency of the terminology at least partially. A table summarizing the findings of previous studies and surveys in this field is intended to help the reader to associate the terms used in this study to those from previous ones, and to see where simplifications have been made or different sub-variants have been grouped into a more general term.

3.2 Categories of financial instruments

Even though Article 14 of the MWD does not make any detailed specifications in this respect, except the fact that provides as an example a financial guarantee in the form of a financial deposit, including industry-sponsored mutual guarantee funds (as it is applied in the UK gravel industry) the financial instruments can be divided in three main categories depending on the degree to which the financial guarantee is decoupled from the mine operator's assets:

- the financial guarantee remains within the operator company,
- the financial guarantee is guaranteed by a third (commercial) party,
- the financial guarantee is transferred to the government or a trust fund.

The more independent the financial guarantee is, the less it is affected in case of a bankruptcy. To put it simple: a financial guarantee which is not independent of a company's assets might be worthless in case of bankruptcy. This categorisation of financial instruments is schematically represented in Figure 3.2-1, which contains only those terms which are used throughout this study.
A disadvantage of any schemes involving third party guarantees is the legal risk that the guarantor may successfully dispute its obligations, even under circumstances that the competent authority believed would be included. A second linked problem is that the legal costs of producing agreements can be substantial.

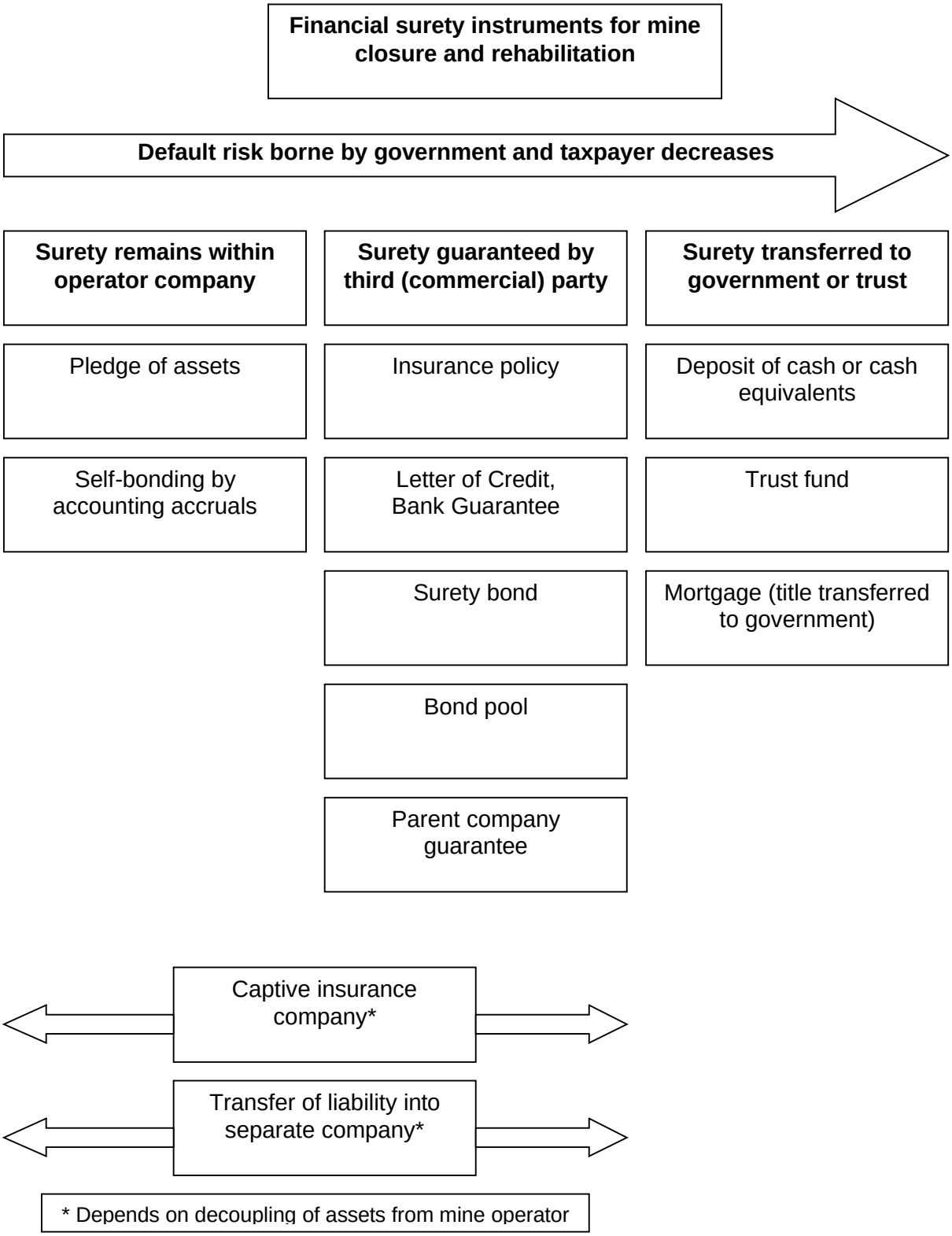

Figure 3.2-1: Categories of financial guarantee instruments and typical examples

Self-bonding by accounting accruals

This approach is based on the evaluation of the financial health of the mining company, and the assurance from the company itself that sufficient funds will be set aside to carry out reclamation and closure obligations. Accrued liabilities to close and environmentally rehabilitate a mining operation are stated on the liability side of the balance sheet. Whether the company meets its obligations can be seen from the structure of the balance sheet (Ref. 12 and 41).

“Company Guarantees require a long history of financial stability, a credit rating from a specialised credit rating service and at least an annual financial statement prepared by an accredited accounting firm.” (Ref. 41).

Many large firms prefer this method of providing financial responsibility. There are significant advantages for the mine owner and operator, including tighter control of funds and savings in reduced transaction costs. One disadvantage of this approach is that there are times when even large companies which look good on paper must declare bankruptcy, leaving the civil society (government) to absorb the full costs of any reclamation, remedial actions and mine closure costs. Self-bonding and provisions are synonymous. In Germany provisions are common financial instrument. A problem with provisions is that they might be not protected against bankruptcy.

Whereas bankruptcy is cited as the typical scenario that mining companies fail to fulfil their obligations including environmental rehabilitation in many parts of the world, it must be underlined that the commercial and penal law in EU Member States makes unexpected bankruptcies very unlikely, and strongly limits the consequences of financial strain of a company with respect to environmental obligations. This is exemplified by information from WVB, the German association of the mining industry:

- The German Corporate Control and Transparency Act of 1998 obliges companies to implement a risk management system which enables them to detect risks (including insolvency) and take counter-measures. This makes an unexpected bankruptcy very unlikely.

- The amended insolvency regulations, valid since 1999, require that the corporate management files for bankruptcy even in case that insolvency cannot be reasonably excluded. Failure to do so leads to personal liability of the managers, so that there is a strong incentive to ensure that all obligations of a company are met.

- In the case that a company files for bankruptcy, its obligations will be honoured under very strict regulations, and must also be met by its legal successor. Access to the company's assets is very restricted, and is only allowed to the appointed liquidator.

- In a legislative environment such as described in this German example above, provisions are a suitable and fully acceptable instrument to provide financial surety for environmental liabilities.

A survey of the insolvency legislation in the EU Member States would go beyond this study. However, it must be clearly stated that the overall criticism of provisions and other forms of self-

guarantee must be weighted against the concrete legislative environment in each EU Member State.

Pledge of assets

A pledge of assets is not accepted in many countries (Ref. 12 and 41). It covers all surplus equipment including the mine infrastructure (e.g., buildings, machinery, etc.) and scrap metal including all metal debris produced during site demolition and the clean up process that remain at the mine site after closure.

Used as financial guarantee, the pledge of assets have to ascertain that the assets are not fixed, charged with burdens or contaminated and that there is a market demand for the assets. A third party should calculate the amount that has to include the cost of reclamation and transportation of the assets from the site to the market place.

Parent company guarantee

In principle, the mechanism is the same as for self-bonding of the mine operator. The difference is that the operator belongs to a parent company which guarantees to provide the funds needed by the subsidiary to close and rehabilitate the mine site. The parent company consolidates the liabilities of its subsidiaries and guarantees in its balance sheet.

If the parent is a large, financially healthy company, its guarantee is often more reassuring than that of the (usually smaller) local subsidiary. However, also multi-nationals are not immune to financial stress and may default on their guarantees, which leaves the government or civil society with the burden of cleanup and rehabilitation (Ref. 12 and 41). It should be noted however that parent company guarantees based on fixed assets (like properties, etc.) are significantly harder than just a soft declaration and display many similarities to the mortgage form of a guarantee.

Insurance Policy

General forms of insurance policies are the premium financing, commercial general liability and professional indemnity, for instance, which normally do not cover environmental liabilities or long term rehabilitation costs (Ref. 41).

In the USA an insurance policy has to consider the costs of rehabilitation, the credit worthiness of the mine operator as well as the market value of the mine assets in the case of bankruptcy. The actual rehabilitation costs are paid to the government out of the funds. In case there is a surplus in the account at the end of the mine's life, it goes back to the operator and in case of bankruptcy. The actual rehabilitation costs are paid to the government out of the funds. Most of the existing insurance schemes are usually tax deductible.

Letter of Credit / Bank Guarantee

Letter of credits, also known as bank guarantees (see Section 2.1 of Ref. 41), represent agreements between a bank or institution and a proponent in order to ensure the availability of funds for the payment of a third party, mainly the relevant government department, in case of a licensee defaulting on its obligation to remediate.

Within the letter of credit the terms and conditions of the agreement considering the rehabilitation programme and the agreed costs are enclosed. Any changes to the letter of credit require the consent of all parties involved. A letter of credit provides certainty of value and can be liquidated or revised in case the required amount has to be changed (see Ref. 24).

“To obtain a letter of credit, the proponent will have to demonstrate to the bank that provisions have been made for the rehabilitation of the mine site and that it has sufficient funds and liquidity to cover the costs. The letter of credit is usually issued for a year and renewed annually following a review of rehabilitation requirements and costs. If the bank, for any reasons, does not renew the letter of credit, and the proponent fails to provide an acceptable alternative form of financial guarantee, the government can request the payment of the full outstanding amount of the letter of credit.” (Ref. 41).

The government will accept only a letter of credit from banks previously specified. The annual cost of a letter of credit ranges from 0.5% to 9% of the guaranteed amount, depending on the proponent’s credit rating. The funds held in a letter of credit do not generate any interest (Ref. 41).

Surety bond

Surety bonds are popular in the construction industry and include bid bonds, performance bonds, labour and material payment bonds, maintenance bonds and variations of those. They represent an agreement between an insurance company and a proponent in order to provide funds to a third party under certain circumstances. In this instance the third party is the relevant government department.

The surety bond covers the terms and conditions of the agreement between the proponent and the government considering the rehabilitation programme, the agreed costs and the conditions for the release of the bond. Any changes to the surety bond require the consent of all parties involved (see Ref. 41).

“The surety bond is issued by an insurance company that should be licensed under the relevant legislation. It is issued for a specific time period and can be renewed for further time periods, based on a credit review of the proponent. During this process the amount of the surety bond can be increased or decreased depending on the amendments to the rehabilitation programme. If the surety bond is not renewed, and the proponent fails to provide an acceptable alternative form of surety, then the government has the option of drawing the full amount. The proponent should be responsible for all fees and charges associated with the surety bond.” (Ref. 41). The government has to guarantee that the surety bond is not invalidated through default of the proponent.

Bond pool

Bond pools are established to pay for reclamation and closure costs incurred by bond pool members, in case of bankruptcy or other unforeseen events that render them financially unable to fulfil reclamation and closure commitments. Bond pools are often proposed to meet the needs of small operators, many of whom are unable or unwilling to provide the substantial

collateral required by insurance companies (Ref. 13). Membership in bond pools is voluntary. There is typically a test for entry, which includes evaluation of the following:

- compliance record, including number of permit violations,
- financial standing,
- years in operation,
- reclamation experience.

Captive insurance company

A captive insurance company ("Captive") is a funding vehicle that can aid in the administration and formalization of risk retention within the risk management function. It is an insurance company owned by the insured or an affiliate of the insured and is typically formed to insure the owner's risks (Ref. 13).

There is no transfer of risk outside the corporate family. The Captive would represent, in simple terms, a vehicle for formally segregating the owner's retained risks.

Transfer of liability into separate company

At least in theory, the possibility of establishing a specialised company to carry out only mine site rehabilitation has been considered. Such a company would have a contractual arrangement with the mining company involved and would be responsible for providing insurance cover. To the best of our necessarily incomplete knowledge, this type of surety has not been used so far in practice.

Deposit of cash or cash equivalents

The amount required to cover all closure and rehabilitation costs is paid into a bank account accessible only by the government. In case the mine operator defaults on its obligations, the government has immediate access to the funds in the account. An alternative to cash are investment-grade securities such as treasury bills which are payable at or before maturity to the government in case the mine operator defaults on its obligations.

Trust fund

“Trust funds are indemnity agreements made by the mine owner/operator, and they involve the mine owner/operator setting aside collateral, cash, or cash equivalent financial devices, equal in value to the estimated costs of reclamation and closure. These funds or assets are then held in trust by the regulator, the government, a bank, or a similar financial institution.” (from Ref. 12).

Mortgage

A mortgage is a property title (e.g., real estate) which the operator of a mine transfers to the competent authority in order to secure the performance of a predetermined closure and rehabilitation duty. As soon as the duty is fulfilled, the property title is transferred back to the operator. If the operator fails to accomplish its obligations (e.g., due to bankruptcy), the financial value of the property title can be used by the competent authority to pay for the necessary closure and rehabilitation works. The real financial value of given property title might be subject to considerable fluctuations over time.

3.3 Use of financial instruments

In the evaluation of the presented financial instruments it is important to consider aspects like international competitiveness, efficiency, reliability, transparency and applicability of the selected financial guarantee.
The previous reports mentioned in Table 3.1-1 form a large database of the current international practice. They have been analysed for the purpose of this study. The result is shown in Table 3.3-1 and Figure 3.3-1. Supporting information for further reading is available in Ref. 32, 43, 44 and 49.

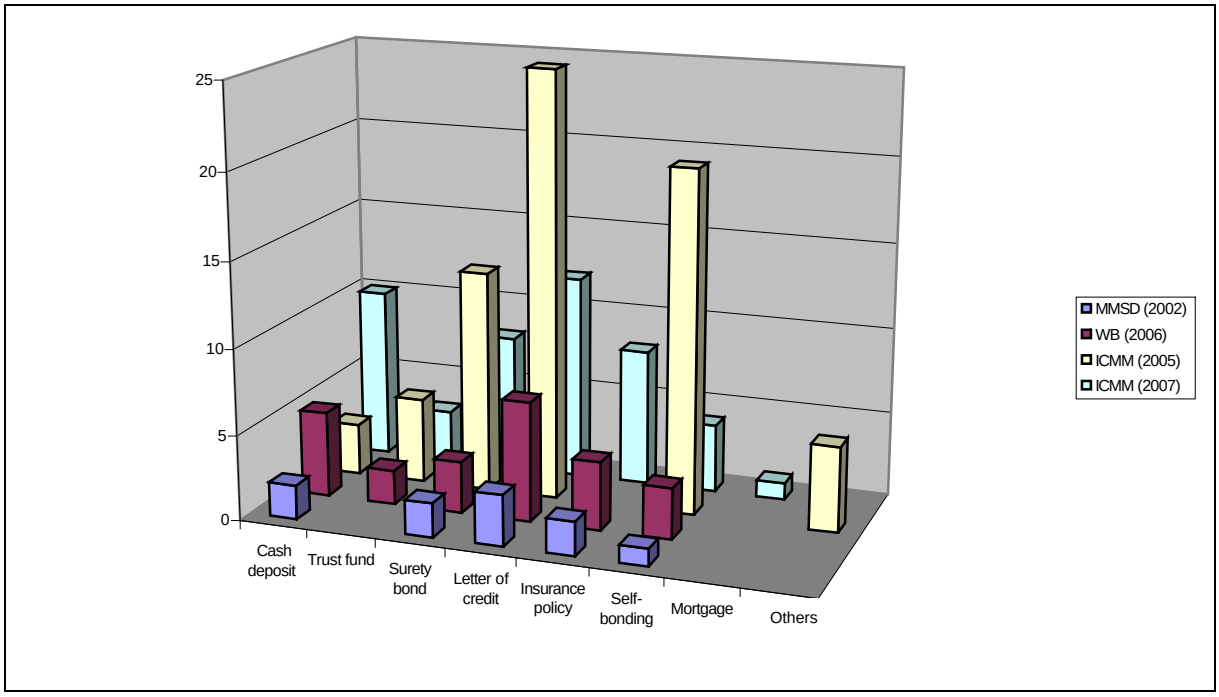

Figure 3.3-1: Abundance of the basic types of guarantees (according to findings of Table 3.3-1)

The chart in Figure 3.3-1 showing the abundance of financial instruments reproduces the findings of other authors and studies which can be summarized as followed:

- The most commonly accepted type of financial guarantee is the letter of credit (LOC), which is accepted by all developed countries surveyed.
- Widely accepted, albeit to a lesser extent, are trust funds, bonds and insurance products, which transfer the financial guarantee from the operator/owner to a third party.
- “hard” financial instruments like a deposit of cash or cash equivalents are used less frequent than a letter of credit.
- Various forms of self-bonding (including corporate guarantees from the parent company) where the risk of default is ultimately borne by the taxpayer are widely used.

The reasons for the popularity of the LOC is its administrative simplicity, see Table 3.3-2. The widespread use of self-bonding (e.g., provisions) is its minimal impact on liquidity and the ability of the operator to borrow and invest.

Table 3.3-1: Financial instruments occurred in the previous studies

	MMSD 2002 [12]			Sassoon/WB 2006 [41]			ICMM (2005) [13]			ICMM (2007) [56]	
	Term defined?	Countries/ Legislations	other terms used in report	Term defined?	Countries/ Legislations	other terms used in report	Term defined?	Countries/ legislations	other terms used in report	Countries/ Legislations	other terms used in report
Basic types of surety											
Cash deposit		Bureau of Land Management Arizona (BLM)	possibly as deposit with state treasurer,. Certificate of deposit		Ontario, Queensland, Ghana, Papua New Guinea (PNG), Sweden	bought as cash equivalent, also bank draft		3		10	
Trust fund	✓			✓	Ontario, Nevada		✓	5	Cash trust fund	3	
Surety bond	✓	US BLM, Arizona, Brazil		✓	Ontario, Nevada, Ghana	Performance bond, Insurance bond	✓	13	Reclamation or Closure Bond, Performance bond. Miller notes that Bond may come in various forms, such as L/C, Cash deposit, parent company guarantee etc.	8	
Letter of credit Bank Guarantee		Arizona, BLM, California	Irrevocable L/C	✓	Ontario, Nevada, Queensland, Victoria, Ghana, PNG, Sweden	Bank guarantee	✓	25	Bank guarantee, Bankers' Undertaking	12	
Insurance policy		Arizona, BLM		✓	Nevada, Queensland, Ghana, PNG		✓			8	Certificate of insurance
Self-bonding	✓	Arizona	Financial tests, accounting accrual, Evidence of ability to meet a corporate financial test or corporate	✓	Ontario, Nevada, PNG	Company Guarantee, also including Parent Company Guarantee	✓	20	Corporate Guarantee, Parent Company Guarantee, Captive Insurance Company (depending on how the assets of the Captive are detached from the operator's assets)	4	

	MMSD 2002 [12]			Sassoon/WB 2006 [41]			ICMM (2005) [13]			ICMM (2007) [56]	
	Term defined?	Countries/ Legislations	other terms used in report	Term defined?	Countries/ Legislations	other terms used in report	Term defined?	Countries/ legislations	other terms used in report	Countries/ Legislations	other terms used in report
			guarantees as provided by 40 Code of Federal Regulations section 264.143(f)								
Mortgage										1	
Negotiable United States Government State and Municipal securities or bonds		BLM									
Investment-grade greater securities		BLM						1	Deposit of Securities		
Unit Levy (not instrument in itself, but payment of unit amount per ton of ore or waste, into a financial instruments such as a cash deposit)				✓	Ontario						
Sinking Fund (not instrument in itself, but payment of unit amount per year until total amount is reached, into a financial instrument such as a cash deposit)		Arizona	Annuities	✓	Ontario						
Pledge of assets				✓	Ontario, Sweden			1			
Transfer of liability into specialised mine rehab company				✓	none			1	Mining Reclamation Contract and Security Agreement		
Bond pool	✓			✓		Fund pool?					
Captive Insurance Company											
Other financial assurance mechanisms that are acceptable to the inspector		Arizona									

Table 3.3-2: Brief evaluation of the commonly used financial instruments

Instrument	Advantages	Disadvantages
Self-bonding	• Most advantageous for mining company • Does not tie up capital • Simple to administrate • Public availability of Annual Reports	• Even very large companies can fail, no matter what their financial health was when mining project started • Annual Reports and financial statements are not immune to manipulation (accounting scandals) • Problematic public acceptance
Insurance policy	• Low costs also to smaller mining companies • No tied-up capital • Modest cash outflow from mine operator	• Only very few insurance products are currently on the market • Reluctance of large insurers to cover environmental liability risks
Letter of credit, bank guarantee	• Cheap to set up (provided that company meets the bank's requirements) • No tied-up capital • Modest cash outflow from mine operator • Less administrative requirements • The government can reserve the right to approve banks from which they accept an LOC, thereby minimizing the risk of failure of weak banks	• Surety provider (bank, surety company) itself may fail • Obtaining an LOC may reduce the borrowing power of the mining company • Availability of bonds depends on state of surety industry and may be negatively affected by market forces outside the mining industry
Surety bond	• Generally low costs • No tied-up capital	• Bond issuer may fail over the long term (see also under "LOC") • rating of the company that determines the cost and it will be substantially higher for small companies, especially those without proven track records
Cash deposit	• Cash is readily available for closure and rehabilitation • Investment-grade securities (treasuries) can be traded with minimal risk of liquidity • High public acceptance ("visibility" of guarantee) • for small and junior mining companies, if they fail to meet the criteria of a bank • Can be dissolved only partly in case of need • Can be transferred in a pooled fund	• Significant capital is tied up for the duration of the mine life, especially for large mining projects • Some governments may be tempted to use the deposited cash for purposes other than securing the mining project • Cash is more vulnerable to being lost to fraud or theft
Trust fund	• High public acceptance ("visibility" of trust fund) • Trust funds may appreciate in value (but may also lose value, see "Disadvantages")	• Risk of bad management of the trust fund (loss of value if fund invests in risky assets) • Trust fund may not have enough value accumulated through annual payments if mining project ceases prematurely • Trust fund management and administration consumes some of the value and income earned
Mortgage	• Easy to administrate • No cash outflow from company	• Value of mortgaged property may change (lose) with general market conditions • Administrative cost to government to liquefy mortgaged property • Discount on property value in case rapid liquidation is necessary • Mortgage reduces ability of mining company to obtain loans

3.4 Aspects to be considered in the design of financial instruments

3.4.1 Timing

For most countries, the existing studies show that financial guarantees must be lodged before any environmental disturbance occurred, i.e. before starting the deposition of mine waste. Whether the financial guarantee is put in place before the mining title is granted or before the actual works start (possibly requiring the issuance of another "work permit") is a matter closely related to the procedural subtleties of national mining legislations.

MWD lays down that the financial guarantee is required before the deposition of waste into the waste facilities.

3.4.2 Assessment of the needed amount

Another question which is linked to the time of lodging the financial guarantee is whether the full amount required for closure and rehabilitation should be secured at the beginning, or only the amount to cover the liabilities incurred for the next period of time, say, 12 months.

This step-wise procedure has the advantage that:

- new liabilities in a period can be (at least partially) offset by progressive remediation of liabilities in the same period. This netting of new and released liabilities reduces the effective secured amount, and encourages progressive rehabilitation efforts of the operator;

- not the entire amount must be secured at the beginning, which helps especially small sized mining companies which still have to build up financial strength in the course of a mining project, and may be welcomed to invest in the resource sector of a country.

On the other hand, the administrative burden is higher due to the detailed evaluation of the works foreseen in the future and the release of the guarantee for the progressively completed remediation works.

Often, the financial volume of the financial guarantee to be lodged is based on a closure plan, which may contain progressive rehabilitation elements and therefore a time dependence of the liabilities. For example, the regulations of the BLM Nevada office (see Ref. 46) stipulate that "upon request by the operator, the BLM in Nevada may allow phased or incremental bonding for plans of operations. Some plans may be designed so that operations will occur in discrete "blocks" or operational phases. Bond coverage will be established to cover each phase of an operation as it progresses. In all cases, bond coverage will be required prior to disturbance. Likewise, reclamation may be designed to occur in discrete blocks or phases. An entire site may be reclaimed in phases or an operation may be designed so that reclamation is completed in one area, while new disturbance is beginning elsewhere in the same operation. In the latter case, a fixed amount of bond coverage may be "rolled over" from one part of the operation to another with approval by the appropriate BLM field office."

The netting approach is also implicit in all self-bonding instruments, because the provisions are adjusted annually to reflect new incurred and released liabilities for closure and rehabilitation.

3.4.3 Review

Often in the legislation it is prescribed that financial guarantees are regularly reviewed to check whether they still reflect the environmental liabilities incurred appropriately. The review periods typically range from 1 to 6 years, but most regulatory authorities reserve the right to inspect the site at any time.

Table 3.4.3-1: Summary of calculation principles for some legislation, review and release criteria (Ref. 41)

Country	Calculation principles	Review period	Release criteria
Ontario, (Canada)	3rd party at end of project	3 years	after successful closure, some portion may be retained
Nevada, (USA)	3rd party cost + 10...15% administration	may be revised at any time	after successful closure, some portion may be retained
Queensland, (Australia)	2 levels: Level 1 (large mines): project basis + 10% monitoring/maintenance costs; Level 2 (small mines): total area, risk associated with rehabilitation. Discount up to 75% based on previous environmental performance	depends on mining title, but EPA has right to do so at any time	when no further claims are likely, with progressive rehabilitation portion not longer needed is released
Victoria, (Australia)	based on closure plan, 3rd party costs, negotiable	at any time, depending on risk of financial failure, typically 1-6 years	after successful rehabilitation, with progressive rehabilitation portion not longer needed is released
Botswana,	cost estimate of all closure works	5 years + 1 year prior to closure	n.a.
Ghana,	Full reclamation costs, third party - not specified, (5...10% of the ultimate costs, Miller 2005 [Ref. 13])	2 years	3 years after completion of closure plan, 7 years if AMD may occur
Papua New Guinea,	flexible with respect to financial strength of operator, includes premature closure	2 years if remaining mine life < 10 years, otherwise 5 years, any time at request	after successful closure, may be retained for up to 10 years
Sweden,	n.a.	5 years according to EU MWD	after completion of mine closure works

Other studies show very much of the same picture, and are therefore not repeated here. Some key issues arise from the analysis of the current international practice.

3.4.4 Amount of financial guarantee and release criteria

The aspects “amount of financial guarantee” and “release criteria” cannot be seen independently as the criteria (set by the authorities) for the release of the financial guarantee determine the amount of money required to meet these criteria.

In most legislations, the financial guarantee is released "after successful completion of closure works" which leaves room for interpretation, even if a closure plan was approved by the regulator at the outset of the mining project.

Table 3.4.3-1 gives an example of how the calculation, the review and the release of the financial guarantee are regulated in different countries. There may be substantial disagreement between the mine operator on the one hand and the authorities and affected communities on the other hand about the exact scope of the necessary closure works. Examples abound of dramatic mismatches between the provisions made by the operator (and often approved by the regulator) and the real cost of closure works (see for example, the Zortman & Landusky Mine or the Chino & Tyrone Mine case studies presented in Ref. 23 and 37), or the case study on Alaska by Chambers (see Ref. 26). In the light of these facts, the authors of MMSD 2002 (see Ref. 12) suggest to assume the "worst case scenario" to calculate the required guarantee.

However, Sassoon (Ref. 41) rightly argues that this temptation to over-estimate should be resisted because it would be to the detriment of the financial viability of the mining industry. This uncertainty over the demands of authorities is one of the reasons that guarantee providers such as insurance companies are reluctant to cover environmental liabilities (see Ref. 62). Consequently, the authors of ICMM 2007 (see Ref. 56) require that "regulators should clearly define the standard of reclamation and include considerations of the future land use at the site when doing so." Supportive information is further available in Ref. 27 and 28.

3.4.5 Calculation of the costs

Conceptually, there are two approaches for calculating the amount of a financial guarantee:

- Some legislation such as Queensland (for an affected surface of less than 10 hectares) allows a calculation of the closure costs on the basis of the area affected by the mining operation. Although, rather simple, this method does not take into account the site-specific requirements to closure and rehabilitation. It may under- or over-estimate the guarantee (but, as experience has shown, over-estimation is a very rare exception).
- Other legislations require the financial guarantee to be based on the cost estimate of the works foreseen in a detailed closure plan. The closure plan typically contains all measures required to restore the site to an acceptable state, and should (but not always does) include long-term measures as stipulated by Article 12 (4) of the MWD. This approach is much better suited to carry out meaningful cost estimate and can be subject to reviews which take into account changes of the situation on site.

3.4.6 Scope of the financial guarantee

An important issue for the calculation of the costs is the scope of the guarantee. Some pieces of legislation, such as those listed in Table 3.4.6-1 describe the scope of the closure works and the financial guarantees required.

Table 3.4.6-1: Scope of closure and post-closure activities covered by financial guarantees for some selected legislations (Ref. 41)

Nevada	Ontario	Queensland
• The removal of all plants and equipments • The demolition and disposal of infrastructure • Stabilisation and regarding of surfaces • Erosion control • Recultivation • Process fluid stabilisation Interim fluid management	• Mining infrastructure • Underground mines • Audits • Open pits • Tailings storage facilities • Surface and ground water monitoring • Acid drainage • Physical stability • Recultivation	• Removal of plant and equipment • Reshaping waste dumps and pits • Capping tailings storage facilities and other hazardous materials • Breaching dams and restoring water courses • Making slopes and openings safe • Replacing topsoil • Recultivation • Monitoring water and air quality, erosion rates, vegetation • Conducting contaminated land surveys • Implementing site management plans

Other legislations are much more general. For example, the German Mining Law, in Section 55 (1) (Ref. 122) item 7, says that the "necessary precautions must be taken to return the land to an appropriate after-use". Other countries such as Sweden use similarly general requirements.

3.4.7 Long-term (post-closure) costs

The requirement that the financial guarantee shall be released and returned to the mine operator/owner can become ambiguous if there are long-term maintenance needs such as water treatment.

Miller (see Ref. 42) pointed out that "there is a qualitative difference between those sites which can be successfully rehabilitated or reclaimed at the end of the mine life, and others which require long-term care. The latter are often associated with metal mines in which acid rock drainage is a problem. In this situation, the run-off from the mine site contains acid and

metal ions. Conventional rehabilitation methods may be unsuccessful in controlling the acid drainage and the only known solution is to provide for collection and neutralization of the site drainage for many years."

In his survey of Financial Assurance for Mine Reclamation and Closure, Kuipers (see Ref. 23) notes that "actual clean-ups prove that mines with acid drainage cost much more to reclaim. Acid-generating mines pollute surface water and groundwater with toxics and carcinogens, requiring more expensive surface reclamation and long-term water treatment. As a result, acid generating mines' clean-up is an order of magnitude more expensive than that of non-acid generating mines." This aspect is also dealt under the Environmental Liability Directive (ELD, 2004/35/EC).

Miller (see Ref. 13), Kahn et al. (see Ref. 59) rightly point out that those tasks can form a substantial share of the total liabilities, and that tasks such as water pollution abatement can reach far into the future, exceeding the actual mine life. Chambers et al. (see Ref. 26) clearly state that currently, "financial sureties are not generally required for catastrophic events such as earthquakes, floods, tailings dam failures, or the unanticipated onset of acid mine drainage after mine closure. Where such incidents have occurred, the civil society has generally been responsible for a large part of the cleanup costs. (…)However, at the moment the authors are not aware of any active legislative or regulatory proposals that address this issue."

In our own consulting experience, too, the need and time horizons for water treatment (mine effluents, seepage from waste dumps and tailings ponds), monitoring (dam stability, surface subsidence etc.) and other after-care activities are often dramatically underestimated when the mining project starts. At the time of closure, however, when these issues become more apparent, guarantees turn out to be insufficient while, on the other hand, competent authorities and communities see proper implementation of these measures as part of the closure works. The following issues must be clarified:

- time period for which post-closure tasks must be performed before the competent authority takes over such tasks from the operator,

- determination of an appropriate discount rate to arrive at a net present value which must be set aside today to cover expenditures which lie often very far in the future.

In the regulations of Western Australia (see Ref. 33) these issues are not even mentioned. The cost estimation tools of New South Wales (see Ref. 1) restrict maintenance and treatment to a period of 5 years which is certainly inadequate for many mines. A number of other legislation, for instance,

- Manitoba Mine Closure Plan Guidelines (see Ref. 29),
- ANZMEC Australia and New Zealand (see Ref. 30),
- South Africa (see Ref. 36),
- U.S. BLM (see Ref. 112),

mention the need to take into consideration long-term post-closure activities. The review of legislations has revealed very little insight on how exactly long-term expenditures should be taken into account when calculating the guarantee. The following three examples are meant to illustrate the practice of legislation which requires taking the following long-term activities into account:

- In Nevada, BLM regulations (Ref. 46) say that "for those operations that may require long-term (more than five years) post-closure monitoring and maintenance activities, operators may choose to acquire separate financial instruments to address and cover those identified long-term post-closure obligations. This would allow for the release of the original financial guarantee upon completion of all reclamation and closure activities." However, they do not specify any details as to the calculation basis, nor whether such coverage is practicably available.
- The Nevada Standardized Reclamation Cost Estimator (see Ref. 46 and 50) requires the user to make assumption about the period of water treatment and maintenance, and the associated unit costs.
- Miller (see Ref. 42) mentions that the Japanese system of financial guarantees recognizes the different situations. In the first instance, the operator must lodge a security for the immediate post closure rehabilitation costs. If this work fails to produce adequate control of surface run-off quality, then additional amounts must be lodged to guarantee support for the necessary long-term monitoring and control measures.

3.4.8 Third-party cost basis

The use of a third-party cost basis as a calculation principle seems widely accepted among legislators, because – in practice - it is a third party contracted by the government that carries out closure and rehabilitation if the original mine operator cannot meet its obligations.

Miller (see Ref. 13) notes, however, that "many mining companies rightly feel that they can carry out the necessary work most economically, using their own equipment and manpower". They hence consider the third-party method to overstate the costs.

Yet, if the objective of a guarantee is to protect the taxpayer from the closure and rehabilitation cost in the event of the operator's bankruptcy, a third-party cost basis is required since an insolvent mine operator cannot carry out the closure and rehabilitation himself.

4 SURVEY OF SELECTED CASE STUDIES

The case studies are very important to the project as they indicate the different ways of managing mining waste, of the after-care of mining waste facilities and the established financial guarantees worldwide and therefore, serve as representative source of mine waste management experience. Several case studies have been evaluated illustrating the arrangements that have been implemented in various countries, in different types of mining projects with regard to the deposit (e.g., open pit, underground, etc.) and the commodity (e.g., gold, uranium, coal, energy minerals, etc.). An overview of the described case studies is given in Table 4-1.

To ensure that a variety of arrangements regarding mine closure and rehabilitation of mining waste facilities we examined countries with different historical and political background in the mining sector. Of interest are also former communist countries like Romania and Poland which are generally in the process of adapting EU legislation.

Similar to the identification of the relevant literature, the case studies are selected with regard to:

- relevance to the project,
- availability and quality of data provided by mining companies, governmental authorities, etc.,
- diversity of information with regard to the main types of extractive industries, mining waste facilities, managing of the mine closure, rehabilitation scenarios and countries.

In detail, the survey covers the following sectors of different extractive industries:

- energy minerals (e.g., coal, lignite, uranium, etc.),
- metal ores (e.g., base metals, gold, etc.),
- industrial minerals (e.g., salt, etc.).

Other authors' research has been extensively used for the description of the case studies and is indicated wherever possible. Reference to supporting literature has been made under the relevant chapters as well.

4.1 Review of case studies for financial guarantees

The compiled case studies largely base on the response to the questionnaires which have been sent out to various mining companies representing different countries and types of

waste facilities. But not all of the data gained from the survey is incorporated in the case studies and is therefore briefly presented in the following evaluation of the questionnaires.

Legislation and Governance

In the majority of countries surveyed there is a geology and mining law or equivalent in place which also regulate issues related to the rehabilitation of mine waste facilities.

There are only few situations in which mining companies which are not requested by law to elaborate a closure and/or rehabilitation plan for their mine waste facility. In most cases such a plan is demanded by the competent authority already prior to the commencement of any deposition operations and needs also the approval from the responsible governmental body. As it is discussed in more detail under chapter 10.1 the responsibility for supervising the remediation activities is mostly distributed among various authorities each of them responsible for only one part of the mining operations. The Ministry of Environment is usually responsible to assess the mine closure procedures. Regarding the financial guarantee, the regional competent authorities are responsible for the approval of the adequacy of the amount.

In Poland, for instance, the final closure and rehabilitation plan is developed just before closure. Only a framework of a mine closure plan exists from the beginning of deposition operations. For further details see Ref. 169 and 170.

Financial instrument

In most cases the competent authority decides about the form and scope of the financial instrument. Austrian, Spanish, German and Polish mining companies answered that it is at the discretion of the mine operator to select a financial instrument or it is sometimes negotiated between the authority and the operator.

The most commonly used financial instrument is the bank guarantee, followed by cash deposits, letter of credit as well as insurance cover against bankruptcy. The balance sheet test (financial health) is also often selected. Like in Spain, in most countries the form of the financial guarantee is specified in the legislation. In the case of Sweden nothing is specified by law but a bank or a parent company guarantee are favoured. The balance sheet test is preferred by German companies. The majority of the surveyed mining companies had already financial guarantee arrangements in place for deposition operations; however, some of the arrangements are still under preparation.

Scope and level of financial guarantee

According to our survey a number of mining companies calculate the amount of the financial guarantee based on the tasks described in the mine closure and rehabilitation plan. The amount that has to be paid to third parties who will carry out the rehabilitation work is included into the cost estimation.

Long-term commitments (e.g., monitoring, after care, etc.) are taken into account on a best-estimate basis, even though no clear official calculation methods exist. The other method to

calculate the financial guarantee often applied by the surveyed companies is based on unit amount calculations (e.g., per t of mine wastes produced, etc.).

In the case of a Polish company the amount due is calculated by the operator separately for each operation and is equivalent to the amortization allowance required by the respective tax law.
In approximately half of the surveyed companies the level of the financial guarantee is based on end of project costs and the rest is calculated on an incremental basis.

Review and release
According to our survey the amount and the appropriateness of the financial guarantee are periodically reviewed in a number of mining companies.

The review of the financial guarantee is mostly done annually or bi-annually. In some countries the review is undertaken at any time on request of the State Mining Authority, as it is the case in Poland. In Finland the review is carried out only in the case the permit is updated (after 9 years) and in Greece every 5 years.

Regarding the release of the financial guarantee there are different procedures.

For Poland the period of liability for the mine waste facility is described in the Mine Closure and Rehabilitation Plan, which also regulates how and when the financial guarantees have to be released. Only after approval of the plan by the competent authority the financial guarantee will be released. Also a Greek mining company responded that the competent authorities inspect the area and give their permit to release the financial guarantee in case all obligations stemming from the environmental impact assessment study have been fulfilled.

In the case of a German mining company, only after the approval by an external auditor that all closure and rehabilitation measures have been finalised according to best practice and to the closure plan, and that no hazard exists, the financial guarantee is released.

In Ireland the perpetual after-care liabilities make the release of the financial guarantee extremely difficult. According to the answer of a Swedish company the release of the financial guarantee is not specified in the legislation. But as the financial guarantee should only cover the reclamation cost, no financial guarantee is required after the reclamation work is completed. As mentioned before similar release criteria are binding for Polish companies. The financial guarantee is not released until all environmental liabilities have been removed (including long-term tasks such as monitoring and water treatment, if applicable). The Finnish company indicates that nevertheless the closure operations are completed adequately the liability of the mining company with regard to the environment will continue to a period of at least 30 years.

In the case the mining title is transferred to another company there are almost no specifications in the different mining laws or other regulations of the surveyed countries.

Preference and Experience

Most companies which have been asked for their preference with respect to financial guarantees answered that they would favour a balance sheet test (financial health) or a self guarantee of company or parent.

For some companies a bank guarantee is the financial instrument which would serve their needs the best. A mining company in Spain would prefer an insurance cover against bankruptcy. The main reason for the preference of these financial instruments is their minimal impact on liquidity and on the structure of the balance sheet test. The other criterion for the decision for a particular instrument is its acceptability to regulatory authorities (i.e., accelerating permitting procedures) as well as its tax-deductibility.

A German mining company specifies that "soft" guarantees would be preferred from a financial point of view but, as the authority may require a "hard" guarantee, the bank guarantee would be the most convenient financial instrument. A Polish mining company which indicates that for (tailings) pond the reclamation costs do not change significantly from the beginning to the end of its exploitation, recommends not overcharging the (tailings) pond's owner at the beginning of the investment with financial burden.

Table 4-1: Overview of the main characteristics of the selected case studies

Company	Country	Commodity	Deposit	Type of waste / related problems	Financial instruments used
WBH GmbH	Austria	Tungsten	Mittersill, UG	WH, Tailings	Self bonding (balance sheet)
DSK AG	Germany	Coal	Ruhrgebiet, UG	WH, Tailings, subsidence	"Rückstellungen", provisions
MIBRAG GmbH	Germany	Lignite	Profen, Schleenhain, OP	WH	Self bonding (balance sheet)
General	England and Wales	Coal	UG mines	WH, subsidence	Hard financing guarantees
Gabriel Resources	Romania	Gold	Rosia Montana, OP	WH, Tailings, GW contamination, AMD	Not yet decided!
KGHM Miedź S.A	Poland	Copper	UG mines	WH, subsidence, GW contamination	No specification of "Mine closure fund"
K+S AG	Germany	Salt	"Salt mines"	WH, subsidence, GW contamination	Provisions in the balance sheet
EMPG	Germany	Gas and oil	Lower Saxony, Gas field	Oil sludges, saline solids and muds	Provisions
Boliden	Sweden	Base metals	UG mines	WH, Tailings, AMD	Bank guarantee, letters of credit, cash bonds
General	Ontario, Canada	Base metals, Gold	UG and OP mines	WH, Tailings	Cash deposit, letter of credit, bonds, etc.
General	Nevada, USA	Base metals, Gold	UG and OP mines	WH, Tailings	Bonds, letter of credit, insurance, trust fund
OTML	Papua New Guinea	Gold	Ok Tedi, OP	WH, Tailings	Bank guarantee, cash deposit
General	Namibia	Base metals, Uranium	OP and UG mines	WH, Tailings	Provisions, environmental trust funds, etc.
Cerro castillo SA	Argentina	Base metals	UG mines	WH, Tailings, AMD	No requirements
Applicant for financing	Congo	Base metals, Gold	UG mines	WH, Tailings	Self bonding
Inkai Joint Venture	Kazakhstan	Uranium	In-situ Leaching (ISL)	ISL, GW contamination, sludges	Self bonding
General	Australia, Queensland	Base metals, Uranium	OP and UG mines	WH, Tailings	Cash deposit, bank guarantee, bond, etc.

Legend:

OP	Open pit
UG	Underground
WH	Waste heap
GW	Groundwater
AMD	Acid mine drainage

5 EXPERIENCE FROM OTHER POLICY AREAS AND SECTORS

In order to find out more about the experiences from other segments of the mining and energy sectors this chapter will review other policy areas, e.g., the landfill and environmental liability directives as well as arrangements in the nuclear industry. For further information see Ref. 95.

5.1 Sureties for landfill operations – the situation in Germany

5.1.1 EU legislation

Recital 28 and Article 8 (a)(iv) of the EU Landfill Directive 1999/31/EC require that adequate provisions shall be made by the landfill operator to ensure that all obligations from the operating permit can be satisfied including those related to closure and after-care.

Article 7 (i) requires that the financial surety must be lodged at the time of application for a permit, whereas Article 8 (a)(iv) sets out that adequate provisions on the basis of the "modalities to be decided by the Member States" must be lodged prior to the commencement of the disposal operations. They must cover closure and after-care provisions as per Article 13 (Closure and after-care procedures) of this Directive.

The Landfill Directive allows provisions "by way of a financial security or any other equivalent".

5.1.2 Transposition into national law

Germany has transposed the EU Landfill Directive by adopting the Landfill Act ("Deponieverordnung", 24 July 2002, latest amendment of 13 December 2006). Part 6, Section 19 (Surety) of the Directive requires that the operator must:

- during the application phase for a landfill permit demonstrate that he will be able to provide the necessary surety (Section 19 (1)),
- prior to starting the disposal operations provide (Section 19 (2)) provide the financial surety to fulfil all obligations during the operations, closure and after-care phases.

For landfills of class I through IV, the after-closure period which has to be covered by the financial guarantee must be at least 30 years.
It is the competent authority which eventually determines the amount, scope and form of the surety. The Landfill Act stipulates that the following forms of surety can be accepted by the authority:

- guarantee according to Section 232 of the Civil Code, i.e.,
    - cash,
    - securities,

  - pledge of assets,
  - pledge of officially registered receivables,
  - mortgages of real estate and registered vessel mortgages ("Schiffshypotheken"),
  - pledge of mortgages,
  - a suitable guarantor,
- balance sheet test,
- corporate guarantee,
- bond or guarantee issued by a financial institution.

In case of bankruptcy of the landfill operator, the competent authority can unconditionally draw the guarantee.
Section 19 (5) requires that the competent authority checks regularly whether the amount of the guarantee is still adequate or must be adjusted. In case the guarantee must be increased, the operator has to comply within 6 months. On the contrary, if the guarantee can be reduced, the competent authority must release the excess amount immediately. No financial guarantee must be provided by state- or community-owned landfill operators.

5.1.3 Case study of a hazardous waste landfill

The hazardous waste landfill at Wetro near Dresden, Germany, is owned by Preiss-Daimler Industries GmbH, a German industry conglomerate. It has been built in a former clay/kaolin quarry. A company located close to the quarry used the clay which was of very high purity to produce refractory materials. The clay deposit was mined out to a degree that a residual clay trough of several meters thickness was left which now serves as geological liner for the landfill. The landfill obtained its operating license in March 1999, with a very wide range of acceptable waste codes. A hydrogeological expertise concluded that there is no measurable impact on the groundwater aquifer beneath the landfill. To elicit the information on the financial guarantee, a questionnaire was filled in by the mine operator (References referring to this chapter are: Ref. 9 and 63).

Waste facility
The landfill is structured into several, reasonably sized, disposal cells. This also allows structuring the guarantee into smaller pieces instead of one large single guarantee. The guarantee for a particular cell must be lodged before any disposal operation in this cell can start.

Legislation and Governance
Even though the legislation allows a wide range of financial instruments including soft instruments (see above), the competent authority, namely the Waste Management Authority, requested an irrevocable bank guarantee, payable to the federal state (Free State of Saxony) in which the landfill operates. This is justified by the need to have sufficient security against bankruptcy of the operator. The guarantee is calculated on the basis of a closure plan and a detailed design developed by an external consultant. It takes into account:

- the securing of slopes and berms,
- the final cover of the wastes (including an impermeable liner system according to the EU Landfill Directive and the German Landfill Act).

The detailed design (including closure plan) are scrutinized by the Waste Management Authority at the “Regierungspräsidium Dresden” which is the lead authority for the complex permitting procedure ("Planfeststellungsverfahren" or plan permitting procedure). The lead authority involves other authorities (such as water quality or nature conservation etc.) in the process.
There are no specific provisions for technical measures in the case of unforeseen (premature) closure, i.e., if the landfill cell must be closed before it is fully filled with wastes. However, according to information from the operator, this case if highly unlikely to lead to problems because in case of bankruptcy of the current operator the landfill operations can be profitably continued by its successor and the additional costs arising in the case of premature closure are small compared to the amount lodged.

Financial instruments
The unit costs are 40 € per square meter of footprint of the landfill and are based on third party costs.

Review
Even though the law stipulates regular reviews of the appropriateness of the financial guarantee, this is neither specified in the permit nor has this happened so far. The operator has no obligation to report any changes to the competent authority. The operating company itself, of course, annually updates the provisions needed for closure and rehabilitation, in line with the German requirements of annual financial reporting. An external consultant estimates the actual closure and rehabilitation costs and provides them to the Financial Auditor of the company.

Release
The guarantee is fully released if an external auditor ("Fremdüberwachung") who is paid by the operator but reports directly to the competent authority confirms that all measures foreseen in the closure plan have been carried out according to best practice. The competent authorities satisfy themselves of the orderly closure during a final site visit.

5.2 Environmental Liability Directive

5.2.1 EU legislation

The Environmental Liability Directive (ELD, 2004/35/EC) regulates the prevention and remedying of environmental damage through the furtherance of the "polluter pays" principle.
It clearly states that an operator should be made responsible for the caused environmental damages or the expected consequences of the operations in the form of a financial liability. The operator also covers the costs of assessing environmental damages or imminent threat

of such damages. Consequently, to reduce financial liabilities the operator is interested to introduce measures and practices to minimize the risk of environmental damages of the deposition operations (see Ref. 15). The competent authority or a third party, which are acting in the place of an operator, should ensure that the costs incurred are recovered by the operator. To define to what extent human health is likely to be adversely affected or determine damages to land and water as well as to protected species and natural habitats the usage of risk assessment procedures is suggested by the ELD. Generally, activities with potential or actual risk for human health or the environment should be identified by the reference to the relevant Community legislation. Public authorities are then in the responsibility to ensure the proper implementation of the scheme provided for by the ELD. The ELD does not apply to cases of personal injury, damage to private property or to any economic loss. An operator is not liable if damage results from authorized emissions. NGOs have the right to submit to competent authority a request for action (preventive or remedial action). Further information is available in Ref. 52.

5.2.2 Transposition into national law

Germany has transposed the ELD into national law through the Environmental Liability Law ("Gesetz über die Umwelthaftung zur Vermeidung und Sanierung von Umweltschäden, 10 May 2007"). The German law does not specify the type of financial instruments which could be used to cover the costs of remedying environmental damages.

5.2.3 Availability of financial instruments

Transposition of the ELD into national legislation is not yet completed. Therefore, an insurance product under the ELD does not yet exist. Whereas some Member States have adopted in their draft proposals the full scope of the Directive, some Member States have established draft legislation that goes far beyond the scope of the ELD. Moreover, some requirements of the ELD still leave room for interpretation and need to be clarified with the European insurance industry before insurance products become available.
An important source of information on the current practice of covering liabilities under the ELD is the White Paper on Insurability of Environmental Liability (January 2007) issued by the Environmental Expert Working Group (EEWG) of the Comitée Européen des Assurances (CEA). The CEA states that „There is no established environmental liability market [...] match[ing] the scope of the ELD. More work needs to be done to make those risks [e.g., biodiversity damage] insurable." The main problems raised by the financial services industry which have so far prevented the development of financial instruments are:

- too much room for interpretation by authorities (much clearer definitions needed),
- transboundary liability cases remain largely unclear,
- compensatory remediation (interim losses) cannot be quantified which means they are not insurable,
- insurers want a say in the definition of remediation targets and methods (claims management), otherwise they face the risk of unjustified claims by authorities and NGOs towards operators.

These problems are likely to be raised when, according to Article 14 (2), the Commission shall present a report on the effectiveness of the Directive, inter alia, the availability of insurance instruments.

5.3 Proposal for an amendment to Directive 2004/35/EC

The "Proposal for a Directive establishing a framework for the protection of soil and amending Directive 2004/35/EC" has been published as COM (2006) 232 final (22 September 2006). Its objective is to complement existing European Community acquis by a strategy for the protection and sustainable use of soil, by integrating of soil concerns into other policies. In the European Community, there are various national legislations concerning the protection of soil, which the extractive industry operating in those countries must comply with. However, there is no unified legislation on the Community level, a gap which will be closed by the proposed Directive (More information on the Proposal can be found under ec.europa.eu/comm/environment/soil/index.htm).

As mineral extraction is inherently a disruptive process with respect to the earth's crust, and management and storage of extractive wastes has a significant impact on the soil resources, the proposed Directive and the requirements which are eventually transformed into technical and organisational measures during and after closure of a mining operation, must be carefully taken into account when calculating the financial guarantees. After all,

- establishments where dangerous substances are present according to the Seveso Directive (1996/82/EC), such as tailings ponds containing dangerous processing residues (The Proposal of the Soil Directive does not explicitly mention Directive 2003/105/EC which amended the original Seveso Directive 1996/82/EC by the inclusion of mining activities. However, it is assumed that the Proposal actually has the amended version in mind.),
- mining installations (…) including extractive wastes facilities as defined in Directive 2006/21/EC
- pipelines for the transport of dangerous substances (e.g., tailings transport pipelines)

are explicitly mentioned as potentially soil polluting activities in Annex II of the proposed Directive.

Although an exact assessment of the consequences of the upcoming Soil Directive can be given only after the final version will have been agreed by the European Parliament and the Council, the following provisions of the proposed Directive can be highlighted as being of particularly importance for the extractive industry:

- Article 4: Precautionary measures shall be taken by the Member States in order to prevent or minimize adverse effects on the soil whenever such a negative impact is likely. This is the case in the extractive industry.
- Article 6: The Member States shall identify areas where soil degradation processes have occurred or are likely to occur. These processes include compaction (e.g., by the

storage the transportation of extractive wastes) and accumulation of soluble salts in soil (e.g., by highly mineralised effluents from extractive wastes). These risk areas shall be made public.

- Article 8: The Member States shall draw up risk reduction measures for the risk areas identified under Art. 6. These measures may affect the extractive industry in that they set additional remediation targets (and thus costs for which provisions have not yet calculated).
- Article 9 requires that the intentional or unintentional introduction of dangerous substances on or in the soil shall be limited. This may have consequences for extractive waste facilities which store dangerous wastes such as cyanide tailings or wastes which tend to acidification and release of heavy metals.
- Article 11 requires that the Member States will identify the location of at least the sites where the activities listed in Annex II of the Proposal (see above) are or have been carried out. This means that the extractive waste facilities will be investigated from the perspective of soil protection. Depending on whether the requirements derived from the new EU Soil Directive will exceed the national standards, additional costs may be necessary to consider in the financial guarantee.
- Article 13 requires that contaminated sites must remediated and that appropriate funding mechanisms are set up. This requirement will have consequences in Member States which have had no such regulation in the past, and where extractive industry has caused (or still is causing) soil contamination. As for the funding mechanisms in the extractive industry, these are in place with the provisions of Art. 14 of the Directive 2006/21/EC, but a re-calculation of the exact amount may become necessary if the proposed Soil Directive leads to any additional requirements.

5.4 Decommissioning of licensed activities by CNSC

This chapter is primarily based on Ref. 24 and summarizes the experiences the Canadian Nuclear Safety Commission (CNSC) made with regard to the decommissioning of licensed activities. It further provides guidelines regarding the establishment and maintenance of measures to finance the decommissioning of nuclear plants.

Under the Nuclear Safety and Control Act and its regulations it is required that with the application or the granting of a license the proponent have to lodge provisions adequate to ensure safe operations and the decommissioning of the existing or proposed operations. The type of the financial guarantees and the method of decommissioning are not further specified by the regulations but the operator has to submit acceptable decommissioning plans, including a realistic estimation of the required costs.

Dependent on their individual situation the operators can decide for a financial guarantee that is sufficient to compensate decommissioning costs and is orientated on the licensed activities that have taken place prior to the licence period, or will take place under the current licence. The costs of the expected decommissioning work should cover all decommissioning activities required during operations and after shutdown as well as include unit costs for each phase of the decommissioning plan, considering the generally accepted accounting and quantity-surveying methods, the local construction rates for labour and material as well as third-party

costs. A sound estimation of the risks associated with the decommissioning costs is obligatory as well.

There are 3 risk groups for about 10% to about 30% remaining risk during cost calculation. The CNSC has to verify whether the amount and the availability of the envisaged financial guarantee are appropriate for the decommissioning activities and access funds if a license is not available to fulfil its obligations. According to the general criteria such as liquidity, certainty and adequacy of value and continuity of the financial guarantee the CNSC will evaluate the selected financial instrument.

The CNSC is accepting cash, irrevocable letters of credit, and surety bonds, insurance and expressed commitments from a government (either federal or provincial) as financial guarantee. “The administration of the financial guarantees should be accomplished by clearly defined and legally-enforceable arrangements to the CNSC.” (see Ref. 24). In addition to that, the CNSC requires the periodic review of the financial guarantees at any time and will decide about possible changes of the amount.

6 STAKEHOLDERS

The stakeholders relevant in the implementation of Article 14 of the MWD are:

- the national legislator represented by the competent authorities,
- the industry concerned (i.e. the extractive industry),
- the public, represented by NGOs.

Their positions are briefly outlined in the following sections.

6.1 Competent authority

Based on the case studies, responses to questionnaires and statements of representatives of regulatory authorities (see Ref. 5) the requirements of the competent authorities in relation to financial guarantees can be summarized as follows:

- financial guarantees have to be readily available whenever they are needed to rehabilitate a site if the operator or titleholder is no longer able to fulfil its obligations.
- financial guarantees have to be "ring fenced" from the company's normal operations and assets in order to avoid these funds being used for other emergencies (e.g., insolvency).
- financial guarantees must be sufficient to cover long-term expenses such as water treatment or site maintenance. Companies have a limited life span, but some sites may need permanent aftercare.
- administrative effort (time, staff and other resources) required to check the adequacy and appropriateness of the financial guarantees should be as small as possible. There should be incentives to the mining companies to keep available sufficient financial guarantees, even without regular checks by the authorities.
- there should be only limited room for individual decisions by officers of an authority, and where such freedom exists the decision should be as transparent as possible. The legal certainty of decisions should be as high as possible, in order to avoid lengthy legal conflicts with proponents on one side and NGOs on the other.
- they have a say in defining the closure and rehabilitation objectives in the permitting phase, and consequently in the decision when to release the financial guarantee.
- despite the overarching character of EU regulations (including the environmental sector and the general provisions by the MWD), national differences of mining and environmental legislations will persist. Consequently national regulators will want to adapt the general guidelines according to the specific national needs.

6.2 Extractive industry

The views of the extractive industry with respect to financial guarantees depend on the specific demands and requirements of each mining company. However, there are some positions that are common to the entire industry, which are reflected by industrial associations such as Euromines or ICMM.

Euromines

Euromines, in several publications (see Ref. 91 and 5) has clearly outlined its views with respect to financial guarantees as required in Article 14 of the MWD. The guiding principles are that the financial guarantees must be:

- transparent,
- fair,
- temporary,
- efficient,
- without interference with international competition (personal comment Euromines).

More specifically, Euromines proposes the following characteristics of the financial guarantees (citations in quotes have been taken from Ref. 91):

- minimal cost and impact on liquidity.
- minimal indirect costs as Miller (see Ref. 13, 70 and 73) and Lindhal (see Ref. 5) note, indirect financial burdens may well exceed the direct costs by lost return on capital. The financial guarantee instruments must not adversely deteriorate the financial strength of the mine operator, and hence the ability of the mining company to borrow. A weakened financial strength leads to less projects that can be financed and, consequently, to a weaker competitiveness of the European mining industry.
- minimal administrative effort and simplicity of administration.
- flexibility of the instruments including "soft" and "hard" forms of guarantees to best suit the needs of an individual company.
- clear determination of the rehabilitation standards and objectives to be achieved before the mine can be considered to be finally closed and safe and the guarantee can be eventually released. "A facility is considered to be safe when the contained wastes are not able to override natural attenuation processes to the extent that they pollute surrounding areas. (…) In setting the level of Financial Guarantee or equivalent, the permit, under Article 7 of the Directive, should be used to identify the required standards for rehabilitation of the waste facility."
- appropriate tax arrangements must be in place to make the provisions and/or other instruments tax-deductible. Also, rather protracted taxation issues in the case of transfer of ownership of a mine operator must be resolved (such as described in the case study on the German coal mining company DSK).

- availability of alternatives to financial guarantees such as a proven track record of mining companies. A successful environmental management and rehabilitation history of a mining company and a good reputation (which the company is anxious to keep up) should be acceptable en lieu of financial guarantees.

- adequate timing of lodging the financial guarantee: the guarantee should be lodged when the operation permit is issued or before deposition operations start. It is not acceptable to lodge the guarantee during the permitting procedure.

- incremental approach: financial guarantees should be lodged in line with the environmental liabilities incurred, and should take progressive rehabilitation into account. This serves as an incentive to the mining company to implement progressive rehabilitation measures and keep the new environmental liabilities to a minimum. By contrast, it is not acceptable to the mining industry to lodge the maximum amount of the surety at the beginning of the operation.

- limited requirements for disclosure of confidential information. Whereas the industry accepts that transparency is important in the process, the disclosure of closure and rehabilitation provisions may have to contain confidential information which is not in the commercial interest of a mine operator.

- no retro-active application of the regulations.

- restriction of the guarantee arrangement to waste facilities as defined by Article 2 of the MWD.

- temporary limits: Financial guarantees or equivalent should not be expected to cover items such as,
    - risk of future contamination due to future incident,
    - after-closure care; that is, on-going operation, maintenance, and monitoring after suitable arrangements are in place.

- social aspects of overall mine closure including sustainability of utilities, social facilities (health, education), infrastructure (roads, airstrips, and wharves), business development etc. should not be covered.

- adaptation to specifics of the site: The level of financial guarantee or equivalent that will be needed can differ widely between countries and should be established on a site by site basis. It is not feasible to establish a definitive guide.

- adaptation to Available Technologies: "The Financial Guarantee or equivalent should remain subject to review due to the inapplicability of universal standards for rehabilitation and the possibility of changing requirements and technology options over the longer lifetime of a mine or quarry."

- flexibility as to the method used to calculate closure cost, including,

- use of a formula based on the type of waste facility, rehabilitation plan and track record of the company,
- use of standard rates and unit costs as specified in legislation,
- calculation as a percentage of capital costs,
- negotiation based on the feasibility study,
- negotiation on a per t basis.

- "operators must not be required to pay public officials or the employees of business partners any portion of a Financial Guarantee or equivalent. They must not be asked to use subcontracts, purchase orders or consulting agreements as a means of channelling payments to public officials, or to their relatives or business associates."

- periodic reviews: "The period between reviews can depend on the life of the waste facility, but should be a pre-determined cycle (e.g., every 3 to 5 years) to account for improved knowledge or changed circumstances."

ICMM

The International Council of Mining and Metals (ICMM) is an industry organisation, comprising many of the world's leading large mining and metals companies as well as regional, national and commodity associations. In many regards, Euromines has the same positions as ICMM. In Ref. 13 some additional aspects have been highlighted:

- distinction between small and large companies: the former may have shorter planning horizons than the latter. Smaller firms may be more inclined to walk away from a problem site, or may be forced to do so, through a shortage of resources. This suggests tighter regulations for smaller, inexperienced companies, as compared to larger, well-established incumbents.

- industry and international institutions may wish to consider studying and promoting consistency and coherence among governments in terms of the principles on which their framework policies affecting environmental guarantees are based.

6.3 NGOs

Questionnaires have been sent out to the NGOs which are listed in Annex 7. Response was generally poor, but those NGOs which responded (CSP2 and Mining Watch Canada) did answer the questionnaires quite completely. The standpoint of NGOs most of which have a very critical stance to mining can be best illustrated by the three examples of the World Wildlife Fund (WWF), Mining Watch Canada and the Centre for Science in Public Participation (CSP2). Ref. 75 provides further information on the position of the NGOs.

Mining Watch Canada

A study entitled "Financial Options for the remediation of mine sites: a preliminary study" prepared for Mining Watch Canada (see Ref. 100), contains the following requirements to financial instruments:

- must cover the full costs of clean-up (and any long-term monitoring, care and maintenance).
- must be lodged before the mine is developed.
- must be easy to access. ”Hard” guarantees are the preferred form. "Softer" types of guarantees such as bearer bonds, parent company guarantee, captive insurance, surety, self-assurance and other less certain forms of financial backing, should not be accepted.
- must be available to public and to a full process of public review (bonding calculations are crucial).
- the calculation must be based on third-party costs and include administration costs. This ensures that the works can be done by a third party in case the mining company is no longer able to fulfil its obligations, and it will provide an incentive for a company to complete its own reclamation work because it can do so less expensively than a third party.

It their response to the Consultant's questionnaire, Mining Watch Canada specifically lists the following financial instruments which should preferably be used to provide the financial guarantee namely cash deposit, letter of credit, bond and trust fund, due to their easy acceptability for governments and the civil society. The choice of a particular financial instrument should be based on a standard legal requirement. The calculation method of the financial guarantee should be a detailed costing based on the tasks described in the mine closure and rehabilitation plan, adjusted for the hazard potential of the wastes and taking 3rd party costs into account. With respect to the release criteria, Mining Watch Canada requires that financial guarantees must not be released as long as long-term care and maintenance (e.g., monitoring and water treatment) are needed, possibly forever. All obligations should be transferred in case that the mine is transferred/sold to another owner or operator. The review to verify amount and appropriateness of the financial guarantee should be carried out every 2 years by the competent authority.

Centre for Science in Public Participation (CSP2)

CSP2 staffs are generally considered experts in environmental impacts of hard rock mining. In their response to the Consultant's questionnaire, CSP2 favours the following financial instruments to be used for lodging a financial guarantee, namely cash deposit, letter of credit, bond, bank guarantee, trust fund and insurance cover against bankruptcy, which are all "hard" forms of financial guarantees. CSP2 emphasise that:

- self-guarantees pose a significant risk to the civil society,

- the success of these financial guarantees depend not only on the long term viability of the company involved, but also on the diligence of the regulatory agency responsible for monitoring the mine and company.

The choice of a particular instrument should be based on a standard legal requirement, but with the possibility of negotiation between the mining company and the authority. The instruments should be payable, in case of need, to the competent authority, in full and on demand. With respect to the release criteria, CSP2 requires that sureties must not be released as long as there is any environmental liability associated with the property. The liabilities and the surety should be transferred in the case that the mine is transferred/sold to another owner or operator. CSP2 recommends reviewing the amount and appropriateness of the financial guarantee at least every 3 years, by the mining company (self-compliance), external auditors and competent authorities. The best option is to have external auditors do the review on behalf of the competent authorities. The amount of the financial guarantee should be based on the tasks described in the mine closure and rehabilitation, taking third-party costs basis (market rates) into account. This is essential, since bankruptcy is the most likely scenario for which the surety would be called.

World Wildlife Fund (WWF)

In 2003, the WWF drafted a “Position Paper” (see Ref. 109) on the proposal of the EC Mining Waste Directive. With respect to financial guarantees, the WWF is of the opinion that "forms of bond where the money remains an asset of the mining company are less satisfactory in general than those in which the financial guarantees are transferred into public ownership, and can only be returned to the operator once all environmental obligations have been met." In other words, the WWF favours instruments where the financial guarantee is decoupled from the mining company. Furthermore, the WWF advocates the definition of criteria of when mine closure can be finally considered "safe", because the environmental impacts of a mining operation may reach very long time scales. This is closely connected to the question of when the guarantee can be released.

Summary of NGOs' views on financial guarantees

- "Hard" forms of guarantee are clearly preferred, i.e., detached from the company's assets. Only hard sureties ensure that the funds are available in case of the mining company going bankrupt, which is the most frequent case where the guarantee is called.

- The amount of the guarantee should be based on third-party costs and administrative costs, because the whole idea of a guarantee is to cover the costs in case the mining company is no longer able to fulfil its obligations and a contractor has to do the closure and environmental rehabilitation. In fact, not assuming third party costs would be implausible.

- Amount and appropriateness of the guarantee should be regularly reviewed, typically every 2-3 years.

- Public access to the guarantee calculation and to information about the status of the surety must be guaranteed.

7 RECOMMENDATIONS ON FINANCIAL GUARANTEES

In accordance with the “polluter-pays" principle the objective of the MWD is to improve the management of waste from the extractive industry and thus, minimize any damage to the environment.

From the beginning of deposition operations it has to be clearly stated that the mining operator is fully responsible for any caused environmental damages and has to made funds available at any given time for the rehabilitation of land affected by the waste facility (Article 14 (b). In this context Article 22 (1 b) of the MWD indicates that technical guidelines for the establishment of financial guarantees have to be adopted by the EU Member States by 1 May 2008. These guidelines are necessary to support the different national legislation of the Member States in clarifying the financial liabilities of the mining operators with respect to the waste facility and to ensure a responsible and uniform management of such waste.
The emphasis of this study is on technical aspects to be taken into account when establishing the appropriate type of financial guarantee rather than on the specific type of financial instruments and institutional aspects. In the following, general considerations on the implementation of financial guarantees are provided, while section 7.2 describes the aspects which have to be considered in calculating the financial guarantees.

7.1 Considerations for the implementation of financial guarantees

Article 14 of the MWD requires that "all obligations under the permit" including the requirements under the waste management plan must be covered by the financial guarantee or equivalent. However, the separation of mining waste facilities from other liabilities which must be rehabilitated at closure is often conceptually difficult. Risks of environmental damage are beyond the scope of financial guarantees under the MWD. They are covered by the ELD 2004/35/EC (see section 5.2).

7.1.1 Definition of closure objectives

The clear definition of closure objectives should be part of the closure plan required by Article 5 (3 f) of the MWD. The closure plan shall be submitted along with the management plan for the waste facility.

The closure plan should include after-use scenarios and quantifiable environmental standards, which must be safely met before the site can be finally released. The integration of a closure plan including rehabilitation, after-closure procedures and monitoring into the waste management plan guarantees that remediation measures and costs are taken into account from the beginning of deposition operations. These measures could include, but are not limited to:

- ensuring the geotechnical stability of waste facilities (e.g., dams, slopes, etc.),
- measures to achieve seepage quality criteria before discharge into the environment (or quality of the seepage after treatment),

- measures to guarantee that threshold values for the emanation of noxious gases are not exceeded (e.g., cyanide, etc.) and of dust blown off from the facility.

Unplanned or premature closure requires explicit consideration. In many cases, the maximum cost of closure and hence, the level of guarantee required by the MWD will result from early closure. This risk of early closure should be avoided by evaluating the operator's ability to meet the objectives of the waste management plan at any time of deposition operations.

7.1.2 Waste characterisation and classification

The **characterisation** of waste is only one of the elements which have to be addressed under the waste management plan. The aspects which have to be specified prior to the deposition operations in accordance with Annex II of the MWD are:

- waste transport system,
- method of deposition,
- chemical treatment of the mineral resource and their stability,
- classification of waste,
- the expected chemical and physical characteristics of the waste.

Characterisation of the wastes includes chemical and geotechnical aspects. The costs of a thorough characterisation of wastes must be taken into account in the calculation of the financial guarantee. Most often, waste characterisation is a continuous process for which costs must be foreseen in the financial guarantee at any given time and for the case that the deposition operations terminate prematurely.

Apart from the characterisation, classification of the waste facility into a category is required by Article 14 (2 b) in conjunction with Annex III. In case a waste facility falls into category A, the costs resulting from the special precautions must be taken into account, which include in accordance with Article 5 (3 a), *inter alia*,

- o the periodic review of dam safety reports by independent qualified experts,
- o the preparation and periodic review of emergency management and response plans,
- o geotechnical instrumentation of dams, installation of a monitoring system for geotechnical and/or hydrochemical parameters, as appropriate.

7.1.3 Environmental impacts of the waste facility and future land use

Article 14 (2 a) of the MWD requires that the amount of the guarantee should be based on the environmental impact of the waste facility and the future use of the rehabilitated land.

The environmental impacts are assessed through the Environmental Impact Assessment (EIA) which has to be carried out during the permitting phase. Directive 85/337/EEC provides

the necessary information regarding the requirements of the EIA which have to be covered by the operator.

According to Directive 85/337/EEC the aspects to be examined under the EIA, are the direct and indirect effects of a project on:

- human beings, fauna and flora,
- soil, water, air, climate and the landscape,
- the interaction between the factors mentioned in the first and second indents,
- material assets and the cultural heritage.

The financial guarantee should as a minimum take account of the costs associated with the assessment of the factors listed above. National environmental legalisation can lay down additional factors which can influence the calculation of the financial guarantee.

Future land use

As defined by Article 11 (e) of the MWD the operator has to ensure that suitable arrangements are in place with respect to the after-closure phase of the waste facility. According to Article 14 (2 a) the calculation of the financial guarantee should consider the environmental impact of the waste facility including, among other aspects, the future land-use of the rehabilitated land.

For example, the expenses for the remediation of a former mine site with an industrial after-use differs significantly from those for a residential area or similar sensitive use scenarios. The intended after-use allows defining the admissible environmental impact of the waste facility after closure, and subsequently the prevention or mitigation measures needed to achieve those objectives. This encompasses the water path, gaseous and dust emissions, but also visual impacts of the waste facility.

The determination of the after-use, respectively of the future land use is often an interactive process, reconciling the interests of the community, local, regional and national governments and those of the mine operator. The intentions and preferences of those parties can change over time.

The following table shows how the range of after-use scenarios can be achieved by typical technical measures. It must be noted, however, that these are merely typical examples which are always to be adjusted to site-specific conditons and national legislation.

Table 7.1.3-1: Typical technical measures to be considered for highly and less sensitive usage scenarios

Technical measures	Less sensitive after-use	Highly sensitive after-use	Remarks
Example for after-use scenarios	Use of waste fadcility surface for industrial purposes, e.g., wind turbines, parking area	Recreational area, hiking trails and playgrounds	Some sensitive after-uses may be precluded for certain waste facilities, e.g., containing dangerous wastes
Seepage water management	Treatment of seepage water so that general environmental standards and needs of downstream users are met	Treatment of seepage so that discharged water does not negatively impact local surface water streams which may be used for drinking water or irrigation Placement of a cover which minimizes infiltration into wastes and thus seepage flow rate	
Cover system	Placement of a simple cover which prevents inadvertent access to wastes and dusting	Placement of a multi-layer cover which minimizes infiltration into wastes and thus impact on groundwater aquifer which may locally be used as a water resource	Cover system design and water management are closely linked. A more sophisticated cover system which effectively minimizes infiltration and prevents acification (if wastes tend to acidication) may allow a less expensive water management solution
Reshaping to improve visual appearance	Scarifying, leveling of surface Simple grass vegetation	Reshaping of the waste facility to blend with the environment topography (shape of hills, valleys etc.) Planting tree and shrub species typical for the region	

7.1.4 Time estimates

The financial guarantee has to be lodged "prior to the commencement of any operations involving the accumulation or deposit of extractive waste in a waste facility" and has to be adjusted periodically (Article 14 (1), MWD). This ensures that environmental liabilities are financially covered before they are incurred.

A time estimate for the closure period and post closure activities such as water treatment must be made in order to calculate the long-term costs to be covered by the financial guarantee. The time needed to treat the effluents from a waste facility is usually difficult to predict especially if neither the precise composition of the effluent nor the exact details of the contaminant sources and pathways are known. However, an approximate estimate can still be made and would provide at least an order of magnitude for the time scales to be plausibly expected. Only during the mining phase precise information concerning the volume, degree of contamination and mobilisation of effluents can be obtained. This information influences the assumptions on the time period over which mitigation and after-care measures are needed. This new information should be used in the revision of existing (or the preparation of more elaborate) hydrochemical predictive models.

The time estimation is also an important input into the cost estimates for monitoring activities, because monitoring is required as long as technical measures, such as water treatment, is needed.

7.1.5 Review

According to Article 5 (4) of the MWD, the waste management plan must be reviewed every 5 years, or more frequently in the case of substantial changes of the operations. This period should also be applied as a maximum period to the review of the financial guarantee. The mine operator may have a strong interest in more frequent reviews, e.g., during the early years of operation.

The review and update of the waste management plan, including the closure plan should incorporate the latest knowledge of the deposited wastes and their environmental impact, as well as the technological progress in the prevention, minimization and mitigation of the environmental impact. This can lead to changes of the estimated closure cost (both increasing and decreasing earlier estimates). In reviewing the financial guarantee several aspects need verification, such as:

- validity of the after-use scenarios of the waste facilities,
- assumptions of the usage of environmental resources (e.g., groundwater, surface water, air, etc.), the change of unit costs for rehabilitation measures (e.g., due to increased material prices, or new, more efficient technologies, etc.),
- success of closure/remediation measures,
- change of the regulatory framework (e.g., water discharge limits, etc.) and of predictions on environmental impacts.

More frequent reviews of the financial guarantee can create an incentive to mine operators to complete rehabilitation works and achieve the partial release of the guarantee lodged. This would be also in the interest of the general public and authorities.

Instead of lodging the entire amount at once before the start of the waste disposal, the operator may want to build up the guarantee on an annual basis. This would allow smaller mining companies, which would have difficulty to lodge (or obtain a bank guarantee for) the maximum amount, to generate a cash flow from operations first before making larger contribution in later years as required. On the other hand, authorities may wish to adjust the financial guarantees more frequently if they see significant uncertainties of the environmental impact. For example, the occurrence of acid rock drainage (ARD) from waste rock heaps may become an issue if ARD generation was not adequately predicted in the waste management plan. In such cases, upward adjustments of the financial guarantee may be justified to cover long-term water treatment costs.

In conclusion, it is recommended that the review period of the financial guarantee be left to negotiations between the authorities and the mine operators on a case-by-case basis, but shall not exceed 5 years.

7.2 Considerations for the calculation of financial guarantees

Article 14 (2 a) of the MWD states that the financial guarantee shall be calculated on the basis of "the likely environmental impact of the waste facility, taking into account in particular the category of the waste facility, the characteristics of the waste and the future use of the rehabilitated land." In this context "rehabilitation" is defined by Art. 3 (20) as the "treatment of the land affected by a waste facility in such a way as to restore the land to a satisfactory state (...)".

The following section gives necessary technical information that may be used as input to prepare technical guidelines for the establishment of financial guarantees. Each mine waste facility has its special requirements, both technical and regulatory. These technical guidelines should be understood as a checklist of issues to be kept in mind rather than a detailed instruction.

An overview of the main technical aspects to be considered in the calculation of financial guarantees is given in Figure 7.2-1.

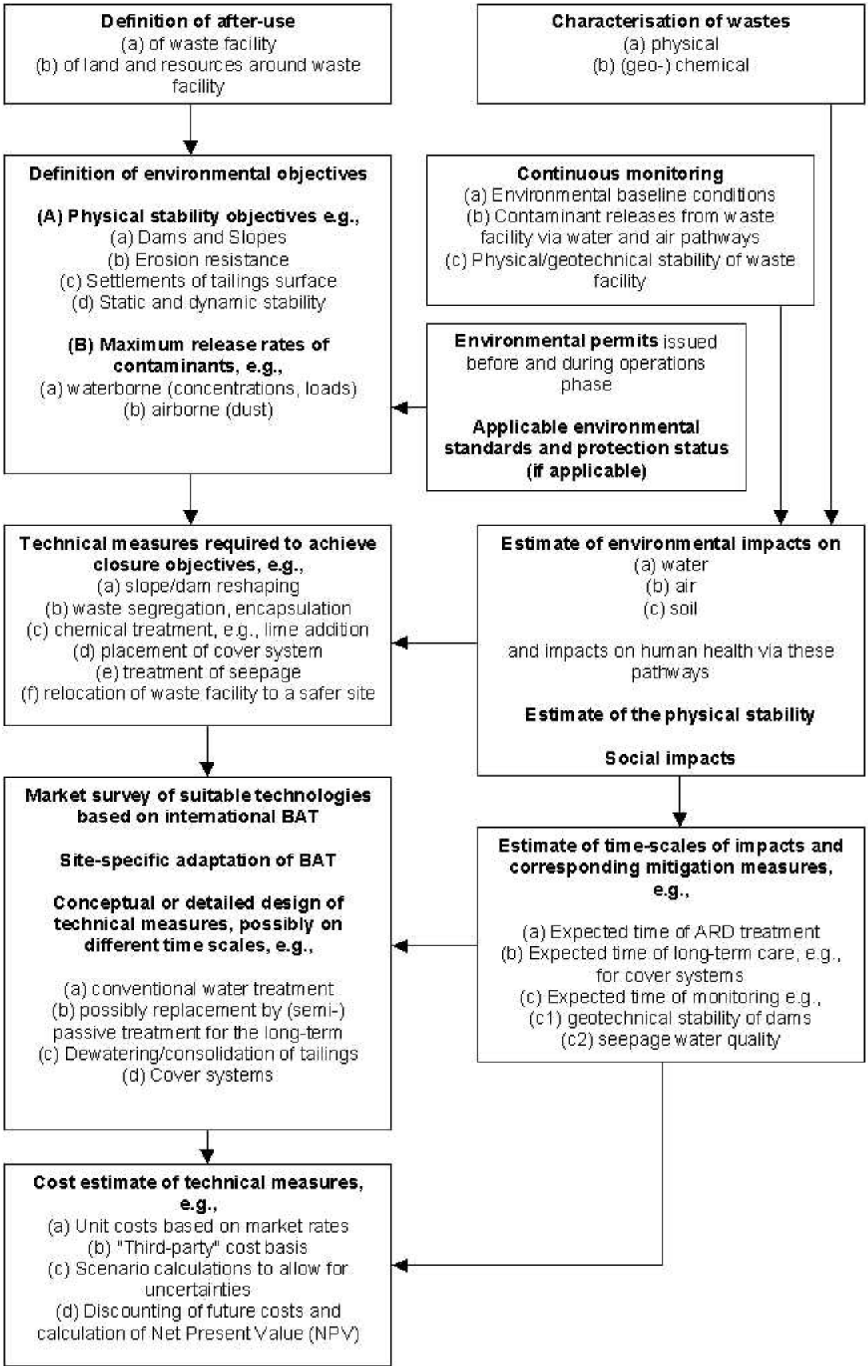

Figure 7.2-1: Flow sheet of the principal steps to calculate a financial guarantee

7.2.1 Management plans

The management plan(s) of a waste facility, in particular the closure plan, is important when calculating the financial guarantee. MWD (Article 7) clearly states that the application for a permit has to contain a waste management plan as required by Article 5. The waste management plan is usually drawn up for the entire mine site, including the extractive waste facilities such as tailings and waste rock heaps as the most important elements.

The closure plan required in Article 5 (3 f) and the quantitative closure and rehabilitation objectives defined in this plan require technical measures, such as reshaping/stabilizing of slopes and dams, placement of cover systems, or seepage treatment. In order to develop a credible closure plan, a quantitative understanding of the wastes and their mechanical and chemical properties is paramount. Data regarding the characteristics and the mechanical and chemical behaviour of a waste facility can be obtained in the permitting and pre-operation phase, but most of the information can only be generated during active deposition operations. To be permanently informed about the actual and future rehabilitation costs it is recommended to implement a continuous monitoring system which generates relevant data for the update of the closure plan.

The closure plan is also linked to other management plans of a mining operation such as:

- operation (waste deposition) plan,
- risk management and emergency preparedness plans,
- water balance and water management plans,

which are usually part of the Environmental Impact Assessment (EIA).

A closure plan should contain the following elements:

- applicable legislation,
- description of the natural and social environment,
- environmental and social impacts of the waste facilities, based on a description of the wastes, their physical and chemical properties,
- closure objectives (short and long term),
- technical measures to achieve the closure objectives throughout the operation phase, closure phase and post-closure phase, with respect to:
    - physical stability
    - impacts on the aqueous environment, air and soil
    - other impacts (e.g., social development which, even though hard to quantify in the context of financial guarantees, forms an integral part of all modern approaches to mine closure and rehabilitation – see also Recital 5 of MWD).
- technical measures during temporary suspensions of the mining operations,

- uncertainties of the cost estimates,
- organisational responsibilities, such as record keeping and updating of the closure plan.

7.2.2 Monitoring

According to the MWD the Member States should require the operator to apply monitoring procedures during the operation and in the after-closure phase of the waste facility. The monitoring should be adjusted to the risk posed by the individual waste facility. Generally, monitoring is an on-going process which serves multiple purposes:

- Monitoring of baseline conditions are needed to assess the state of the environment and to evaluate the impact of the mining waste facility.
- Monitoring of the quality and quantity of emissions from mining waste facilities can be used by the mine operator to double-check if the data in the environmental impact assessment is correct or must be modified. This is particularly relevant for the review of predictive models.

Data monitoring can also serve as a tool for competent authorities when checking if permits requirements are met.

The following components should be taken into consideration when calculating the cost of monitoring:

- water monitoring of ground and surface water bodies, in order to determine the impact of the waste facility on the water path,
- air monitoring (mainly dust and noxious components such as cyanide),
- monitoring of geotechnical stability of slopes, dams and other physical structures,
- supervision of vegetation patterns (e.g., detection and eradication of deep-rooted plants where this could damage the function of a cover system, re-seeding/re-planting where vegetation has not taken hold as intended),
- inspection of the functionality of hydraulic structures (e.g., whether water diversion channels are intact) and cover systems (e.g., erosion gullies, slope failure of covers on dam slopes, etc.).

Not all components may be relevant at all sites, diligent site-specific selection being thus required.

The best monitoring practice is described in the EU BREF document (see Ref. 157).

During the operation phase, monitoring is usually included in the operating expenses. However, for the case of premature cessation and closure of the operations, monitoring expenses must be foreseen in the financial guarantee.

Closure and post-closure (long-term) monitoring can be very important to determine the duration of active technical measures, such as water treatment. Therefore, monitoring costs

should be taken into account in the financial guarantee for a time period which is at least as long as environmental mitigation measures are expected.

7.2.3 Assessment of environmental and health impacts

The predicted and observed environmental impact of a waste facility determines the choice of technical measures needed to achieve the environmental objectives.
Waste facilities can have an impact on the environment via different pathways, such as:

- water (on ground and surface water),
- air (e.g., by dust or gaseous emissions, etc.),
- soil (e.g., by dispersion of dust or erosion of waste material, waterborne transport to floodplains, etc.).

Water contamination
The contamination of water is one of the most complex, long lasting and consequently most costly environmental impacts waste disposal can have. The range of contaminants in effluents depends mainly on:

- the mineralogical composition of the waste rock and/or the ore and, consequently, of the tailings,
- the ore treatment technology used,
- the water and oxygen fluxes in the wastes.

The flow rate of effluents/seepage from a waste facility depends on the water balance of the wastes which, in turn, depends on the hydraulic properties of the wastes, the water balance of a cover (if present) and the climatic conditions of the site. The water contaminants to be dealt with depend on the type of extractive industry. For example,

- metal mines with heavy metals and arsenic, sulphate and low pH (e.g., in case of sulphuric ores, etc.),
- coal mines with high iron and manganese concentrations and low pH,
- gold mines using cyanide extraction with cyanide and nitrogen compounds, heavy metals, arsenic and sulphate depending on the mineralogical composition of the waste rock and ore body,
- salt mines with salinity and turbidity.

A valuable overview of predictive modelling of seepage quality from mining waste facilities is provided by Ref. 126.

Air contamination
The above mentioned classification and characterisation of a waste facility similarly apply to the air pathway and are the prerequisite for estimating the influences of the deposition operations on air. Apart from dust from tailings beaches, gaseous emissions may be important, such as cyanide emanating from gold leaching tailings. Elaborate modelling tools predicting airborne transport of dust and gaseous components have been developed to facilitate the understanding of a possible impact of the waste facility on the environment.

While an analysis of the various tools would go beyond the scope of this study, two important model types are presented in the following:

- "Particle-track" models: This type of model simulates the path or "track" of a particle (dust, toxic compound) along the aerodynamically calculated flowlines from the source (e.g., surface of a tailings pond) to the receptor (e.g., human settlement). While it provides realistic results, this model type requires a detailed input of the topography and weather conditions in order to produce a realistic flow pattern of the air, in which the particles are transported.
- "Gauss-type" models: The spread of gases or airborne particles in the atmosphere is modeled as a continuum behaving like a "Gaussian bell distribution" which undergoes increasing dispersion with increasing time and distance from the source. Gauss-type models require only a small set of input parameters, but are only useful for rough estimates of the air pollution dispersion.

In most practical cases, however, the air pathway is less critical than the water pathway, and can be mitigated more easily, e.g., by simple soil covers, a "wet" cover, or dust suppressants to mitigate the dust problem.

Health impacts

For the assessment of health impacts not only the impact on water, air and soil is important, but also factors describing the transfer of contaminants to human beings, like food chain e.g., the consumption rates of drinking water, use of water for irrigation, living and nutrition habits and land-use. The derivation of most environmental standards, limits and guidelines is based on such "pathway analyses", for example:

- the Directive 2006/11/EC on the pollution caused by certain dangerous substances discharged into the aquatic environment of the Community which has ameneded the Directive 1976/464/EEC aims to protect international watercourses and the marine environment from pollution,
- the soil quality regulations such as the "Netherlands List" or the German Soil Protection Ordinance, specifying various use scenarios of soil and the associated exposure pathways of humans to contaminants (direct ingestion of soil, transfer of contaminants into plants which are then eaten by humans, etc.),
- the entire dose calculation framework of radiation protection (see Council Directive 1996/29/EURATOM), which is also applied to radionuclides in mining wastes,
- the Ontario Air Standards For Hydrogen Cyanide (2005), regulating the release of HCN (e.g., from gold ore leaching tailings ponds) into the atmosphere.

The parameters used for the assessment of health impacts may be different for each country or region, reflecting, for example, the proportion of centralised water supply to local wells, or the consumption of foodstuff produced regionally (i.e., near extractive waste facilities).

7.2.4 Technical measures to achieve the environmental objectives

The following technical measures have to be considered when calculating the financial guarantee. Not all of the following measures are necessary or relevant at all sites, so that the following items should be considered as checklist.

Stabilisation of dams and slopes

One of the primary concerns in extractive waste management (and subsequent closure and after-care) is the physical (geotechnical) stability of slopes and dams. A detailed description of the technologies used for tailings and waste rock stabilization is beyond the scope of this study. There are different technical standards and requirements concerning the stability, depending on the type of the wastes, their potential impact on the environment, and external factors such as seismicity. Whatever the details of a given situation, stability can be achieved by a combination of the following measures (not necessarily all being applicable to the same waste facility):

- reshaping (flattening) a dam or slope,
- erosion prevention measures such as water management,
- diversion of undisturbed rainwater runoff from the flanks of a waste facility,
- removing decant water on a tailings surface,
- dewatering of tailings behind a dam,
- seeding/planting vegetation.

These measures must be appropriately judged when calculating the financial guarantee.

Waste segregation/encapsulation

Under some circumstances it may be useful to implement a waste segregation strategy during the operations phase. For example, separating potentially acid generating (PAG) waste rock from benign (non-acid generating, or NAG) wastes and encapsulating the former by the latter may help to minimize the potential of acid generation of a waste heap.

Even if the mine production plan which is closely linked to the waste management plan foresees a sufficient amount of NAG material for the entire life of the mine, NAG material may not be available in sufficient quantities to fully implement the encapsulation technique, during certain periods of the operations phase, thus leaving parts of the PAG wastes exposed to atmospheric air and rainwater and thus making them more prone to generating acidity.

The mine production plan schedules the amount of ore, waste rock and overburden, the ore grade (and thus the output of the mine), the disposal routes of the extractive wastes (transfer mining, final storage facilities), and the utilization of equipment. It is not only the basis of the financial planning ofn a mining operation, but also provides the input of the waste management plan.

This situation must be taken into account in the calculation of the financial guarantee because it becomes critical in cases of premature closure or suspension of the mining

operations. The financial guarantee should be calculated based on one of the following assumptions (or a combination of both):

- prevention measures in case of incomplete waste segregation/encapsulation, such as placement of a sufficient cover on the PAG wastes,
- mitigation measures such as acid water capture and treatment,
- relocation of the PAG wastes to another place if such an option is feasible at all.

Cover systems

Cover systems on extractive waste facilities fulfil one or more of the following purposes:

- control (most often minimization) of the infiltration of precipitation into the wastes, which may lead to the occurrence of contaminated seepage at the toe of the waste facility and/or infiltration of contaminated water into the groundwater,
- control of gas diffusion into the wastes which may lead to acidification of the wastes and occurrence of acid rock drainage, often also carrying heavy metal contamination,
- protection of the waste surface from erosion (e.g., wind erosion, water erosion, etc.),
- isolation of hazardous wastes from public access,
- minimization of the airborne release of contaminants (e.g., radon or gaseous cyanide compounds, etc.),
- support a vegetative cover which corresponds to the intended after-use.

In the case of tailings which must be dewatered at closure, the cover system may also play a crucial role in draining the pore water which is pressed upwards, and lead it to a collection point from where it is then discharged into the environment or, if need be, pumped to a treatment station.

In order to achieve these purposes, the cover will often consist of numerous layers whose functions closely interact with each other. Consequently, the **capital cost** of cover systems which must be accounted for in the financial guarantee is determined by the following parameters:

- reshaping works of the wastes before a cover is placed,
- thickness of the components (layers) of the cover system,
- material cost (e.g., per m^3 of soil or per m^2 of a synthetic plastic liner),
- special requirements such as compaction,
- surface dewatering measures (e.g., canals, ditches, drains, etc.),

- quality assurance, particularly if strict quality requirements must be fulfilled (e.g., welding plastic liners, etc.).

The **operating cost** of a cover system consists mainly of supervision and monitoring which can extend over several decades. In this context it must not be forgotten that monitoring the functionality of a cover system alone is useless unless corrective measures are taken into account, too. These may include, but are not limited to,

- repair of damaged covers (e.g., erosion gullies, etc.),
- eradication of unwanted species (e.g., deep-rooted plants, etc.),
- re-seeding/re-planting vegetation if previous efforts have not yielded the required results.

As the future behaviour of cover systems is beset with rather large uncertainty (and thus the cost incurred by malfunction or necessary repair works), deterministic models could be complemented by probabilistic models with suitable assumptions on the long-term behaviour of systems components. Probabilistic approaches have been particularly widely used for more complex systems such as tailings ponds where geochemical processes within the tailings body, cover systems with certain geochemical functions (controlling oxygen and/or water transport) and groundwater aquifer form a complex system. Computer-aided probabilistic simulation models are commercially available to assist the calculation process.

Probabilistic models result in probability distributions for the cost estimates which may involve long tails of extreme costs resulting from very improbable situations. It is up to the judgement of both the mining operator and the competent authority to negotiate whether

- to use certain realistic scenarios out of the multitude of simulated scenarios,
- to use statistical values such as the median, the average of the cost probability distribution,
- to use any percentile of the probability distribution (i.e., to cut-off the cost probability distribution at a certain probability threshold),

in order to avoid unrealistically high cost estimates which reflect rather hypothetical situations but would impose an unnecessary financial burden on the mining operator.
It may be useful to set up test plots well before a final selection of the cover system is made and the cover is placed. If test plots are not feasible, an alternative may be existing waste facilities at the site or at neighbouring sites, which can be used to draw analogies to the waste facility in question.
Even though the performance of cover systems can be simulated using elaborate water balance and hydro-chemical models, these models (and the input parameters) are beset with uncertainties. Test plots where different configurations of cover systems are tested in parallel over many years under real climatic conditions give reassurance to the public and the authorities (and the mine operator itself) that the assumptions made in the design of the cover system are correct or, should this not be the case, allow correcting and modifying the design parameters.

The cost of test plots should be included in the closure cost estimate and therefore into the financial guarantee. Even though they seem to increase the closure cost in the first place, they are considered a worthwhile investment as they reduce the overall uncertainty of the cost estimate and help to avoid additional costs later on which then are not covered by the financial guarantee.

Subcontracting of waste management and disposal

The case study of a German gas extraction operator has shown that it is quite common to subcontract waste management and disposal to external companies in the oil and gas industry. Extractive wastes such as sludge and contaminated scrap are disposed of in landfills. These waste streams, even though are initially subject to the MWD, are released and fall then under the Council Directive 1999/31/EC on the landfill of waste (Landfill Directive). This is current practice in Germany, for example (see also the case study on ExxonMobil Germany.). Transfer of extractive wastes ("Bergbauabfälle") into ordinary waste regulations requires the approval of the mining and waste authorities. However, this procedure seems to be a peculiarity of the energy minerals industry (oil/gas).

The calculation of the financial guarantee must consequently take the following cost structure for waste disposal into account:

- excavation and loading of the waste,
- waste transport (often under ADR regulations for hazardous wastes),
- disposal in a landfill (Landfill Directive),
- administration and waste characterization (e.g., chemical and physical analyses).

The review of the financial guarantee must also check whether certain disposal routes are still applicable. As external landfills are used, their continued acceptance of the wastes is critical, and may change according to new developments in the regulatory framework. For example, according to the new regulations on the combustibility of the wastes prohibit the use of landfills for certain wastes the revised cost estimate for future disposal wastes has to be taken into account in the financial guarantee.

For example, the landfill ordinance of Germany (Deponieverordnung, see Ref. 63 and 134) was revised in 2006. It now requires that wastes with combustion energy content above 6000 kJ/kg must be incinerated before they can be accepted by a landfill. This makes it difficult for certain oil sludges (extractive wastes of the oil and gas industry) to be disposed of in landfills, particulary as they typically contain radioactive precipitates (e.g., Barium/Radium Sulphate or Lead Sulphides). This changes the available waste management and makes it more expensive.

7.2.5 Long-term care and maintenance

Long-term care and maintenance measures of mine waste facilities must not be underestimated and have to be adequately taken into account. As already mentioned the MWD (Article 12 (4)) requires under certain circumstances long-term measures and the related costs for rehabilitation of mine waste facilities.

Care and maintenance measures shall ensure that the environmental objectives are safely achieved over the long-term, i.e., over a time period exceeding the immediate closure activities. Such measures may include, but are not limited to:

- long-term geotechnical monitoring of dam and slope stability and tailings consolidation,
- regular checks of erosion control measures and the function of drains, ditches, and water diversion canals,
- inspection of vegetation status on covers, repair/replanting of vegetation if required.

Water treatment, which is often the most important single long-term activity, is dealt with separately in the following paragraphs.

Water treatment

Water treatment is an important aspect during mine closure and in the after-care phase and has to be taken into account while calculating the financial guarantee.

There are different options of water treatment described in the following:

Conventional water treatment

Treatment of liquid effluents (seepage water, contaminated runoff) may become one of the main cost factors of environmental mitigation of a waste facility particularly in the closure phase of a mine waste facility.

Tailings and waste rock heaps often generate contaminated seepage, which must be treated before it can be discharged into the environment. Tailings ponds often have a decant pond which must be removed before a cover can be placed if "dry" closure is chosen. The decant pond water may need treatment, too, before it can be discharged into the environment.

Typical contamination patterns are:

- metal mining wastes with acidity and heavy metals, possibly arsenic (in the case of gold mines using cyanide leaching with cyanide and nitrogen compounds), sulphate,
- salt mining with salinity (which, however, is usually not feasible to be treated), turbidity,
- coal mining with acidity, high iron and manganese contents.

There are numerous technical guidelines and references to BAT in the area of water treatment for mining and mine waste effluents (Refs. 10, 156 and 159).

For the calculation of the financial guarantee the following cost components must be considered:

- capital costs for the water treatment plant including
  - design and possibly pilot testing,
  - construction supervision,
  - water capture, holding/mixing ponds, and pumps/pipelines.

- operating costs including,
  - consumables (treatment chemicals),
  - energy,
  - personnel,
  - monitoring, analytics,
  - maintenance and repair of the installations,
  - safe storage of treatment wastes.
- decommissioning costs,
  - decommissioning of treatment plant,
  - closure of treatment waste storage site.

(Semi-) passive water treatment

Over the long run, the contaminant load from a mining waste facility may significantly decrease, but will nevertheless require treatment. In such cases, conventional treatment systems may be replaced by passive or semi-passive water treatment systems. They are often based on biological processes such as microbial sulphate reduction or hyper-accumulation of metals by special plants and algae. Ref. 159 provides a good overview of the state of the art of passive treatment.

The costs which must be taken into account to calculate the financial guarantee consist, in principle, of the same components as for conventional plants, even though operating costs are much lower. However, passive treatment systems are not maintenance-free, as has been often optimistically asserted in the past, but do require some degree of personnel and consumables, see Ref. 158. Therefore these methods are often referred to as "semi-passive".

Long-term obligations

Suitable arrangements for long-term obligations such as perpetual water treatment may include, but are not be limited to:

- an independent trust fund which takes responsibility for the proper implementation of the long-term measures. The widespread use of trust funds in Namibia (see Annex 3) could be mentioned as an example for this form of financial guarantee. The assets of the fund are provided by the mining company. The on-going costs are paid from the interest on the fund's underlying assets or from the returns of active fund management. A conservative (i.e., risk-averse) fund management should be encouraged to avoid losses of the fund's value.
- payment of a lump sum to the competent authority, as an equivalent to the net present value of the long-term liabilities.

The independent trust fund is recommended as preferred option because of the risk that the funds are used for other purposes by a government under budgetary strains.

7.3 Remarks on cost calculation

There exist further tools which can be supportive in the calculation of financial guarantees in order to facilitate the estimation of environmental impacts and the determination of costs.

7.3.1 Scenario calculations and use of probabilistic models

Often, input parameters of the cost calculations are uncertain. Scenario calculations should be used. In case of significant uncertainties of input parameters and possibly complex interplay of various factors affecting the cost estimate, probabilistic models (usually run as Monte-Carlo simulations on computers should be used to:

- obtain the range of possible outcomes and their probability distribution,
- identify those input parameters which most sensitively influence the cost estimate.

Probabilistic approaches can be used for the prediction of environmental impacts such as the seepage quality and quantity, as well as for the cost estimate of technical measures such as water treatment plants or tailings dewatering, where uncertainties of unit prices and/or design parameters exist.

Compared with deterministic models which merely allow to calculate costs using a single set of assumptions, probabilistic models have the advantage of running large numbers of scenarios with different assumptions, each occurring with its characteristic probability distribution. Therefore, the result has a statistical distribution, too. Rather than showing just one outcome among many, it shows the entire range of outcomes and their relative likelihood, which provides the operator and the competent authority with an additional piece of information.

For example, the financial guarantee must include provisions for cover systems and/or seepage water treatment if the wastes tend to acidify and heavy metals may be mobilized into the water path. The predictions of geohydraulic models of the cover system and hydrochemical models of contaminant mobilisation and transport are often beset with considerable uncertainties (see Ref. 126). Instead of basing the closure design (and hence cost estimate) of waste cover and water management on a single set of model assumptions, probabilistic calculation tools return an answer of the kind "With a likelihood of x percent, the combined cost of cover system and water management will not exceed a certain financial amount if a certain impact on the ground and surface water must not be exceeded." This allows the operator and the competent authority to take better informed decisions. As probabilistic models run on computers, are widely available and easy to use, they make it easy to change assumptions, scenarios and model parameters with a minimum of time and effort.

7.3.2 Discounting of long-term costs

While some technical measures such as water treatment or monitoring may be required over many years or even decades, the financial guarantee to cover these obligations must be lodged before these liabilities are incurred. This requires the calculation of the net present value (NPV) of the future obligations. The standard method of calculating the NPV is to add

the costs "C_i" expected for each year "$_i$" in the future, discounting them with a discount rate "r" that takes into account inflation and interest earned on funds set aside today:

$$NPV = \Sigma_{i=0...N} C_i \, (1+r)^{-i}$$

The requirement is to calculate the capital sum which would be required to provide sufficient money to cover long term costs. The relevant discount rate is therefore the long term return (net of inflation) which can be achieved for different types of investments. The discount rates published annually by governments (e.g., for the appraisal of public investments) could be used, for example.

7.3.3 Unit levy

The use of a unit contribution to the financial guarantee (e.g., per t ore mined or m³ of waste deposited) can greatly simplify the calculation procedure. In the light of Article 14 (2a), this is only acceptable if this unit amount is well-founded on a comprehensive closure and rehabilitation plan.

Unit levies could be an easy and simple method for continuous and homogenous waste streams with clearly definable possible effects on the environment.

7.3.4 Third-party cost basis

According to Article 14 (2) (b) of the MWD the calculation of the financial guarantee should be made on the basis of the assumption that any rehabilitation work performed by independent and suitably qualified third parties. This is necessary in case the operator itself is not able to carry out the required measures.

Third-party costs are usually obtained by a survey of market prices for the different technical measures required to achieve the environmental objectives. Design (and possibly testing), administration and supervision costs must also be included in the cost estimate. Market prices can considerably vary with time and location. Therefore third-party costs should be updated during every review of the financial guarantee, on the assumption that such costs are needed.

7.3.5 Independent experts

It is recommended that competent authorities and financial auditors seek advice from independent experts in the relevant fields (e.g., geochemistry, geotechnics, etc.), when the competent authority does not have the specific expertise in-house, in order to cross-check the assumptions made by the mining companies.

7.4 Release

If the financial guarantee is based on a clear set of quantifiable closure objectives (see section 7.1), the release criteria and therefore the conditions of the "exit ticket" are defined.

Some extractive waste facilities may require perpetual after-care, e.g., treatment of seepage which contains heavy metals or acidity. In these cases it would be impracticable to keep the mining company involved for an unforeseeable future. It is recommended that the mining company is released from its legal (and financial) obligations after suitable arrangements are in place. These arrangements have to be negotiated and then approved by the competent authorities in. Such arrangements could be the resort to an independent trust fund or the payment of a lump sum to the competent authority. In any case, a clear definition of the conditions of the final release of the mining operator is required. The indefinite retention of the financial guarantee by the competent authorities to cater for non-quantifiable, rather hypothetical risks should be precluded.

7.5 Acceptable financial instruments

Article 14 (1) leaves the decision of the acceptable instrument(s) to the competent authority which will decide on the required degree of taxpayer protection.

The freedom of choice by the authorities enshrined in the Directive cannot be waived or limited, but recommendations will be given for an informed decision.

According to Figure 3.2-1 there are "soft" and "hard" instruments, depending on whether the guarantee is tied to a company's assets (soft instrument) or is decoupled from the mining company and guaranteed by an independent surety provider such as a bank.

Any soft form of guarantee, by definition, becomes unavailable in case of bankruptcy of the mining company as the guarantor. Competent authorities who require maximum taxpayer protection will prefer hard guarantees. Large mining companies with sufficient financial strength have a very small risk of bankruptcy. In fact, transferring the guarantee to a financial institution such as a bank may not bring real benefits except for the bank itself. In fact, there are periods where the default risk may be higher for financial institutions than for resource companies. In these cases, the competent authority may well rely on the financial strength of the mine operator and accept a "soft" guarantee. However, this requires a close financial guarantee and technical monitoring of the mining company and an intact "early warning system" for financial stress. However, if signs of a weakening financial health become visible to the authority, hard guarantees may become more expensive or even unavailable, too.

The competent authority must decide whether it has sufficient expertise and resources to monitor a mining company and to require shift from soft to hard guarantees before the latter becomes unavailable. After all, it is the competent authority which is held accountable if the closure costs are finally borne by the taxpayer. It is therefore recommended that the competent authorities, if they accept soft forms of guarantee, have the necessary resources and capacity in the technical and financial field, or, if this should not be the case, undergo qualification for their own staff or contract suitable experts (auditors and technical experts).

PART II: INSPECTIONS

8 INSPECTIONS

8.1 EU legal framework

The Commission has introduced a substantial number of directives with respect to environmental protection over the past decades. The directives address the following key areas of concern (from Ref. 20):

I. Water
II. Control of Air Pollution
III. Waste
IV. Harmful substances: chemicals
V. Noise

The directives on waste management and environmental protection have set the scene for a more stringent environmental legislation in the EU Member States.

However, when Member States implement the environmental legislation, they prioritise the protection of air, water and soil differently. This is why the permitting legislation across EU Member Sates varies.

In order to harmonise the work of inspectorates within the Member States, the Commission has developed practical guidance in accordance with the following Directives:

- Water Framework Directive (2000/60/EC),
- 2008/1/EC Integrated Pollution Prevention & Control Directive,
- 96/82/EC Control of major Accident Hazards (Seveso II Directive),
- 85/337/EEC Environmental Impact Assessment.

The Recommendations of the European Parliament and of the Council of 4 April 2001 on the Minimum Criteria for Inspections in the Member States (2001/331/EC) describe what to consider when planning environmental inspections. The inspection plan should as a minimum outline the inspection frequency, the area or organisation, the mine waste facilities and the terms for revision. Useful information can be obtained from (Ref: 19):

- the database or register of industrial installations,
- a survey of the existing regulations and conditions,
- study of major environmental problems,
- the state of compliance of industrial facilities with regulatory and other requirements,
- the performance indicators and data on previous inspections.

Article 17 of the MWD has provisions for the inspections of mine waste facilities covered by Article 7 of the MWD. The competent authority has to verify the compliance of the mine waste facility with its permit conditions. The competent authority is obliged to inspect the mine waste facility prior to the commencement of the deposition operations, and at regular intervals thereafter, including the after closure phase. The mine operator is fully responsible for the entire lifespan of the facility and after mine closure and can not be released by "…an affirmative finding of the competent authority" (from Ref. 7).

Under Article 17 the mine operator is expected to continuously maintain updated records of the operations. The operator is also expected to provide up-to-date information on all waste management operations on request from the competent authority. In the case of a change of the mining title during the management of a waste facility an appropriate transfer of relevant data must be guaranteed.

In most of the EU Member States it is already common standard to submit rehabilitation and/or mine closure plans with the application for a mining license.

The competent authority responsible for the supervision of the compliance with the plan, and the permit conditions, is not always the same. According to Ref. 20, the legislation which applies to permit conditions is commonly enforced by the central government and then applied nationally, or in some cases delegated to the regional authorities. It is mainly the Ministry of Environment or equivalent institution which is the governmental body responsible for the development of the environmental legislation. In numerous EU Member States there are also other ministries or agencies which have taken over the responsibility for environmental issues.

Due to the harmonisation of national legislation with EU requirements, and self-regulatory instruments like Environmental Management Systems, the tasks and responsibilities of the inspectorates have become more complex within the EU Member States. There is still a large variation among the EU Member States with regard to the organisation of inspectorates (from Ref. 20). These differences became evident while evaluating questionnaires received from various competent authorities within the EU.

The questionnaires on the subject of inspections have given an overview of the different elements commonly reviewed during inspections and of suggestions on how to improve the work of inspectorates. A number of case studies on the European and international practice of inspecting mine waste facilities can be found in Annex 4.

9 SUMMARY OF SELECTED CASE STUDIES

10 detailed case studies have been compiled for this report and are mainly based on the response from different competent authorities to the questionnaires.

Questionnaires with questions on inspection practices have been sent to 27 competent authorities in the EU Member States. The questions covered:

- information on inspection practices,
- observations and procedures made during the pre- and post inspection phase and in the field,
- estimated length of time between each inspection,
- objects in the focus of the review and of the assistance of external auditors,
- implemented procedures in case of non-compliance of the mine operator with the permit conditions (see Annex 5).

In addition to that, the case studies selected among the EU Member States (plus Norway) were complemented with information on relevant national legislations. For the sake of completeness the USA, Canada, Australia and South Africa are included in this study on inspections as well. The case studies are attached in Annex 4.

In the end, 22 competent authorities of the 27 contacted EU Member States submitted their answers. Their answers have been used as a basis for the summary of existing arrangements of inspections, such as management techniques and the institutional framework of the inspectorates.

10 REVIEW OF EXISTING ARRANGEMENTS OF INSPECTIONS

As only 10 case studies are presented in this report but a lot more completed questionnaires were received from the various competent authorities, it is valuable to include this information into this study summarizing the findings. This is done by evaluating all the questionnaires provided by the competent authorities on the base of a summary table (see Annex 5). The response of some of the mine operators which commented on the work of inspectorates is considered as well.

Among the EU Member States the organisation of inspectorates and the problems met by the national inspection authorities vary widely. In the following, the differences but also similarities in terms of organisation, administrative capacity, regional competence and the implementation of inspections are considered.

10.1 Competent authorities

In most of the interviewed countries, the competencies regarding inspections of mine waste facilities are divided between several institutions and agencies:

- In the UK, the inspecting authority is represented by various institutions and ministries each of them responsible for different sectors of the mine waste facilities.
- Due to a division of Belgium in three legislative regions (the Flemish, Wallonia and the Brussels Capital Region) each of them has its own competent authority for setting up and implementing legislation and consequently its own regional government including a minister for the environment which is assisted by environmental administrations (from Ref. 20). In Flanders, it is the Environment Inspection Section, which is responsible for enforcing the environmental legislation. In the Brussels Capital Region the Inspection and Surveillance Division of the Brussels Institute of Environmental Management is occupied with pollution in all environmental sectors except waste transit and all nuclear energy issues.
- In Spain several ministries of the central government have authority on different aspects of the mining industry, e.g., civil works, security, environment, health, etc. Each of the 17 Spanish regions has its own government (“Comunidadas Autonomas”) which is responsible for the implementation of the inspections.
- In Finland, 13 Regional Environmental Centres and 414 Municipal Environment Protection Boards are supervising the compliance with permit conditions and are issuing permits (from Ref. 20).
- In France the Regional Directorates of Industry, Research and Development (DRIRE), an external service of the Ministry of Industry, are observing technical aspects of the licensing and are undertaking the inspections. 24 of such regional directorates exists which are obliged to inform the Ministry of Environment in case of any environmental damage.

- In Greece, the Ministry of the Environment, Physical Planning and Public Works is the competent authority for granting licenses for category A installations and for environmental inspections. For smaller mining operations the Departments of the Environment in Local Authorities (Prefectures) are responsible for licensing and the inspection procedures.

10.2 Pre inspection activities

All competent authorities in this survey review the previous inspection reports prior to the on site inspections. Apart from the Czech Mining Authority, all countries also routinely check the permit documents.

The frequency of the inspections usually comprises a routine component and a risk component. The routine inspections usually take place at least once a year. In Norway, small sites are visited only every two or three years. The Romanian General Directorate for Mineral Resources routinely carries out inspections every three months. In addition to the routine inspections, 7 competent authorities report to inspect mine waste facilities also on special request of local authorities and sometimes of NGOs.

In 8 cases the planned date for the inspections is forwarded to the mine operator and 3 competent authorities even provide a detailed inspection plan to the mining company. Further, 2 competent authorities send an inspection plan in case the operator needs to prepare for very complex issues. In 4 countries inspections are always unexpected.

10.3 Field inspection activities

To assess the compliance with the permit conditions most of the competent authorities review the relevant documentation, current condition of the waste facilities and estimate whether the staff and waste facility manager carry out their duties. This includes also the sampling of material and data which is done in half of the countries by contracted specialists and in the other half competent authorities undertake the sampling with own staff.

Generally, any visible negative impacts on the human health and safety and on the environment are considered during the inspections in the majority of countries. In the Czech Republic the mining legislation is taken as main criteria for any misbehaviour on behalf of the mine operator.

The compliance with the rehabilitation plan is a criterion to assess the conditions on a mine site. In France the competent authority is estimating the risks of pollution and the level of remediation of the land surface. In Ireland and the Czech Republic, however, competent authorities are not responsible for the verification of the rehabilitation plan.

The review of the financial guarantee is a sensitive element regarding the supervision of mining companies. For some countries the competency with respect to the review of the financial guarantee is not part of the area of responsibility of the inspectorates. In Romania,

Poland, Belgium (Flanders), and Latvia the financial guarantee is not subject to the inspections at all. In Ireland, however, the financial guarantee is regularly reviewed and assessed but not during physical inspections.
In Bulgaria representatives of the Ministry of Economy and Energy or the Ministry of Regional Development and Public Works are reviewing the amount and appropriateness of the financial guarantee. In Spain one of the competent authorities has no experience in controlling the financial guarantee and the other ("Junta de Comunidades de Castilla-La Mancha") verifies the annual restoration balance, respectively the balance between the affected mining surface and already rehabilitated surface, in order to assess the adequacy of the financial guarantee.

Most of the competent authorities agree on the fact that the compliance with recommendations from previous inspections has to be checked each time new inspections are implemented.

According to the majority of the involved parties the inspections do not coincide with inspections undertaken by external auditors particularly contracted by the mine operator.

10.4 Post-inspection activities

Regarding the post mining activities written records on the findings of the mine supervision are submitted in the majority of countries to the mine operator, except from Norway, where those information are sent only in case of already phased down mine sites. Also in Belgium (Flanders) and on Cyprus it is not standard to provide the mine operator with the results of the supervision. In Poland a post-inspection protocol is regularly sent to the operator. More than half of the demanded competent authorities also maintain an electronic database of all the findings of the inspections.

There are various possible actions mentioned by the competent authorities with regard to the follow-up of the inspections. The most common way of keeping contact with the mine operator after and between the inspections is via telephone, e-mail or through meetings. In some countries workshops are held.

In case of non-compliance, nearly all of the surveyed competent authorities prepare clear procedures which are in some cases contained in the technical mine closure plan, in the code of administrative procedure or in the post-inspection protocol.

10.5 Suggestions of the competent authorities

Most of the competent authorities estimate their qualification with respect to the supervision as suitable and supportive for the mining company as through the periodical inspection the companies get used to look after the deposition operations and mine closures procedures themselves. Furthermore, the competent authorities support the mine operators in pointing on the important environmental aspects that have to be considered already during on-going deposition operations.

However, the competent authorities recognise a deficit in the quantity but also quality of the inspectorates. It is not only the manpower that is often insufficient but in most cases the personnel is not familiar with the EU legislation and even not with their own, national regulations.

On the subject of extractive processes, tailing ponds or special sampling methods only five of 22 answered competent authorities are satisfied with the level of qualification of their staff. The evaluation of the questionnaires revealed that most of the competent authorities would wish, amongst others, a professional development and training of their personnel regarding the best practice in the mineral industry but also in the data management and maintenance. Nevertheless, there is only one competent authority, which is convinced that its activities do not improve the conditions on the mine site including the safety, health and the environment.

11 EXPERIENCE FROM OTHER SECTORS

Closely related to the work of the competent authorities inspecting the waste from the extractive industry is the work of the environmental inspectorates checking how the requirements resulting from the 2001/331/EC Directive are met. Over the last years, the EC has rapidly developed environmental policy and legislation in order to harmonise the environmental requirements imposed on the industry within the EU and the competent authorities developed a system of controlling the implementation and of reporting on the results (from Ref. 20).

In the context of inspections the experiences and findings of IMPEL, the European Union Network for the Implementation and Enforcement of Environmental Law, are regarded as good practice. IMPEL (see Ref. 18-21) was formed in 1992 as an informal network of the environmental authorities of the EU Member States. Its common objective is to create the necessary impetus in the Community to make progress on ensuring a more effective application of environmental legislation. To achieve this, the network has set itself the task of promoting the exchange of information and experience and the development of greater consistency of approach in the implementation, application, and enforcement of environmental legislation, with a special emphasis on Community environmental legislation. It will provide a framework for policy makers, environmental inspectorates and enforcement officers to exchange ideas both, jointly and separately, and to encourage the development of enforcement structures. The network meets on a regularly basis and considers broad issues related to implementation and enforcement and approves the work programmes as well as the annual budgets.

At the request of IMPEL a reference book for the environmental inspections (see Ref. 20) has been prepared. This reference book could be used as an example for the mine waste inspections as well. The reference book prepared for the environmental inspections describes:

- the responsibilities of the inspectorates with respect to implementation and the enforcement of the environmental legislation,
- the regulatory cycle (e.g., development of legislation, permitting, implementation, enforcement),
- the law enforcement,
- the legal and permitting framework.

In all cases the particularities in the different EU Member States have been considered. The guidance provided is non-binding.

IMPEL supports the principles and implementation of the Recommendation by the European Parliament and Council (2001/331/EC) on Minimum Criteria for Environmental Inspections (RMCEI), the purpose of which is to ensure that environmental inspection tasks are carried

out in all EU Member States according to minimum criteria, thereby strengthening compliance with Community environmental law and contributing to a more consistent implementation and enforcement of that law (see Ref. 21). The principles laid down in the "Recommendation of the European Parliament and of the Council of providing for minimum criteria for environmental inspections in the Member States", Point III – Organisation and carrying out of environmental inspections stipulate:

1. "Member States should ensure that environmental inspections aim to achieve a high level of environmental protection and to this end should take the necessary measures to ensure that environmental inspections of Controlled Installations are organised and carried out in accordance with Points IV to VII of this Recommendation."

2. "Member States should assist each other administratively in carrying out the guidelines of this Recommendation by the exchange of relevant information and, where appropriate, inspecting officials." (see Ref. 18).

Existing "quality standards (also referred to as 'minimum criteria') are recognised to be essential not only in improving inspection results, but also to support transparency, effectiveness and efficiency of environmental inspectorates as public institutions on the national, regional or local level. Furthermore, a proper use of the minimum quality standards may contribute to the improvement of environmental policy-making, as well as to legislative and licensing processes." (from Ref.18).

Within the EU, each country - and perhaps even each environmental inspectorate within a certain country - posses its own set of quality procedures for inspection work. To standardize and facilitate the implementation of inspections, it is desirable to identify quality parameters for inspectorates that cover most, or even all environmental inspectorates in Europe.

It has been agreed upon that the EU Member States report to the Commission on their experience of the operation and inform about the implementation of these recommendations together with details of environmental inspection mechanism.
The principle underlying this guidance is the recognition of a large amount of data within each inspecting authority and the need to collect, collate and evaluate the data.

IMPEL's suggestions concerning the organisational and reporting structure could well serve as an example for the competent authorities inspecting the mine waste facilities as well. It is worth to investigate whether overlapping responsibilities (e.g., environmental aspects, occupational safety, hydrology, etc.) exist. In case they do exist one should try to avoid time consuming duplication of responsibilities to the sake of the competent authorities and industry.

12 ASSESSMENT AND RECOMMENDATIONS ON INSPECTIONS

12.1 Objectives and scope of inspections

The most important objective of inspections and the additional enforcement is to ensure the compliance with the permit conditions, including the adequacy of the financial guarantee for the rehabilitation work during on-going deposition operations and in the phase of mine closure and in general, to guarantee the implementation and application of Community environmental legislation (from Ref. 149). This is in accordance with Article 17 (1) of the MWD where it is recommended to execute inspections in order to ensure compliance with the permit conditions. Article 7 (2 d) indicates that the permit has to contain adequate arrangements regarding a financial guarantee or equivalent.
In the end, all involved parties are commonly interested in avoiding the consequences of permit violations or bankruptcy as they may cause the competent authority to seize assets or close the mine prematurely (Ref. 152).

The frequency of the on-site inspections is based on a check of the compliance with permit conditions and dependent on the classification and characterisation of the particular mine waste facility in accordance to the MWD.

Through the identification of potential liabilities, risks and hazards the overall aim of inspections is to recognize and reduce negative environmental impacts of on-going and closed deposition operations. Potential risks of a mine waste facility comprise three main categories, such as:

Structural risks:

- Bad performance of operators,
- Unstable economic situation of operators and insolvency risk,
- Did the base for the economic viability of the mining operation change (due to variations of the market prize of the mined minerals, new environmental requirements, improved mining technologies),

Physical and technical risks:

- Stability of tailing dams,
- Consolidation problems of tailing sludge,
- Subsidence due to mining and consequently instability of tailings, waste heaps and private property,
- Waste heap stability (e.g., self ignition of coal waste heaps, decreasing stability),
- Erosion, eolian denudation, abrasion of surfaces over medium to long-term periods,

- Failure of water treatment to meet the effluent standards due to unexpected geochemical processes within the mine.

Chemical and biological risks:

- Seepage of tailing ponds (e.g., cyanide, acid, liquids),
- Acid generation of the wastes,
- Groundwater contamination, e.g., due to leakages of basal liners beneath tailings facilities,
- Bioturbation in tailings ponds and waste rock cover,
- Insufficient growth of revegetated areas,

Based on the risk assessment and according to Article II, 2 c of the Directive 2001/331/EC insepctions should include the following activities:

- site visits,
- monitoring of environmental quality standards,
- consideration of environmental audit reports,
- consideration and verification of self monitoring by operators,
- assessing activities and operation carried out at the controlled mine waste facility,
- checking the premises, relevant equipment and adequacy of environmental management,
- checking relevant records kept by the operators of controlled mine waste facility (see Ref. 150).

Further objectives of inspections are to minimise the cost of the financial guarantee by presenting data on the environmental risk as accurate as possible. Through regularly exercised inspections most of mining companies aim at gaining insurance against environmental impact liability. However, an insurance policy against environmental accidents and incidents is at present not very common or possible to obtain.

Inspections of mine waste facilities should be orientated on the environmental requirements described in Community legislation and transposed into national legislation or applied in the national legalisation. According to Ref. 150, in most countries the verification of compliance with national legislation has been carried out.

The Recommendation 2001/331/EC providing for minimum criteria for environmental inspections aims at contributing to a more consistent implementation and enforcement of Community environmental law in all Member States. According to Ref. 150 this aim is achieved through:

- establishing plans for inspections,
- performing inspections,

- reporting on inspections,
- investigating serious accidents, incidents and occurrences of non-compliance.

When inspecting mine waste facilities it is essential that the supervision and enforcement by the competent authorities are as uniform as possible and in accordance with the environmental legislation. It is important to increase the disclosure and exchange of information between the operator and the competent authorities and consequently, improve the transparency; uniformity and efficiency of the inspecting procedures (see Ref. 18). This can be achieved by exchanging of reports and open communication between the involved parties.

The International Chamber of Commerce specifies the scope of inspections as a management tool comprising a systematic, documented, periodic and objective evaluation of how well mine operators are performing.

Checking compliance with the MWD requirements should be undertaken separately from other inspections carried out by other agencies or authorities (e.g., environmental, mining, etc. agencies) although these measures can be done in parallel to benefit from the findings of the different environmental authorities involved. Other inspection work includes offsite assessment of reports, issuing reports or instructive letters to the mine operators before or after an inspection, reviewing financial instruments or the compliance with the existent legal situation.

Nevertheless, the competent authority also requires sufficient flexibility to carry out their legal duties. In the following, the work of inspectorates with respect to quality insurance, frequency and main objectives is described.

12.2 Timing and frequency of inspections

With regard to the specific characteristics of a mine waste facility competent authorities should elaborate criteria and a scoring system to assess the category of a waste facility and thus, to determine the frequency of inspections. The criteria can be orientated on the investigations by IMPEL (Minimum Criteria for Inspections, 1997 and Frequency of Inspections, 1999). According to Ref. 20 criteria for defining an appropriate frequency of inspections may include:

- relevant polluters similar to IPPC-installations, where the relevant impact on pollution is due to the potential danger (e.g., toxicity, explosion) of used substances and the amount of mass flow of substances emitted,
- mine waste facilities older than a certain number of years (e.g., 15 years),
- where past experiences have raised concern about the operation of the mine waste facility (e.g., previous poor performance of the operator or where there has been a large number of complaints),
- where poor management of a mine waste facility has resulted in pollution incidents,

- local situation (e.g., residential areas, protection areas, polluted areas and density of waste disposals as well as of emissions),

- plan for inspections covering the contents, the scope and a defined period (e.g., annually),
  - subsequent orders or administrative fines in the past,
  - number, specific knowledge and equipment of staff,
  - participation in self-monitoring systems,
  - relevant participation in EMAS with regard to inspection,
  - results of monitoring the state of the environment (water and air quality, etc.),
  - change of operator,
  - polluting potential of the process,
  - deterioration in the operational performance of the process,
  - frequency of public complaints or expressions of public concern,
  - the authorised process having a minimal polluting potential,
  - operational performance of the process to demonstrably high standards (from Ref.20).

In accordance with the minimum criteria for inspections competent authorities should set baseline frequencies for each category of a mine waste facility, based on the subsequent relevant directives and legislations:

- mine waste facilities covered by the Council Directive 96/61/EC of 24 Sep.1996 concerning Integrated Pollution Prevention and Control (IPPC-Directive),

- mine waste facilities covered by Council Directive 82/501/EEC of 24 June 1982 on the control of major-accident hazards of certain industrial activities (Seveso-Directive) or the Council EU Directive 96/82/EC on the Control of Major Accident Hazards (Seveso II),

- mine waste facilities to be inspected according to national/regional requirement priorities (from Ref. 20).

Generally, the frequency of inspections and duration of a visit is based on site-specific conditions and characteristics of the waste facility, on the so-called inspection burdens and prioritising parameters (see Ref. 18), for example, on the sector, size, risk and the complexity of the depositional processes. In this context, it is clear that the inspection of a large mining company with more complicated processes requires more time than the inspection of smaller companies with simple depositional processes. Companies with an expected greater environmental impact are consequently inspected more often than those having a smaller impact. This applies in particular to mining companies in which infringements of environmental legislation, complaints or accidents have already occurred in the past (Ref. 20).
Not all inspections are carried out on a regular basis and are announced in advance or are undertaken as non-routine inspections but both, routine and non-routine inspections, are common in all countries. In some cases the non-routine inspections are executed as follow-

up of routine inspections. According to Ref. 150 it is recommended to plan the inspection activities in advance based on an inspections plan.

12.3 Staffing of competent authorities

The fact that some staff members of competent authorities show deficits with respect to the national and EU environmental legislation, the knowledge about extractive processes and sampling procedures reveals that the position of the inspectorates has to be strengthened in order to provide assistance and competent advice.

Combining the critical recommendations provided by the competent authorities with the theoretical demands the following checklist for the structure of inspections including organisational aspects has been developed:

- Is the supervision of the mine waste facility under the responsibility of one or more institutions or agencies?
- Are the responsibilities clearly defined?
- Are there overlapping responsibilities with other inspection purposes like environmental inspections?
- Is there a transfer and exchange of information between the involved authorities?
- Is there sufficient staff for the execution of inspections?
- Are the inspectorates adequately educated and trained for the purpose of inspection?
- Are the inspectorates authorized to introduce ad-hoc sanctions in case of non-compliance?
- If there are various inspection activities, (pre-, field and post-inspections require different approaches) are the inspectorates prepared for the particular tasks?
- Do inspectorates have access to independent experts which can provide expertise and perform measurements (e.g., to confirm monitoring results) if deemed necessary by the inspectorates (and the necessary financial means)?

According to Ref. 152 the enforcement capacity of the inspectorates must be clearly and explicitly defined so that the competency of the inspectorates in stating clear procedures in case of non-compliance with the permit conditions is not divided among several agencies and the implementation of the restrictions is comprehensive.
In general, to improve the quality of the work of inspectorates the following aspects should be considered (see Ref. 18):

- Protocols and working instructions should be standardized between different inspectors.
- Inspectorates should be trained on the job.
- Coordination between different competent inspection bodies should be envisaged.

Capacity requirements

The capacity of the authorities is of paramount importance for the success of the inspections. With respect to extractive waste facilities, it is recommended that inspection teams are formed which, depending on the specifics of the waste facility inspected, comprises qualifications as shown in Table 12.3-1.

Table 12.3-1: Recommended qualifications of inspection personnel for waste facilities

Qualification recommended	With main focus on
Geotechnical engineer	Slopes, dams, berms, stability of physical structures
Waste management expert, preferably with a mining or ore processing background	Optimized discharge of tailings, waste rock segregation
Civil engineer with background in hydraulic engineering or hydrology expert	Erosion control measures, water capture and diversion
Biodiversity expert	Negative impact of waste facility on biodiversity in its vicinity, assessment of success of recultivation of waste facility (or cover)
Air quality expert	Dust prevention, prevention/mitigation of gaseous emissions from waste site (e.g., cyanide compounds, radon, depending on type of waste)
Hydro-geochemistry expert	Assessment of aqueous discharges and treatment (if required)
Soil expert	Management of topsoil/subsoil heaps for later use as cover material, contamination processes

12.4 Establishing plans for inspections

A single fixed schedule for inspections does not exist as it is not applicable to the various types of mine waste facilities. The inspection activities should rather be orientated on the envisaged objectives and agreed outcomes than on general requirements. According to the recommendation of Ref. 150 a general schedule for inspections has to cover particular aspects and be orientated on strict procedures which have to be included in the plan for inspections.

Planning and preparation of site visits are essential in the pre-inspection phase to focus the inspection on the most important issues and to ensure that proper procedures are followed (Ref. 160). The following checklist might be supportive when preparing the site visit:

- Are all relevant technical facts about the mine waste facility known?

  - Location and geographical features,
  - Names of official or representatives,
  - Personnel, size of facility, operations, etc.,
  - Safety requirements and special examptions from them,
  - Legal and technical issues of the mine waste facility.

- Are previous inspection reports, drawings, rehabilitation plans, production records and waste disposal plans reviewed prior to the inspection?
  - Findings from previous inspections, including violations,
  - Compliance history (complaints from citizens about the facility, occurred incidents, etc.).

- Are regional regulations and public concerns considered?
  - National, regional and local initiatives,
  - Environmental justice and regional concerns.

- Is the reason for the inspection stated, the scope and target identified and communicated to the operator?
- Is the schedule and frequency of the inspection announced in advance to the mine operator?
- Do the inspectorates provide the mine operator with an inspection plan before inspecting the site?
- Has the operator provided an updated and complete record of technical and environmental (monitoring) data? Has this record been checked for plausibility and completeness?
- Are the documents allowing a systematic and continous project monitoring and technical records regularly requested by the competent authorities?
- Are permit documents reviewed and updated?
- Were there follow-up activities required and have these activities been systematically implementated or pursued?

Prior to the supervision an inspection plan that covers the entire territory of the Member State and all the controlled waste facilities shall be in place. According to Ref. 150 the plan should consider the existing legal requirements, a register of controlled mine waste facilities, a general assessment of major environmental issues in the area, a general appraisal of the state of compliance and any available relevant information on the controlled mine waste facility. As minimum the inspection plan should include:

- a defined time period, for example one year,
- specific provisions for its revision,
- specific sites or types of controlled installations covered,
- programmes for routine inspections, taking into account the full range of relevant environmental impacts (in accordance with the applicable EC legal requirements) these programmes should include, where appropriate, the frequency of site visits for different types of or specified controlled mine waste facilities,
- coordination between the different inspecting authorities (e.g., environmental or mining authorities depending on the national legislations and responsibilities), where relevant (see Ref. 150).

12.5 Performing inspections

During the field visit the inspectorates are requested to follow correct administrative procedures and requirements and check planned inspection activities against the actual situation at the site and make adjustments as needed (Ref. 160). It is recommended to prepare the field inspection according to this checklist:

- What is the latest status with regard to mining and remediation activities?
- Control of compliance with permit conditions, e.g.,
  - Do the technical details as listed in the original permit cover the actual situation?
  - Did additional aspects arise due to the current stage of works?
  - Did the progressive remediation work reach a stage where certain objects (e.g., individual waste heaps) can be removed from the list of remediation work to be carried out?
- Adequacy of financial guarantee:
  - Can the amount of the financial guarantee be reduced due to successfully executed remediation work?
  - Is there a need to increase the financial guarantee due to new liabilities or to revised cost evaluation of known remediation work?
  - Are there any signs that the financial guarantee instruments must be reviewed (i.e., stronger form of guarantee)?
- Are the interfaces between the requirements of the MWD and resulting from other directives and/or regulations covered (e.g., environment, etc.)?
- Did an additional need for monitoring and after-care requirements occur?
- Can monitoring measures be started in order to confirm or improve the assumptions made in the management plans (e.g., waste management and emergency management plans)

- Did the technical parameters between mine closure plan and current experience from on-going mining coincide (e.g., geotechnical parameters concerning dam stability, water quality, seepage volume)?
- Do the assumptions for the mine closure plan and actual experience of on-going mining coincide (e.g., environmental baseline conditions, waste segregation, etc.)?
- Are there any special problems requiring external experience?
- Are there complaints by the community which require action (e.g., change of waste management plan, etc.)?
- Are the indented after-use scenarios still adequate or have the interest´s of the community changed? Will this impact the waste management plan and/or closure plan and hence, the calculation of the financial guarantees?

Under Ref. 150 there are guidelines listed summarizing important aspects to be considered during site visits:

- During site visits the full range of impacts of the mine waste facility and its compliance with EC requirements should be examined and the impact of the mine waste facility on the environment should be considered in order to evaluate the effectiveness of the existing authorisation, permit or licensing requirements.
- Inspectorates or other officials entitled to carry out inspections should have a legal right of access to sites and information for the purposes of inspections and that, if site visits are carried out by more than one authority, they should exchange information as far as possible.
- The findings of site visits should be contained in reports or stored electronically and exchanged as necessary between the relevant authorities (Ref. 150).

In Ref. 20 it is suggested that minimum criteria for all on-site visits should include that:

- the visits have to be carried out through an integrated approach where possible. If site visits are carried out by more than one inspecting body, coordination should be assured.
- every site visit have to be recorded and the record should be filed.
- routine site visits have to cover compliance checking, encouragement and understanding and examination.
- ad hoc/non-routine visits in response to complaints, incidents and non-compliances have to cover investigation of the complaint, incident or non-compliance (see Ref. 20).

12.6 Reporting on inspections

Important prerequisite for successfully exercised supervisions is an open communication primarily between the mine operator and the competent authority, thus, avoiding that small

problems grow into major ones (from Ref. 152). A permanent exchange of data and information between the operator and the competent authority supports the early recognition of problems which can be then solved in cooperation. It further avoids that pollution or other negative influences on the environment which sum up in the end of a mine's life represent a costly burden for the mining company at a stage when there are no funds available.
Regarding Ref. 150 inspectorates should process or store the inspection data and their findings in a database, an evaluation thereof and the conclusions on whether any action should follow. The full reports or conclusions of the reports should be forwarded to the mine operator of the checked mine waste facility.

With respect to the results of the evaluation of the questionnaires which have been provided by competent authorities from various countries and the compiled case studies it is obvious that the submittal of relevant documents and records even before the site visit is common standard in most of the EU Member States. As already outlined in Part I of this report, a transparent and precise reporting is substantial for identifying faults and diminishing misunderstanding. Only on the base of a diligently maintained data set the transfer of liabilities from one operator to the other is guaranteed. The purpose of the inspection report should therefore be the presentation of a complete, accurate, and factual record of an inspection, and gather all evidences of an inspection (Ref 160).

The post-inspection phase, starting after the site visit should therefore consider the following aspects:

- Are written records on the findings of the inspection submitted to the mine operator, e.g., in the form of a post inspection protocol, etc.?
- Are the findings also transferred electronically?
- Is a follow-up of inspections arranged (e.g., regular meetings, telephone conferences, mail correspondence, etc.)?
- Are there clear procedures in place in case of non-compliance? If yes, are all involved parties aware of these arrangements?
- Have comments from the operator on the inspection report properly taken into account by the inspectorate?

Format of inspection report
With respect to Ref. 150 and 160 it is recommended to use a clear and uniform template for the inspection report. Although the format and exact contents of an inspection report will vary and also with respect to the adaptations for each sector of the minerals industry, the report should contain the following general sections:

- plan of the inspection, detailing,
  - the purpose of the inspection,
  - specific reasons for the inspections (complaints from third parties, incidents),
  - participants in the inspection

- actions which were taken during the inspection, including the chronology of these actions:
  - statements, records, physical samples and other evidences gathered during the inspections,
  - observations made during the inspections.

- findings of the inspection, subdivided (as appropriate) into,
  - checks of available documents provided by the operator,
  - findings of the site visit,
  - results of environmental samplings,
  - results and findings of interviews with site managers,

- conclusions on the environmental performance of the facility,
- follow-up, recommendations and corrective measures.

The format of the inspection report should not only follow a clear outline regarding the specific information but also the structure of the report (i.e., introduction, activities, attachments, etc.) should be simple and standardized.

The survey of the Recommendations on Minimum Criteria of Environmental Inspections (RMCEI) in various countries revealed that the reporting was carried out in most cases quite completely. Besides the permanent exchange of information between the competent authority and the industry an information chain between the competent authority and the Commission is also desirable as to ensure the adjustment of national environmental requirements onto the EU legislation.

A feedback from the inspectorates to either the policy makers or the licensing authorities is an important aspect in the implementation chain, thus the waste management plan including the financial guarantee can be adjusted if needed (see Ref. 20).

12.7 Investigating serious accidents, incidents and occurrences of non-compliance

In the event of serious accidents, incidents and occurrences of non-compliance the responsibilities and liabilities should be clarified and the conclusions forwarded to the competent authorities, which then have to implement clear procedures. Generally, each operator of a category A waste facility should have in place a safety management system and emergency plans to be used in the event of accidents and provide the competent authority with all relevant information necessary to reduce actual or potential environmental damage.
The enforcement is the first instance before implementing stricter proceedings to guarantee the compliance with the permit conditions.

Enforcement
To ensure that legal requirements are met enforcement consisting of both, preventive and reactive enforcement is the final active process that authorities undertake in inspecting the

waste facility. The regular inspection of companies is known as the preventive enforcement. Reactive enforcement is implemented when a company seriously violates the requirements. In non-compliance situations the authorities may issue warnings or compliance notices and impose administrative, criminal and/or civil sanctions. The enforcement actions available to the authorities vary greatly between countries (see Ref. 20). Inspectorates should always take into account that environmental legal requirements should be enforceable. Some examples of difficulties in the enforcement chain may include:

- the conditions in the licence are too descriptive, as a result of which enforcement is made complicated.
- the inspectorate has limited skills in some subjects or she/he lacks practical knowledge on how to enforce effectively and efficiently.
- in a number of EU Member States the distribution of responsibilities between different authorities is not clear.

The established actions have to be adequate to ensure the mitigation or remediation of the impacts and for the prevention of future such occurrences. The competent authority is further requested to verify whether the appropriate follow-up and enforcement actions, such as sanctions are applied by the mine operator (from Ref. 150).

In Ref.150 an evaluation of the different procedures within the EU Member States in case of non-compliance is made and listed in the following.

Non-compliance

There are different options to react in case of occurred accidents or of non-compliance. Based on the report of several competent authorities the commonly intervention actions comprise administrative sanctions, criminal prosecutions and civil or administrative court actions (from Ref. 150). In the following, some of the procedures in case of non-compliance are listed:

- warnings or compliance notices, issued by inspectorates,
- prohibition notices, issued by inspectorates or authority administrators,
- closing down processes or installations (in case of serious violations with considerable public health risks and/or environmental damage),
- administrative sanctions leading to fines, imposed by inspectorates of authority administrators,
- criminal action leading to fines and/or imprisonment usually initiated by the public prosecutor in response to a report from inspectorates or authority administrator,
- civil action leading to payment of compensation (from Ref. 20).

For further information see Ref. 168, 161, 160, 162, 163, 164 and 165.

12.8 Conclusions

The scope of inspections generally comprises all activities that contribute directly or indirectly to the observance of the requirements of the existing legislation. This includes:

- promoting voluntary observance by providing information, consultation and supervision,
- measuring of the observance by controlling and inspections,
- sanctioning/fining of the operator in case of non-compliance,
- commanding observance by using the sanctions under administrative law and/or civil law (see Ref. 20).

Nevertheless, the Communication from the Commission on the review of Recommendation 2001/331/EC (Ref. 150) revealed an ambiguity in understanding the scope of inspections in various EU Member States. In particular, the restriction of inspections on IPPC installations is mentioned.

Not all installations of the extractive industry, and waste management facilities, such as tailings dams and waste rock heaps, are subject to the IPPC Directive 1996/61/EC. It must be clearly stated that for the extractive industry, the need of inspections is independently defined by Article 17 of the MWD. Moreover, for large tailings dams which contain dangerous substances such as cyanide tailings from the gold industry, the Seveso II Directive 1996/82/EC has deliberately been amended by Directive 2003/105/EC to include these extractive waste facilities, too. For these facilities, specific inspection requirements are laid down in Article 18 of the Seveso II Directive.

Within the EU Member States the minimum criteria are a sound base for the performance of inspection. Inspections and enforcement should be under continuous development and orientated on the prevailing situation, gained experience, and national environmental objectives in each Member State. IMPEL (Ref. 18 to 21) provides minimum criteria for inspections with the focus on inspection and site visit based approaches to the compliance control and compliance promotion steps. To improve the results of the inspectorates lessons learned from the current practice should be always taken into account, in particular, when drafting new laws and rules or amending existing laws and rules.

The analysis of the questionnaires obtained from various competent authorities reveals the existing awareness and high level of implementation of the minimum criteria for inspections in the majority of the EU Member States. In some countries the scope of inspections is still unclear and subject to the competence of various competent authorities and thus, difficult to specify. The other reason for a weakly developed plan of inspection is the deficit in the training and development of inspectorates with regard to important elements of the extractive industry and the legislation. Other problems are arising in reason of:

- little attention is sometimes paid to practical aspects of implementation in the development stage of policy. For example personnel and financial resources to ensure proper implementation are not always sufficiently covered.

- government bodies do not always have practical knowledge about effective implementation of legislation (from Ref. 20).

Possibilities to enhance the quality of inspections are therefore:

- to make the conditions in the licence more detailed and less complicated thereby presenting clear obligations for the owner of the site,
- to improve the mostly limited skills of the inspectorates and the inspecting staff on some subjects including practical knowledge,
- to clearly divide the responsibilities among the existing authorities having responsibilities and functions (e.g., ministries, provinces, municipalities, water boards, police, etc.).

In considering and realising the above mentioned aspects the efficiency of inspections can be increased, thus, ensuring the correct functioning of the regulatory cycle of implementing and supervising of the permit conditions and avoiding cases of non-compliance or even accidents. The international practice and contributions from interested parties, including IMPEL and the European Environment Agency might help in evaluating the effectiveness of inspections.

In addition to that, the inspectorates and competent authorities should be responsible for creating the necessary conditions for the operators to facilitate the implementation mainly consisting of activities which companies undertake to comply with legislation. The cooperation of the public and the private sector in the supervision of mining activities with regard to the management of extractive waste results in the definition of a common interest in avoiding negative impacts on the environment and helps preventing major accidents and disasters.

In conclusions, inspections of extractive waste facilities are clearly required. Of course, the frequency and scope of the inspections should match the environmental risk and impact of the facilities. This means that the characterisation and classification of the waste facility should be undertaken prior to the operation of a waste disposal site so that the scope, level and frequency of inspections can be determined.