



# The role of the independent technical audit in raising finance

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## Synopsis

An independent technical audit by a consultant is part of the accountability process of publicly owned or publicly quoted companies when raising finance through share issues or loans or the sale of equity, and of banks or development funds when granting loans. Africa is undergoing a renaissance in investment in its mining industry. It is forecast that capital investment, in major mining projects in Africa, will be over US\$ 4.4 billion, in the next few years. Most, if not all, of the capital to be raised will require an independent technical audit. The aim of this paper is to assist the management of mining companies seeking finance in appreciating the role of such technical audits.

The reasons for such audits, especially to attract international investment, are listed. The role of the audit is explained in assessing the underlying robustness of the company as 'a going concern' and the viability of any 'expansion plans'. Its use is emphasised in establishing the underlying value of the company based on the mine life as supported by the mineral reserves. The independent consultant role is stressed as a representative of the parties in a finance deal who cannot, in practice, carry out their own detailed and specialized technical due diligence. The various components of a typical audit are examined with examples of critical matters which may require resolution. The definitions, which are used commonly in audits, in respect of competence and reserves and resources, as stated by various regulatory bodies, are compared.

## Introduction

An independent technical audit is part of the accountability process of publicly owned or publicly quoted companies when raising finance through share issues or loans or the sale of equity, and of banks or development funds when granting loans. In fact, an independent technical audit of mining operations and projects is nearly always a mandatory requirement for companies seeking external finance through either equity or debt finance, and for companies or institutions providing equity or loan finance. A technical audit report is always mandatory to meet international stock exchange regulations in respect of share flotations. Even for local stock exchanges, if a share offering is seeking international investors, an independent

Table I

### Types of financial deals for which audits are required

Debt Finance from Development and Commercial Banks
Stock Exchange Listing or Share Placement
Sale or Purchase of Equity Holding by Publicly Quoted or State Company
Privatization Sale by State Company
Insurance Policy and Premium

Table II

### Stages of project or operation at which audit may be required

Expansion of Existing Operation
Start up of New Operation
Proposed Feasibility Study
Rehabilitation Programme
Care and Maintenance Programme

technical audit report is needed to satisfy such investors. The types of financial deals for which an independent technical audit are normally required are listed in Table I.

These types of finance may be sought at different stages of a project or operation as listed in Table II.

The technical audit examines the underlying robustness of the company as 'a going concern' and the viability of any 'expansion plans'. It is used to establish the underlying value of the company based on the mine life as supported by the mineral reserves.

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When raising finance for a mine or proposed mine, the underlying asset against which the money is secured is the mineral reserves. It is essential that the reserves are defined in a manner familiar to the investor and in a form which is consistent with similar projects and mines in other countries.

Mining finance is an international business and finance decisions for major projects and operations are judged according to internationally applied criteria. International Mining Consultants' recent experience includes due diligence for a major loan from development banks for Sierra Rutile<sup>1</sup>, in West Africa, and the competent person's report for the Initial Public Offering of shares (IPO) of PT Aneka Tambang<sup>2</sup>, the state-owned general mining company of Indonesia and various due diligence audits for acquisition of properties and project financing in Russia, Central Asia and China. Africa's mining industry operates in this international market-place and these and other technical audits form useful models, in terms of the similarities in emphasis and reporting requirements, for raising new finance for Africa's resurgent mining industry.

The independent consultant represents the parties in a finance deal who cannot in practice carry out their own detailed and specialized technical due diligence. For example, in respect of a share offer, the parties represented are the incoming shareholders. Even when the potential investors are institutions with their own team of mining analysts, they can rarely individually justify fielding a specialized team for a full audit and rely upon the independent audit and an analyst's visit during the share marketing exercise, close to the share issue date. For project loans, the parties are the commercial banks or development banks. In a sale or purchase of an equity interest, the parties may be either the existing shareholders, e.g. the government ministry and the people the government represents, or the shareholders of the purchasing company.

### Key aspects to consider are:

- ▶ the audit consultant must be independent; a consultant cannot audit his own work
- ▶ the audit must be carried out by experts of demonstrable competence and experience
- ▶ a full audit will necessitate a team of complementary experts in a range of disciplines
- ▶ the value of the project is dependent upon the reserves, which must be defined in a clearly understood and universally accepted manner
- ▶ the result of the audit will be a valuation of the property or project and an assessment of any liabilities.

These points will be addressed in the following presentation.

### Technical audit components

An audit involves a review of documentation and data allied with site visits and the production of one or more reports by the auditor. The aspects addressed for a typical audit are shown in Table III. Each technical aspect requiring auditing has its own specific critical areas and issues. The company being audited has the responsibility to provide the technical auditor free access to documentation and operations to ensure that all these areas and issues can be adequately addressed.

Table III

### The main technical and related aspects to be considered in the audit

location and access
ownership, mining leases etc.
geology, mineral resources and reserves
mining methods and production levels
beneficiation and metallurgical methods and production levels
infrastructure, power, water supplies etc.
health and safety
environmental impact and management
management and staffing
capital costs
operating costs
sales contracts and smelter agreements etc.
revenues and cashflows
net present value (NPV)

It is important to involve the independent technical consultant in establishing the details of the audit programme, to ensure that the technical audit is carried out efficiently and can meet its aims, especially in terms of the completion date for the financing.

The reserves are considered as the prime asset for the mine, providing the underlying security for the investment sought. In most cases a net present value (NPV), which can be either pre-tax or after tax, is estimated for the life of the reserves. The sensitivity of the NPV is analysed with respect to capital expenditure (capex), operating expenditure (opex) and product prices.

The depth of due diligence for the audit is similar for all end users but the level and style of reporting varies, especially between that for a confidential presentation to a bank and a public document such as a prospectus. The technical audit is one of a set of inter-related audits. The financial and legal aspects of the company will also require auditing by independent accountants and lawyers. The technical auditor will inter-relate with the financial and legal auditors.

### Documentation, data

The company itself, or consultants other than those undertaking the audit, has to prepare and assemble the documentation and data to be audited, such as recent production statistics, management accounts and any expansion programmes. The technical auditor will assist by providing a 'wish list' of the documentation expected. Key documentation should be assembled in one place, a data room. Detailed operational data may be better reviewed at the mine sites where it can be discussed with the on-site staff. The documentation would be expected to include the items in Table IV.

If finance is being sought for an IPO or loan then the planned use of the funds to expand and improve the profitability of business has to be audited. Expansion plans should have been prepared to pre-feasibility level or better, if a value is to be assigned to them.

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Table IV

### Typical audit wish list

Details of location, access and climate
Mining and Exploration permits, planning permissions, royalties, etc.
Geological studies, exploration results, core recoveries, assay method, check assays
Mineral Resource estimations, parameters, methodology and data in digital format
Mineral Reserve estimates, parameters, classifications, plans, sections and orebody model
Reports on rock mechanics, slope stability and hydrogeology
Mine plans showing planned production sequence, production statistics and forecasts
Mineralogical information and details of Metallurgical sample collection, testwork and results
List of equipment for mine, concentrator, and other facilities
Details of power and water supply arrangements, agreements, contracts, and consents
Waste disposal for rock and tailings, consents, compliance, technical status, future capacities
Details of transport arrangements - contracts, etc.
Employee numbers, classifications, salaries and wages, overheads, and industrial relations
Management team, qualifications, experience and capabilities
Health, and Safety standards, records and policy
Environmental standards, records, policy and compliance
Major contracts with suppliers, advisors and sub-contractors
Reclamation liabilities - end of mine - bonds - revegetation requirements
Production and operating information - tonnages, costs, productivities
Capital expenditure programmes - committed and projected
Project implementation schedules
Sales contracts - smelter terms, market information - customers, price forecasts
Historical and projected revenues and profits
Future production levels and business plans
Financial information and accounting policies

It is important that the company has a definite plan and programme for its business for at least two years ahead and preferably for five or more years.

There can be a trade off between commencing the audit early, while future plans are still under discussion and waiting until plans are finalized when the time left for the audit is short. It is unreasonable to expect a company to freeze all plans for six months to allow for the audit and finance raising. In principle it would be expected that changes to future plans during the auditing should be limited to an evolution of existing programmes in response to market changes, or refining of particular technical or management options, rather than major changes of direction.

IMC has found that when a state company is involved in an IPO, it often requires a change of 'mindset' from an inherent conservatism to a more expansive and commercial approach to the future. Sometimes the management change in style is too radical and the management becomes overly ambitious and may not have studies which would be adequate to justify its future plans to an outside investor. An open relationship between consultant and company and development of a team spirit can identify and resolve any such problems at an early stage.

Other problems which have been encountered include a reluctance to release documentation which has previously been considered a state secret. IMC resolves this issue by its normal practice of signing a confidentiality agreement, which also covers return or disposal of all documentation in its possession at the end of the audit, depending on the wishes of the client company.

### Site visits

A prime requirement of any technical audit is a visit to all key sites. This visit is made by a team composed of experts who can cover all the technical and other aspects listed in Table III.

Collection of new data is not always required. However, during the site visits the mineralization will be examined both *in situ* in exposures in the mine and in any drill core. Particular emphasis will be paid to sample collection, preparation and analysis procedures. If there is any doubt on the adequacy of existing check sampling procedures then check sampling is conducted during the site visit. It is likely that check sampling will become an obligatory requirement for projects at an early stage of development, especially in the aftermath of the Bre-Ex scandal.

If the data to adjudge environmental conditions and monitoring are considered inadequate some collection and analysis of samples, such as liquid or gaseous discharges, may be required. This may not only be to ascertain whether environmental management standards were up to internationally acceptable levels: IMC found in the case of the audit of the Sierra Rutile<sup>1</sup> operations that it was important to assess the environmental impact and damage caused in the period of abandonment during the civil war.

It is generally a requirement by stock exchanges that site visits need to be made within six months of the date of the report or since the last significant development on site, whichever is later. Revisiting may, therefore, be required either due to unforeseen delays in completion of the finance raising process or positive developments on site, as production and expansion programmes are not suspended during the process. These positive developments could include a new vein exposed underground, completion of updating, or repair of a section of process plant, or expansion of activities commissioned since initial visits.

In respect of legal and regulatory matters, visits may also be required to the offices of government departments involved with monitoring and developing policy in key areas, such as policy for environmental and socio-economic aspects.

### History

The audit will involve a review of the history of the project. Operating companies should provide annual reports to support recent history and project reports, preferably at least pre-feasibility if not feasibility reports, and should provide such information for new projects or planned expansion of existing operations. Establishing the history of a mine or project is not usually a difficult task and is only a case of the auditor verifying with the company that in condensing the history for reporting no discrepancies or inaccuracies arise.

### Location, access and climate

The audit report, as a stand-alone document, will require confirmation of the site location, means of access and

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climate. Good quality maps are required to illustrate the location and access. The climate, especially extremes of seasonal rains or temperature which occur in parts of Africa, can impact on the number of operational months each year. As with the history these are normally straight-forward aspects to audit

### **Mining licences, exploration leases and other permits**

The technical audit report will provide an account of an examination of the tenement and other permits documentation from the point of view of their allowing the sensible operation of the actual or proposed mine. The technical auditor will liaise with the legal auditor with regard to their legal status.

The key factors are that licences and leases cover the minerals and area concerned, that they have adequate life or can be renewed and that they do not contain any significant constraining clauses. With the widespread changes in legislation in recent years the licence and lease situation for a particular property may be in transition or have recently been renewed under new legislation.

Historically, state-owned companies may have had additional protection of title compared with private companies. It is important that, if the raising of finance is tied into privatization, the status of the licences of the new company conform with regulations for the private sector. IMC found this situation when carrying out the audit for an IPO of PT Timah<sup>3</sup>, which had been a 100% Indonesian state-owned tin mining company. PT Timah had operated with hybrid exploration/exploitation licences because of the large areas it had control over, especially offshore. Before the IPO, all its licences were re-issued as either exploitation (i.e. mining) or exploration licences.

Again, good quality maps are required with adequate information on scale and co-ordinates for the accurate location of property boundaries and other features.

### **Geology**

The audit of the geology involves the review of geological reports, plans and cross-sections, computer models, and the examination of exposures and any cores. The prime purpose is to confirm the validity of the company's interpretation of the genesis and geological controls on the mineralization. Particular issues can include the distribution and concentration of particular minerals which can affect the choice of cut-off grade, amenability to mineral processing and metallurgical processes and ground conditions which impact on choice of mining methods, mining recoveries and dilution.

### **Resources and reserves estimations**

The confirmation of the estimated mineral reserves is the pivotal part of the technical audit. It requires a critical audit of the validity and adequacy of the data used to estimate the resources. An audit trail is followed to assess the validity of the data in terms of sample collection methods, accuracy of surveying of sample locations including down-hole surveying, sample preparation and analysis procedures including internal and external checks. The adequacy of the data is assessed with respect to the spacing of sample sites to check if it allows a high level of correlation and interpretation between sites. As well as grade it is important that there are

adequate density measurements both wet and dry. Finally, confirmation is made of the appropriateness of the tonnage and grade estimation methodology. To derive the reserves from the resources requires an audit of the engineering and financial factors used to determine dilution and recovery factors and economic cut-off grades.

The audit involves an independent check estimation of grade and tonnes, usually for the total reserves, although in exceptional cases an estimation of only key reserves may suffice. The check includes a review of the sensitivity of the grade and tonnes with respect to cut-off grade.

For an operating mine a reconciliation is carried out between historic production and historic forecast production. Over a short period, such reconciliations can be distorted as in the normal course of events the actual production areas vary from the planned production areas in response to actual conditions. A review of annual statistics over several years will often establish any basic divergence from overall estimated grade and tonnes and actual production. If this is the case then a fundamental reappraisal of the estimation methodology may be required. In order to reach an acceptable reconciliation, it may only require an upgrade of the modelling software so as to permit a more accurate modelling of the orebody outline or the adoption of more realistic mining dilution and recovery factors.

It is essential that the reserves are defined in a manner familiar to the investor and in a form which is consistent with similar projects and mines in other countries. If the company does not already use such a classification then the technical auditor introduces international standards for mineral resource and mineral reserve definitions and classifications. IMC often finds that long-established mining companies use historical internal planning classifications and state-owned companies may use classification systems developed for non-market driven economies or centrally planned economies. If the management has not had recent experience of other classification systems, it may lack understanding of the international use of the terms 'mineral resources' and 'mineral reserves'. Given adequate definitions of an in-house classification system, the translation to international criteria need not be a problem.

The consensus for international reporting of mineral resources and reserves is the Australasian Code for Reporting of Identified Mineral Resources and Ore Reserves, as contained in the Report of the Joint Committee of the Australasian Institute of Mining and Metallurgy, the Australian Institute of Geoscientists and Australian Mining Industry Council (JORC)<sup>4</sup>, originally released in February 1989, with the latest edition of July 1996, and the Appendix on Diamond Resources and Reserves of October 1993.

In this code, a Mineral Resource is defined as an identified *in situ* mineral occurrence from which valuable or useful minerals may be recovered. Mineral resources are subdivided into three categories which in increasing accuracy go from Inferred to Indicated to Measured Mineral Resources. There is a clear implication that there are reasonable prospects for the eventual economic exploitation of Mineral Resources.

The term 'Mineral Reserves' or 'Ore Reserves' is that part of a Measured or Indicated Mineral resource which could be mined, inclusive of dilution, and from which valuable or

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useful minerals could be recovered economically under conditions realistically assumed at the time of reporting. Mineral Reserves are subdivided into Probable and Proved Mineral Reserves. The Proved Mineral Reserves are more accurately estimated than the Probable. The Mineral Reserves are derived from the estimates of Mineral Resources by the application of factors for economics, mining, metallurgy, marketing, legal issues, environmental controls, social issues and governmental acts and regulations.

Similar codes and definitions have been adopted by the IMM, December 1991<sup>5</sup>, and international stock exchanges. The Council for Mining and Metallurgical Institutions, CMMI (Riddler 1996)<sup>6</sup>, is also establishing similar definitions.

If a company's reserves are not quoted according to these codes then generally the historic production statistics can provide, after auditing, the relevant dilution and recovery factors to allow *in situ* tonnages and grades to be converted to the recoverable tonnages and grades which constitute the reserves.

The importance of establishing audited mineral reserves is that they form a key guideline for adjudging the eligibility of a company in raising certain types of finance. Their valuation is discussed in more detail below.

### Mining

There is an overlap between the audit of the geology and mineral resources and the mining of a deposit. The geological audit will examine the adequacy of the data collected with respect to defining the shape and size of the orebody, ground conditions and hydrogeology. All these factors can influence the appropriateness of the mining method chosen and future decisions with respect to moving, say, from open pit to underground, or changing the method to take advantage of increased mechanization or economies of scale.

Once the reasons for the selection of the mining method have been examined the audit will concentrate on the detail of its application in terms of equipment selection and availability, grade control, mining dilutions and recoveries, productivity and safety record. For an operating mine the site visit plays an important part in enabling the technical auditor to assess the efficiency and skill of the staff and management. Historical data for planned and actual production provides a sound basis for adjudging the longer term performance of the mine. The methods in place for collection of production data influence the confidence that can be placed on historical data. It is preferable if there is more than one set of measurements. Surveying of benches or stopes and sampling of blastholes provide a good set of data at the production face. However, the only data may be from truck counting and grab samples, which is often the case for truck and shovel operations in unconsolidated deposits.

Finance is usually being raised either to start a new mine or for the expansion of existing production. Even an expansion project often involves the introduction of new factors in terms of equipment or mining practices and it is essential that adequate studies are available for auditing. IMC has found on occasions that such studies concentrate on the full production scenario, especially for use of large-scale equipment in open pits with an inadequate allowance for need for smaller equipment to open up an initial pit. In underground mining critical aspects are availability of a

skilled local workforce and supervisory experience in specialized techniques such as backfilling.

If the mining is contracted out then the capability and performance of the contractor and the contract itself require to be audited.

### Beneficiation and metallurgy

A critical aspect of the technical audit of the beneficiation and metallurgical processes is the confirmation that the samples used to establish the process, or any proposed modification in the processing, are truly representative. Often the ore to be processed is poorly exposed at the time when the testwork, which may be a long lead item, is required. This can be overcome by careful selection of drill samples, but for bulk samples ore may only be readily available from near to surface or existing work faces. Such ore can be representative of feed in the early stages of production but may not adequately indicate changes in properties at greater depths, especially with regard to transition zones from oxide to sulphide. IMC has found that even testwork carried out on near surface material can miss critical factors such as the presence of sticky clays.

Historical data for planned and actual production provides a sound basis for adjudging the longer term performance of the process plant with respect to performance of sections of the process and ultimate recoveries.

If the finance is sought for an expansion of a long-established operation using updated but tried and tested technology, the audit can be carried out with more confidence. It is especially useful if the company can demonstrate commissioning of a recent similar expansion.

If the project or operation stops at the production of a concentrate or directly saleable ore then the audit will also need to ensure that the product meets the downstream process specifications such as smelter terms, and there are no major problems with factors such as penalty elements or moisture content which could restrict or prevent sales. If the project is integrated downstream into a smelter or a refinery then the operations of these, too, require auditing.

The process aspect is generally the point at which there is the most environmental impact with regard to potential pollution and waste disposal. It is also the point at which minor minerals may be concentrated to levels at which they can become hazardous. The technical audit needs to pay particular attention to these environmental points as discussed further, as follows..

### Infrastructure

For small operations the infrastructure may be restricted to workshops, stores and offices, a mine road, a tailings dam, and power and water lines. Larger operations may have their own railways, ports, ore-carrying ships and barges and power stations. Some long-established mines can also provide a whole range of social services including housing, schooling, and hospitals. For new projects bussing or flying in staff from existing towns has become the preferred option.

The technical audit confines itself to the technical infrastructure. For power and water, the supply agreements and consents are reviewed. IMC has encountered a trend for many services including power, transport, loading facilities and even maintenance and supply of spares to be wholly or

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partially contracted out. These activities will still require a level of audit including details of the contractors capability and performance, and review of any contracts.

Where social services are not directly part of the technical activities of the company, the audit confines itself to acknowledging the importance of their existence for the functioning of the operation. However, these services do bring with them overhead costs. International investors prefer to see rationalization with the encouragement of contracting out of support services. IMC knows of instances in Indonesia where social services such as housing have been handed over to local government and hospitals bought out by the senior medical staff. Housing may also be sold to the staff.

### **Health and safety**

The technical audit includes a review of health and safety records. Mining has inherent dangers but the implementation of safety training, the creation of a safety culture, and the observance of safe working practices reduce the incidence of accidents. The auditors will expect to see a positive trend in statistics and safety policy. This can be a problem where a mine has suffered from a lack of investment or there is poor application of regulations by the authorities. It is also important that the company has due regard for the local population and wildlife by adequately fencing-off dangers.

### **Environmental impact**

International investors expect that projects, in which they may invest, meet international environmental standards or have a programme which is well advanced towards this end. This expectation may be in part social conscience but is principally to reduce the risk of future liabilities. Environmentally efficient operations are usually more efficient overall. The key operating issues which are audited include types and control of emissions, disposal of waste rock with respect to acid drainage, disposal of process tailings and the adequacy of associated consents, monitoring, compliance, and future capacities of waste rock dump sites and tailings dams. The key rehabilitation issues include revegetation performance and requirements, reclamation liabilities and mine closure plans. These issues are best handled by a full environmental management plan, based on standards laid down by agencies such as the World Bank, especially if the plan is quality assured and has ISO 9001 certification.

For long-established mines, historical liabilities are another issue, in particular for mines which started operations before the 1980s, the time when new and stricter environmental legislation often started in developing countries. IMC knows of situations where more recent legislation has back-dated historical liabilities to activity incurred since the mid-1980s. In such cases the auditor will be required to ensure that adequate financial provision has been made to cover such liabilities and to rehabilitate any affected area.

### **Capital costs**

The aim of raising finance is to meet the capital requirements to expand or rehabilitate an existing mine or to start up a new mine. The audit will involve a detailed review of how the

capital costs have been built up and of the capital schedules. The costs should be supported by feasibility study level documentation, pro-forma invoices for major items of equipment and construction costs to plus or minus 15% accuracy. The audit will examine the adequacy of provisions for working capital and contingency expenditure, and replacement capital. The costs should be split into local costs and those requiring foreign exchange. A clear statement of depreciation policy and capital allowances will be required. If the auditor considers that the capital costs are inadequate in any aspect then additional contingencies may be recommended.

IMC normally considers that capital expenditure prior to the date of the audit is sunk capital and does not assign pre-existing plant and equipment a value as part of the Technical Audit. This is because the plant value is realised in the valuation of the mineral reserves. If it did not exist and it is needed to exploit the mineral reserves then it would require the cost to acquire similar plant to be added to the capital costs. This extra capital cost would then have to be deducted from the Net Present Value (NPV) of the mineral reserves.

The company may well wish for the value of existing plant to be assessed and this can be the subject of a separate audit report, a Property Appraiser's Report.

### **Operating costs**

When the finance is being raised to expand or rehabilitate an existing mine the injection of capital is expected not only to increase production levels but also to improve efficiency and to reduce unit costs. A new project will be expected to come into production at competitive operating costs. The audit will require a detailed review of how the estimates of future operating costs have been derived. As with the capital costs, the operating costs should be supported by feasibility study level documentation.

Important issues are the distribution of costs between fuel, wages, spares and consumables, and between local and foreign exchange costs. It is important for the robustness of future operations that the operating costs sit low down on the cost curve for similar and competing operations. For existing mines the historical costs will be reviewed to determine any trends, up or down, and the areas where future unit costs will be proportionately lower.

Details of recent annual inflation and exchange rates will be required as will details of expected future rises in prices of consumables and wages significantly above inflation. Wage rises may result from expansion and introduction of new techniques which can raise the skill levels and productivity of the workforce, or wages may need to rise to be commercially attractive to retain key workers.

Details of royalties are required. IMC normally considers royalty payments as an operating expense rather than a tax especially when the royalty is a standard charge per unit of volume or weight rather than a percentage of revenue.

### **Revenues**

The ability of repaying loan capital or of maintaining and increasing the value of equity shares depends on a secure market for the product and a good margin between sales prices and costs.

The first item to establish is the point of sale, especially

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with a producer with downstream activities such as smelting and refining. If the audit is restricted to the mine, then if transfer prices do not already exist, the audit will need to introduce this concept to isolate the mine as a profit centre. If the value of the downstream activities is included then the point of sale will be the sale of the processed product, gold bar, metal ingot, chemical fertiliser, etc.

Then in order to forecast revenues, the sales price of the product is chosen. Where the product is freely traded internationally, such as most metals, then published prices, such as those from the LME can form an acceptable basis. This is backed up by the company's historical sales figures to demonstrate that either they sell at this price or at a premium or discount to the price. In most cases, a market report and price forecast are commissioned from a specialized consultant in this field.

It is also important for the company to be able to demonstrate the market acceptance of its product, by sales agreements. For a new project conditional letters of agreement to purchase may suffice.

The value of mineral reserves is often most sensitive to price. It is important that the operation can remain viable even at low price levels. If a mine also produces saleable by-products then the underlying viability of the operation should not rely on their sale but rather that they should be seen as providing additional profit.

### **Cashflows and net present value**

The capital and operating costs and the revenues are used to construct a cashflow model. For an international share offer, it is generally a pre-tax cashflow to allow easier comparison with similar producers in other countries. For a bank loan or equity purchase then tax will be included, including allowances, grace periods and import duties.

The technical auditor's role is to produce a cashflow and value which is sufficiently transparent and simple to allow the lenders and investors to apply their own factors for inflation, discount or premium and sensitivities. For this reason IMC prefers not to apply inflation factors and to discount the cashflow in terms of today's money at a real discount rate. The real discount rate chosen will be consistent with a nominal rate for the average cost of capital for other internationally diversified mining companies.

As an example in a valuation<sup>2</sup> carried out in the middle of last year for a diversified Indonesian state mining company a real discount rate of 7 per cent was chosen which was equivalent to a nominal rate of 10 per cent. This nominal rate was based on corporate debt cost of one per cent above the then ten year bond rate of 7.6 per cent and a gearing for resource stocks of 30 per cent, and allowing for the corporate tax rate for Indonesian companies of 30 per cent.

The level of certainty of the different classes of mineral reserves has also to be taken into account. This can be reflected in several ways: for example, the NPV of the probable mineral reserves could be further discounted and say only 80 per cent of the calculated NPV attributed, or a higher discount rate could be applied<sup>7,8</sup>. In many cases for operating mines, if IMC considers that past operation has shown that probable mineral reserves are nearly always promoted to proved mineral reserves as and when required and the part of the cashflow supported by the probable

reserves is some years ahead and so already discounted in terms of today's money, IMC does not further discount the NPV of the probable mineral reserves.

### **Management and staffing**

The technical audit reviews the ability of the management and staff to carry out the planned expansion or to bring the mine into production. Key issues are the experience, competency and drive of management and the level of skills and experience in the workforce. As part of the development of the company seeking finance, there may also be the rationalization of staffing levels, especially in the administration but also in the operations where new equipment and techniques may require fewer operators. Investors usually prefer any such staff redundancies to be already complete, or there to be evidence of firm commitment and acceptance, to minimise the risk of disruption later.

### **Legal**

The Technical Consultant will review all relevant legal documents from the point of view of any technical constraints and to see if they accord with standard industry practice. However, from a legal point of view these documents will have to be verified by the legal experts. The Technical and Legal Consultants need to liaise on the review to ensure both have fully covered the relevant documents and that their reports are consistent with each other. The report of one or other will need to include a description of the national mining and exploration licensing system.

The Technical Consultant may also play a role in explaining technical terms and issues to the Legal Consultants, especially when a prospectus is being prepared.

### **Reporting**

IMC normally produces first a long form report on the audit. This report is discussed and verified with the company's technical staff and management. At this stage it is the role of the Technical Consultant to advise the company of perceived concerns or areas where work practices could be improved. If the consultant considers that a proposed development or expansion plan is under-resourced in equipment, staff, capex or opex then the consultant will make adjustments to the budgets as it considers necessary.

For a bank loan, the lead bank will normally participate in the discussions on the long form report and may ask for amplification in certain areas. Once any issues from the long form report are resolved it will either then form the basis of the audit report for a loan or be edited into a shorter form report either for a sales document or a prospectus. For a prospectus the report must be dated within six months of the share issue or after the last significant event on site, whichever is more recent.

For a prospectus the Independent Technical Expert's Report is only one of a number of reports including the company's own description of its business. These reports must be consistent and all specialized terms require to be defined. The prospectus usually goes through multiple drafts and will be reviewed by the relevant stock exchange's own technical, financial and legal experts. The technical auditor participates in answering questions during the review process.

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## Use of valuation of mineral reserves

The commercial banks assess risks in the form of guideline ratios, in which the grade and tonnes of reserves play a key role (Butler, 1994)<sup>9</sup>. The main ratio used is the debt service cover ratio (DSCR) which is the ratio between cash available, usually annually, for debt repayment and the loan repayments plus interest:

$$\text{DSCR} = \frac{\text{Net Cash Flow before debt servicing}}{\text{Loan Repayment} + \text{Interest}} = 1.5 \text{ minimum (as a guide)}$$

The grade of the reserves is particularly important to the cashflow. Other ratios used are the loan life ratio (LLR) and the project life ratio (PLR). They are the ratios of the net present value (NPV) of the available cashflows over the projected term of the loan and over the projected mine life respectively, divided by the loan balance at any date. The size of the reserves and production rate determines the projected mine life. The required ratios are typically LLR = 1.5 minimum and PLR = 2.0 minimum.

It can be seen from the higher ratio required by the PLR that a bank expects a mine to have a significant life beyond the debt repayment period. It must be remembered that banks are risk adverse and that they receive their return from interest and do not participate directly in any upside earnings but lose out when a project fails.

The development banks and institutions, such as the International Finance Corporation, the African Development Bank and the various European Funds require similar levels of confidence but they can consider loans at more favourable terms in respect of lower rates of interest and grace periods.

## Stock Exchange requirements

Stock Exchange requirements are there to set minimum hurdles to protect investors. The London Stock Exchange (LSE), Conditions for Listing, 1995<sup>10</sup> include;

'19.3(c) demonstrate that immediately prior to its application for admission to listing; its proven reserves are sufficient to maintain a level of extraction sufficient to support trading on a commercial scale throughout at least the two years immediately following admission to listing or throughout the first two years following the date of commencement of extraction on a commercial scale if that date is after the admission listing;

19.3(d) demonstrate that, immediately prior to its application for admission to listing, the aggregate value (see paragraph 19.15 (l)) of its proven and probable reserves as estimated in the competent person's report, required by paragraph 19.4(a), is not less than 50% of the expected aggregate market value of its equity share capital immediately following admission to listing'.

The LSE does not have provision for the listing of companies which do not have proven reserves. In London, there is both a lower tier market, the Alternative Investment Market (AIM) and an off the exchange trading facility (OFEX) which provide a market for exploration companies. These two markets do not require a mandatory independent technical audit. However, in order to effectively float a mineral exploration company on them, it is essential to have such an audit report in the prospectus.

In Canada, stock exchanges have provision for companies with proven reserves as well as exploration companies. The

Toronto Stock Exchange (TSE) and the Vancouver Stock Exchange (VSE) both require companies with proven reserves for such reserves to support a mine life for a minimum of three years. Exploration companies have to submit a report to support that they have one or more properties of merit. The TSE has set up a task force to strengthen its requirements in the wake of the Bre-X scandal.

Most mining companies, as opposed to exploration companies, who are coming to the stockmarket will be expected to have reserves well above the minimum levels required. The reserves establish the underlying value of the company but the market value can be based on a premium above this either if the investors are particularly keen to invest in the specific mineral commodity or region, or if the mine is expected to define additional reserves during its life. The latter is the 'blue sky potential'. The consultant can only comment on such anticipated life beyond reserves and company policy and record in maintaining a reserves inventory. The premium on the NPV is up to the investor, and the market in the shares created by the underwriter. Investors are looking for the value of their investment to grow and it is important that the company has a potential for future earnings growth. Share and equity investors are less risk adverse than banks and not only look for dividends but also an increase in share price to realise their return on investment.

## Definitions of competence

So who is considered a competent person for certain types of technical audit and valuations and how are they independent? This has been defined variously by the IMM, in the AusIMM ValMin Code, 1996<sup>11</sup> the LSE, and for Canada in the National Policy No.2-A, Guide for Engineers, Geologists and Prospectors, Submitting Reports to Canadian Provincial Securities Administrators<sup>12</sup>.

### IMM Definition, 'Guidelines and Criteria'

- (3) A *competent person* must be professionally qualified and a member in good standing of a self-regulating professional association or institution with professional standards similar to those of the Geological Society, the Institution of Mining Engineers and the Institution of Mining and Metallurgy.
- (4) A *competent person* shall have a minimum of five years' relevant experience in the estimation, assessment and evaluation of mineral resources and mineral reserves.

### In the VALMIN Code, 'Definition of Terms'

- (10) 'Experts' and 'Specialists' mean natural persons who prepare and/or contribute to Reports, who are Independent and whose profession, expertise, competence, experience in the Mining Industry, qualifications and reputation gives authority to a statement made by them in relation to a particular matter.

The following considerations are relevant to whether a person is an Expert or a Specialist.

In the case of Technical Reports on Mineral Assets, an Expert or Specialist must be an appropriately qualified and experienced mining engineer, geologist, geophysicist,

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metallurgist, or other experienced technical professional and be a member of a relevant, recognised professional association.

Experts and Specialists must have technical, commercial, financial or securities qualifications and expertise, competence and experience appropriate to the subject matter of the Report or to those sections of it to which they are to contribute. Where the licensing requirements of the Corporations Law are applicable, an appropriate licence must be held.

'The Expert takes responsibility for the Report whereas Specialists are retained by the Expert to provide subsidiary reports or sections of Reports on matters on which the Expert is not personally expert.'

and:

- '17. A Specialist must have had at least five years, of suitable and preferably recent experience in the particular technical or commercial field on which he or she is to report.

'In the case of a Report, sections of which deal with Mineral Assets, either the Expert or a Specialist must have had ten years of relevant General Mining Industry Experience and that person must co-ordinate, supervise and take overall responsibility for such sections of the Report.'

The London Stock Exchange (LSE), defines a competent person in its 'Yellow Book'<sup>10</sup>:

- '19.12 The Competent Person, if an individual, must:
- be professionally qualified and be a member in good standing of an appropriate professional association, institution or body;
  - have at least five years' relevant professional experience in the estimation, assessment and evaluation of the type of mineral reserves being or to be exploited by the company; and
  - be independent of the company and its other advisers or, if he is not, clear disclosure of the relevant relationships and interests must be made both within the competent person's report and prominently elsewhere in the relevant listing particulars or circular.

'19.13 If the Competent Person is a Company:

- a partner or director must produce or directly supervise the production of the report on behalf of the company and must satisfy the criteria set out in paragraph 19.12(a) and (b); and
- that firm or company and all of its partners or directors must be independent of the mineral company and its other advisers or, if they are not, clear disclosure of the relevant relationships and interests must be made both within the competent person's report and prominently elsewhere in the relevant listing particulars or circular.'

### **Canada, National Policy No. 2-A Definition<sup>12</sup>**

#### **General**

Reports will be accepted only for the purposes of a prospectus if prepared by an engineer, geologist or prospector who has gained a minimum of three years' practical experience....

Where the proceeds of the issue are being applied to the property being reported upon, the person making the report required to be filed with the administrator (Commission) must be free of any association with the issuer.....'

The independence also relates to the payment. For a share issue the fee for the technical consultant cannot be related to the success of the flotation or placement. The fee will also require to be stated in the prospectus. The consultant can only receive a fee and not participate in share dealings.

### **Conclusion**

Africa is undergoing a renaissance in its mining industry. In recent years, new legislation and privatizations encourage private sector investment<sup>13</sup>. It is estimated that capital investment in major projects forecast to be over US\$ 4.4 billion<sup>14,15</sup> over the next few years. Most if not all of the capital to be raised will require an independent technical audit.

The aim of this paper is to assist the management of the companies seeking finance in appreciating the role of such technical audits. These audits should not be seen only as a mandatory additional task but rather as an activity which can also benefit the company. It can assist the company in making a clear presentation to potential investors and lenders, and addressing and anticipating their concerns. The timely involvement of the independent technical auditor can reduce the risk of prematurely seeking outside finance and exposing the project to technical questions which can delay or even jeopardize the raising of finance.

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### Minerals Processing '98 Sea Point, South Africa 6-7 August 1998

For the past 17 years, the Universities of Cape Town and Stellenbosch have hosted the Minerals Processing Symposia. The Cape Technicon joined the conference in 1994, enlarging the research base and making a valuable contribution ever since.

About 177 participants from 6 countries attended the conference which was held at the Arthur's Seat Hotel in Sea Point, offering visitors quick access to Cape Town, the Atlantic Sea Board and essentially the whole of the Peninsula.

About 40 papers and 15 posters were presented at the conference and a further 7 presented at the preceding one-day workshop on Mineralogy for Mineral Processing Engineers. The workshop was well attended. Ivan Reynolds, geologist from Rio Tinto, London, opened the day with a discussion on the role of mineralogy in the design process routes for the extraction of complex polymetallic sulphides. Furthermore, Professor Lorenzen from the University of Stellenbosch gave an update on the most recent developments in the field of diagnostic leaching which shows much potential in the field of liberation modelling.

On the first day of the conference, Professor John Ralston of The Ian Wark Research Institute of the University of South Australia gave a plenary lecture on the fundamentals and control of bubble-particle capture. Using a video imaging constructed from high-speed photography, he vividly showed how bubbles and particles interact on a micro scale, also determining if a stable bubble-particle aggregate would form. Moreover, he has shown the current leading edge work being done at the Ian Wark Research Institute regarding bubble particle interactions, a still ill-understood phenomenon at the fundamental level.

During the rest of the first day, many research students gave excellent oral presentations on their research. One specific topic which captured the author's attention was a presentation by Mr F. Sawyerr, originally from the U.S. but currently studying at UCT, where he used population balance methods to predict bubble size distributions in mechanical flotation cells and backed up his theoretical

work with measurements made by the UCT-developed bubble-size analyser.

Thursday concluded with the Annual Dinner of the Western Cape Branch at the Ritz Plaza Hotel in Sea Point. Mr John Scott, a distinguished journalist gave a very humorous report back of his experiences as a reporter on local issues from the Cape, as well as his experiences as a political correspondent. During the dinner, two SAIMM student prizes were awarded by the President of the Institute, Mr R. Mohring; to Paul Ayers and Andrew Carr, (UCT) and Hanre Rossouw (Stellenbosch) and Maryke Visser (Cape Tech).

Dr Victor Ross opened the second day of the symposium with a very entertaining plenary lecture on Technological Innovation. In his address he referred to the fact that the men of the future must think in a more feminine way, i.e. be more creative, not only to adapt to the changes of the future, but to *create* the future. He stressed the role of diffusion of technology from the original invention and ideas in the heads of researchers to the implementation so that society could benefit from it.

Two papers dealing with the high temperature side of minerals processing were also presented, with Professor Geldenhuys from the University of Pretoria reporting on the complex non-equilibrium processes during ilmenite smelting and Professor Bradshaw (from the University of Stellenbosch) discussing novel ways of high temperature processing with microwaves.

It is hoped that the future will bring more research presentations in the pyrometallurgical field as there is a dire need in South Africa for research in this area which has lately been treated as the stepchild of mineral and metal extraction research, which has attracted very few researchers from South Africa in the past decade.

Minerals Processing '98 was, as in previous years, a splendid showcase of current process-metallurgical research, maintaining or even improving on the high quality presentations of the past. It is a symposium of which the SAIMM and the symposium contributors can be rightly proud. ◆