AN ECONOMIC EVALUATION OF THE MINE DUMP RECLAMATION PROJECTS CONSIDERED IN THE MID-1980s BY EAST RAND GOLD AND URANIUM COMPANY

Graham John Craig

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DECLARATION

I declare that this project report is my own unaided work. It is being submitted in partial fulfilment of the requirements for the degree of Master of Science in Engineering to the University of Witwatersrand, Johannesburg. It has not been submitted for any degree or examination to any other University.

G.J. Craig

Eighteenth day of October 1985

ABSTRACT

In this project report, economic evaluation techniques and investment decision methods are studied. Their application to the gold mine residue reclamation projects of East Rand Gold and Uranium Company (Ergo), an associate of Anglo American Corporation (AAC), is considered.

AAC has been active in dump reclamation since 1953 and by 1982 it was operating three plants on the Rand, namely Ergo, Simmergo and Sallies. The development, by AAC and Ergo's metallurgists, of the carbon-in-leach process created additional investment opportunities. These opportunities were economically evaluated using rate of return analysis and other methods to determine their relative merits. The economic evaluation exercises indicated which investments ought to be undertaken to maximise the profits arising from the amounts invested.

Legal and other aspects influencing the decision-making process are studied, as well as the financing of the capital expenditure.

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1. INTRODUCTION

The charter of the East Rand Region of the Gold Division of Anglo American Corporation of South Africa Limited (AAC) is:

- to profitably extract gold, uranium and sulphuric acid from the residues of mining operations on the Witwatersrand;
- to develop improved technology to increase the profitability of this extraction process; and
- to acquire additional reserves to extend the lives of AAC's companies that are active in the residue retreatment business.

As the Divisional Manager of the Transvaal Section of the AAC Gold Division, I have worked since 1982 on the evaluation of technological developments and of potential reserves in an endeavour to expand the business opportunities of AAC's residue re-treatment companies.

Evaluation exercises are done because they are essential in the mining industry. As each mineral deposit is unique, not only in its location but also in its chemical and physical properties, it requires detailed technical and economic evaluation. Technological developments require similar evaluation.

The mining industry is more concerned than most industries with new project valuation as mineral deposits are a non-renewable, exhaustible resource. Mining companies regularly seek to re-invest part of the proceeds from existing mining ventures in new mining projects. Project evaluation techniques are thus [illegible]t use in an endeavour to replace existing business and to [illegible] alternatives available.

An evaluation report is important because it provides the basis for judging the value of a mineral deposit and the viability of a project. Not only is an evaluation report important to the management and board of a company, but it can be important in dealings with vendors of mineral deposits, shareholders, lenders, customers and governments.

Because an evaluation exercise is necessary and important, it must be done correctly. In this report, it is my aim to show that the evaluation exercises carried out with a view to expanding the activities of East Rand Gold and Uranium Company (Ergo) were executed correctly and that they lead to the appropriate investment decisions being made.

In project evaluation, the basic criterion for the investment decision is that the benefits must be greater than the costs. Although it is not possible to determine the estimated costs and anticipated benefits with certainty, it is possible to derive an understanding of the cost-benefit relationship and the potential effect of events on this relationship. A number of elements must be addressed in project evaluation: technical, economic, financial and legal factors. Information on all of these aspects is gathered and then analysed.

Data gathering for a mining project begins with an assessment of the ore body as it is the unique characteristic on which one is endeavouring to build a business opportunity. Geologists determine the shape and quality of the ore body in order to prove that sufficient ore in excess of an economic grade is present. They also define other characteristics of the ore body as these influence the mining method to be used. This in turn determines the capital and operating costs of extracting the ore.

The capital cost of the project is calculated by the mining and construction engineers. The accuracy of the capital cost estimate is affected by the amount of detailed design that has been done. If limited detailed design has been done, the estimate should have a substantial contingency added to it.

Working costs are incurred in mining, treatment and transportation. Surface mining is considerably cheaper than underground mining and so one is able to mine to a much lower cut-off grade on surface. In evaluation exercises it must be remembered that the cost of mining at increasingly distant work places rises. Thus unit costs of production rise independently of inflation.

An important point to consider is that the technical methods to be employed are at times new, and experienced engineers cannot predict with certainty the degree of operating efficiency, the operating costs or the capital cost of the project. In some of the projects considered in this report, new metallurgical technology was introduced on an unprecedented scale.

Having calculated the capital and operating costs of a project, one considers the revenue arising from the sale of the project's output. There are two distinct features concerning the sale of minerals. Firstly, capital expenditure on many mines does not commence until agreement has been reached on the sale of the proposed output for a number of years. The second feature is that it is uncommon for a mine to establish a pricing policy. Prices are set on commodity exchanges and the mining company has to accept fluctuating prices. In South Africa, the Reserve Bank arranges the sale of the gold production but the mines have to accept a varying price. Uranium on the other hand is sold mainly at fixed contract prices; however, not all of the uranium that is produced can be sold at present.

At AAC, we use simulation approach in our project evaluation exercises. A cash flow model of the project is developed to determine which combination of inputs maximises the rate of return from the project. The economic evaluation is done using the data obtained through the processes outlined above. Several runs of the model are usually required before the return is optimised and before a decision can be made on those factors over which one has control These factors include the production level, the method of production and the nature of the products produced.

There are other factors, however, over which one does not have control and they are subject to errors of estimation. These factors include ore grades and tonnages, prices, capital and operating costs, escalation rates, the production commencement date and plant recovery factors. To cater for these risk factors, one carries out a sensitivity analysis which takes into account the range of values which each risk factor could adopt.

Of the risk factors listed, only the ore grades and tonnages can be estimated with limits of error which can be calculated. The uncertainties associated with the other factors cannot be defined in a completely objective way. Judgement plays the major part in assessing these uncertainties and the quality of the final answer obtained therefore depends on the quality of these judgements.

The evaluation of mining projects is no different to the evaluation of any other kind of investment. The tax treatment of mining project costs and profits differs in several respects, however, to the tax treatment of non-mining costs and profits. The depletion allowance is a distinguishing feature that sets mining project evaluations apart from general investment evaluations. There are, in addition several other important tax considerations which must be dealt with correctly in the evaluation of mining projects.

In the South African gold mining industry, the cost of mineral rights and land is recovered through the depletion allowance Capital expenditure can be expensed, however, in the year in which it is incurred As a result, no costs are depreciable in the determination of gold mining taxation. The capital spent on new projects of a company can, in certain instances, be expensed against the current earnings of the existing operations of that company.

Changing prices of commodities and technological developments have resulted in the evaluations of the residue deposits changing over the three decades in which AAC companies have been active in the residue reclamation business. In this report, the changes over time in evaluations of various residue deposits are discussed. This highlights how evaluations can change markedly with changes in circumstances.

The history of AAC's reclamation operations is recounted in chapter 2. The development of the carbon-in-leach process, which had a major impact on the economics of dump reclamation, is described in chapter 3. The impact of this development on relations between AAC and East Daggafontein Mines Limited (East Dagga) is the subject matter of chapter 4.

Where one has a range of potential projects which could be undertaken independently of each other, it is necessary to rank the projects to learn in which order the projects should be undertaken. Such non-mutually exclusive projects should be undertaken in the order which maximises the profitability of the companies involved. In this project report, I show in chapter 8 that the management of Ergo had four projects to consider in mid-1983 and how it was decided in which order the projects should be undertaken. The four projects were the construction of a carbon-in-leach plant at the Ergo Division, the extension of the Simmergo Division plant, the establishment of the Daggafontein Division and the reclamation of the slimes dam at Withok.

A particular reserve may not be economical if it is treated in a particular way but it may be worthwhile to treat it in an alternative way. Alternative solutions were generated for the reclamation of the Withok and Daggafontein Division slimes dams. It was important that these mutually exclusive alternatives were correctly analysed so that the economically most attractive alternative was chosen in each case. This analysis is presented in chapter 9.

Each of the above-mentioned non-mutually exclusive projects and the mutually exclusive alternatives is a revenue producing project which requires a certain method of analysis. Within these projects and alternatives, there are different ways in which services can be provided. Each service producing alternative requires economic evaluation using the correct methodology.

For the purposes of economic evaluation it is useful to evaluate projects in a number of ways. Rate of return, net present value, payback and break-even analysis were used in the economic evaluations. Because of uncertainty, sensitivity analyses were done to show the impact of varying gold prices, operating costs and capital costs on projects. The sensitivity analysis for the combined Daggafontein Division and Withok slimes dam project is presented in chapter 10.

Different assumptions with respect to escalation can have a major impact on the economic evaluation of a project. One assumption that can be made is that prices and costs escalate in such a way that profits remain unchanged throughout the life of a project. This is

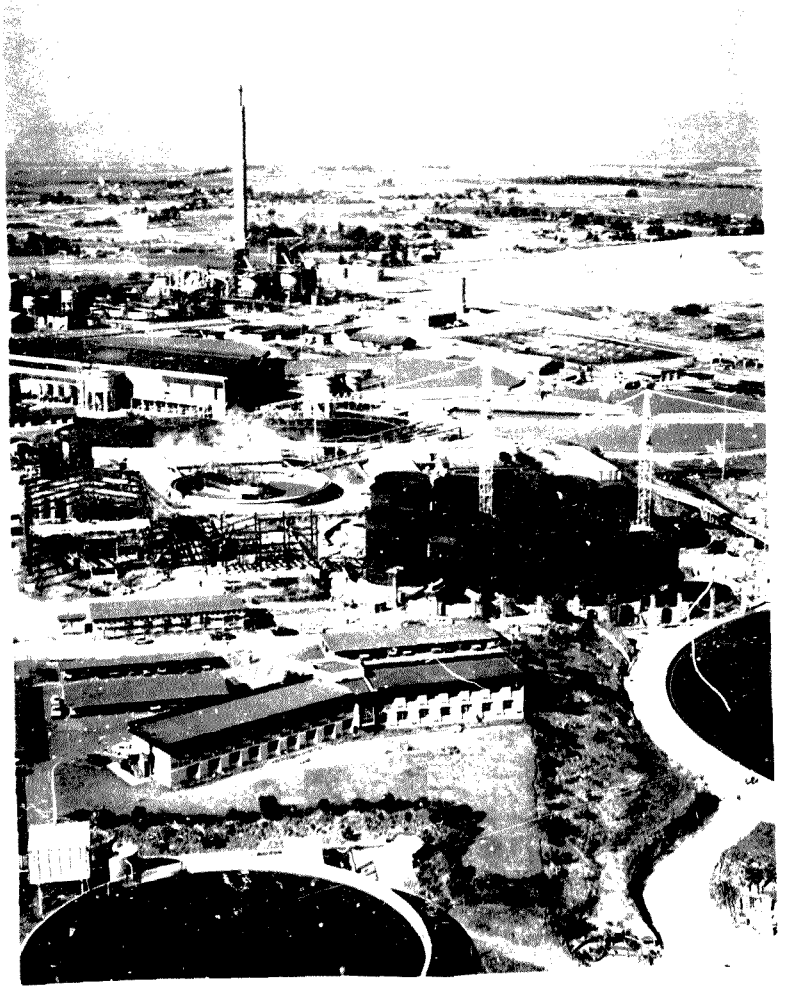


Figure 1.1 The Ergo Division plant in May 1984 with the carbon-in-leach plant being built in the foreground. The flotation plant stands between the thickeners with the gold, uranium and acid plants in the background.

often referred to as an unescalated exercise. These profits can be regarded in two different ways. Firstly, the profits can be regarded as being in current money terms. If this assumption is made, then the discount rate used should include an element both for inflation and for a real return. For example, if inflation is taken at 15 per cent and investors require a real return of 10 per cent, then the discount rate used to obtain the net present value of a project should be ((1,15)(1,10)-1)100=26,5 per cent. This a very conservative assumption and many reasonable projects are likely to be abandoned if it is used in decision making.

On the other hand, the profits can be regarded as being in constant money terms. The discount rate to be used in these circumstances is the rate of return required by investors, namely the 10 per cent used above. This is the assumption used in chapters 5, 6 and 7 where the economic evaluation of the Simmergo Division plant extension, the Ergo Division carbon-in-leach plant and the combined Daggafontein Division and Withok slimes dam reclamation project are presented respectively. Although no hard and fast rule exists, a real rate of 10 per cent is the hurdle rate generally accepted at AAC.

An alternative way of dealing with escalation is to escalate prices, operating costs and capital expenditure at the same or at different rates and to arrive at profits in escalated terms. The discount rate used in this instance should include an element for escalation. Unless all prices and costs are escalated at the same rate every year, it is not possible to determine the real rate of return from a project. If one wants to escalate prices and costs at different rates and to vary the rates from year to year, one should deflate the profits from current money to constant money each year. From these constant money profits one is able to determine the real rate of return. This method of dealing with escalation is used in chapter 9, where mutually exclusive alternatives for the Daggafontein Division and Withok slimes dam project are considered. It is also used in chapter 11, where the sensitivity analysis of this project is

presented. In chapter 12, however, where the financing of the projects is considered, the evaluation exercises were done in escalated terms as borrowings do not escalate but are repaid in inflated money.

In chapter 13, legal aspects of the establishment of the Erg and Daggafontein Divisions are discussed.

The methods used in the evaluation exercises which follow have been outlined in this introductory chapter. Alternative methods can be used in many aspects of an evaluation exercise, for example in dealing with escalation. Alternative methods have been used in this report to illustrate their use.

2. THE HISTORY OF AAC'S RECLAMATION OPERATIONS

Companies administered by AAC began reclaiming mine residue dumps over 30 years ago at the time of the first uranium boom. This followed the discovery of a variety of uraninite in gold bearing ore on the Witwatersrand in 1923 and the British and American governments' encouragement from 1945 onwards that the Union's gold mines become one of the world's major sources of fissionable material. Thus in the early 1950s seven companies in the Anglo American Group agreed with the Minister of Mines to produce uranium as a by-product of gold using a leaching process.

This process required large quantities of sulphuric acid and so, in order to produce the acid, slimes dams were limed and a pyrite concentrate was produced by flotation. The roasting process had the valuable side effect of concentrating the uranium contained in the reclaimed slimes to a level where it was economically recoverable and the roasting process improved the recovery of gold by liberating the small amount normally locked in the pyrite.

The second such operation to be established was at Daggafontein Mines Limited on the East Rand. From 1953 the old Main Reef Leader slimes dam, known today by the Chamber of Mines Code as 7L1, was reclaimed and combined with the current Main Reef Leader residue in the South flotation plant. These flotation residues were deposited on a new slimes dam, now referred to as 7L2. Daggafontein also started recovering the old Kimberley reef slimes dam, now known as 6L19, for its uranium content. A plan showing the location of these slimes dams appears on page 21.

Daggafontein ceased production and the company was de-registered in the late 1960s. East Daggafontein, a neighbouring mine administered by AAC, acquired Daggafontein's North plant in 1967 and with it slimes dams 6L18 and 6L19. East Dagga thus owned slimes dams 6L18, 6L19 and its own 6L20 by the time it ceased underground production in the mid-1970s.

Figure 2.1 The uranium plant built at Daggafontein Mines Limited in the 1950s.

By the early 1970s ownership of many dumps besides 7L2 had been abandoned. Section 161 of the Mining Rights Act of 1967 enabled one, however, to acquire the right to treat these dumps. In 1972 the price of gold was unpegged and it began the first of its cyclical up-swings. This was followed in 1974 by a very rapid rise in the price of uranium which in turn increased the demand for sulphuric acid. So by the mid-1970s, it was opportune for AAC to establish a major independent slimes reclamation operation.

Initially about 1000 test holes were drilled by AAC in several slimes dams on the Witwatersrand and the results justified a full-scale testing programme. In the meantime, metallurgists at the Anglo American Research Laboratories developed a flotation technique to produce a concentrate which contained sufficient gold and uranium to allow a conventional extraction process to be applied.

A pilot flotation plant, with a capacity of one ton an hour, was erected in 1974 and results confirmed the findings of the laboratory test work. Feasibility studies indicated, however, that flotation would have to be conducted on a very large scale to be viable. The plant would need to treat a minimum of one million tons of slime a month - four times the amount treated by the South flotation plant at Daggafontein.

This posed a crucial question as to what would be the best method of transporting the material. Also, should there be a very large single flotation plant or three seperate flotation plants established closer to the slimes dams destined for treatment? It was eventually concluded that the most economic method was to pump the slimes in slurry form by pipeline to a central processing plant.

The decision was taken to locate this plant south of Brakpan where the AAC administered company, South African Land & Estates (Sallies), owned property which was centrally located between many of the slimes dams and an 1100 hectare tailings dam site.

This minimised the distance from the high grade slimes dams but it left the plant remote from the slimes dams Ergo had acquired from Grootvlei and Marievale mines and those belonging to East Dagga.

The go-ahead to build the plant was given in January 1976 and commissioning began in October 1977. For the Ergo share offer made to the public in July 1977, applications totalling R286 million were received which was a record for a South African share issue. The shares offered to the public were subscribed for eighteen-and-a-half times. In November 1977 Ergo received the Rand Daily Mail's Business Achievement Award in recognition of its pioneering technical accomplishments and its outstanding contribution to the development of the South African economy.

While the Ergo plant was under construction, the gold price peaked and then declined steadily until the end of 1976. As a result, the underground operations of Sallies were curtailed. Towards the end of 1976 arrangements were made for Sallies to start treating material from the old Sub-Nigel mine's waste rock dump. The early results encouraged AAC to continue the arrangements and thus before the Ergo plant was commissioned, AAC again entered the waste re-treatment business by treating sand and rock at Sallies.

Contracts with additional suppliers were negotiated by Sallies and by early 1980, the plant throughput had been increased from 80 000 tons per month (tpm) to 111 000 tpm. This enabled Sallies to reduce its unit operating costs and to treat lower grade material. In the same year it was decided to extend the plant and by the end of 1981, the Sallies plant was treating 180 000 tpm.

While the Sallies plant was regularly exceeding its rated capacity, AAC struggled to get the Ergo plant to meet its production forecasts. The Financial Mail reported on September 28 1976 that 'Ergo has been plagued with any number of technical bothers, not to mention labour

problems, and production on all fronts, but particularly gold, has been well down on forecast - though uranium output has been up to the mark for some time now. The principal problem on the technical side would seem to have been a series of outwardly unrelated failures that cumulatively have seriously interrupted the flow of slurry from the slimes dams through to the various plants. As Ergo's MD puts it, the problem has been the stop-start nature of operations. You can't achieve planned recoveries in these circumstances'.

The article stated, however, that the year's targets could be met and the penultimate paragraph read 'So, all in all, it looks as if Ergo is finally on its way. Even if it never hits the original prospectus target on gold, few would argue that, on current prices and production, it is not a worthwhile venture and a leader in the new field of dump re-treatment'.

The concluding paragraph has proven to be prescient for it stated that 'there is every possibility that new projects may be instituted - for example, Ergo may decide to install additional plant and equipment to boost gold recoveries to originally anticipated levels'.

It was no secret that Ergo was considering additional methods of recovery. The General Manager stated in the 1979 annual report, published in May of that year, that ' further pilot tests were carried out to investigate the possible recovery of soluble gold from incoming feed by the addition of activated carbon and small quantities of cyanide to pulp followed by normal flotation. The results are being evaluated'.

By the time the following annual report was published in May 1980, Ergo was finally on its way. The gold and uranium production targets for the 1980 financial year had been met and the targets for the following year were increased 'to figures which are closer to the production levels which can be achieved with existing technology and plant capacity'. But the optimism abounding about future production

was not matched in the section of the annual report on research and development for it was stated that 'tests on the recovery of soluble gold by the addition of fine activated carbon indicated possible adverse side-effects on the main flotation process. Further testwork is necessary before a decision on the use of carbon can be made'.

Ergo's struggle to get its plant operating smoothly nevertheless did not deter it from evaluating potential additional reserves. In April 1979 Ergo acquired a right of first refusal over East Dagga's three slimes dams and an 18 month period in which to assess them. Ergo reported its findings in June 1980 but concluded that it was not in its interest to acquire the rights to treat East Dagga's slimes dams.

It was reported by the General Manager that 'the proposed treatment of the East Dagga dams was conceived at a time when uranium prices were reasonable, i.e. some four years ago. Since that date, both capital and working costs have increased dramatically whereas the selling price of uranium has decreased not only in real terms but also in actual terms'.

'The exercise assumed that Ergo would process the ore in a new plant using a leach-counter current decantation-solvent extraction route for uranium followed by flotation of the leach residue and subsequent cyanidation of the pyrite concentrate. Capital of R142 million would be required and, at a gold price of US$500/oz and maximum overall recovery of 35%, this would give a DCF of only 9%. A selling price of US$1000/oz would increase the DCF but it was still not acceptable at 14%. Therefore, at this stage, even using the most optimistic selling prices, the treatment of any of the East Dagga dams would not give reasonable returns'.

The report cautioned, however, that 'should the resin-in-pulp pilot plant currently in operation at Ergo prove successful this could well supercede the proposed leach-CCD-SX circuit'.

The view of the General Manager of Ergo that 'at this stage the tre.tment of the East Dagga dams would not give reasonable returns' w's indicative that he believed that the R & D being conducted at Ergo would ultimately make the re-treatment of the dams viable. It would, however, prove not to be the research aimed at improving uranium recoveries but the research aimed at gold recoveries that would ultimately provide the break-through.

Ergo's annual report for the year-ending March 1981, published in June of that year, recorded that the plant had come close to producing the 7 000 kg. of gold that were forecast for it in the prospectus. Furthermore, uranium production was well above the initial target but sulphuric acid output was down because of poor grades. Thus the plant could be said to be operating efficiently. A brief note on R & D stated that various methods for improving the overall recovery of gold were under active consideration and the more promising approaches were being evaluated.

In mid-1981, AAC acquired the right to mine the lease area and residues belonging to Simmer and Jack Mines Limited, situated on the Central Rand adjacent to the eastern boundary of Johannesburg. As the nature of the operations to be undertaken consisted, in large part, of the extraction of gold from the existing surface materials, it was considered appropriate for Ergo to exploit the surface and shallow underground rights.

Ergo undertook to establish an 150 000 tpm plant employing the flotation process, with which it was familiar, and the carbon-in-pulp process on which it had been doing test work for a number of years. Construction of the Simmergo Division plant began in late 1981.

Sometime between September 1980 and November 1981, control of the major shareholding in East Dagga was acquired by Mr A.H. Lundin, a Geneva-based Swedish entreprenet with a strong bent for mineral resources, particularly petroleum.

In the latter half of 1981, Mr Lundin recommended to AAC, the technical advisers to East Dagga, that East Dagga join other companies, in which Mr Lundin had an interest, in two oil concessions in the Gulf of Suez. AAC was reluctant to make such a recommendation. Mr Lundin responded by suggesting that AAC relinquish control of the company to allow the group represented by himself to assume responsibility. AAC agreed to this and the reconstitution of the board of directors of East Dagga was publicly announced on 28 April 1982.

In this chapter I have recounted AAC's dump reclamation activities for the three decades prior to 1982. AAC achieved considerable success with its reclamation projects but it was twice thwarted by collapses in the demand for uranium. These sudden changes in fortune highlighted the marginal nature of reclamation operations. This encouraged AAC to reduce its dependence on external factors such as demand and price by improving recoveries. Research and development projects were initiated to improve both gold and uranium recoveries. Before the results of this research could be used to establish another Ergo operation on the Far East Rand, the control of East Dagga was relinquished by AAC.

3. CARBON-IN-LEACH - A NEW METALLURGICAL PROCESS FOR ERGO

When I joined the AAC Gold Division in April 1982, AAC was operating two reclamation operations on the East Rand, namely Ergo and Sallies, and work was in progress on Ergo's Simmergo Division plant. AAC had, however, relinquished control of East Dagga and thus it seemed that the once-mooted plans to establish an operation on the Far East Rand to treat the East Dagga, Grootvlei and Marievale slimes dams would not materialise.

This likelihood appeared more certain when East Dagga acquired slimes dams 7L2 and 5L26. Finance Week stated on September 9 1982 that East Dagga planned to pay R1,2 million in cash and one million new East Dagga shares, worth about R1,4 million, to Egoli Consolidated Mines Ltd. AAC had considered treating slimes dam 7L2 by means of a cyanidation leach and carbon-in-pulp extraction but the expenditure on the operating and capital costs was not justified in the light of the ruling gold price.

East Dagga on the other hand had an economy of scale advantage as it already had three slimes dams adjacent to 7L2. East Dagga's technical adviser stated in a report dated June 1982 that 'the close proximity of the Egoli Dagga dam (7L2) to East Dagga's existing dams makes a reserve in one location which could justify the erection of a plant. A direct leach and carbon-in-pulp process treating large tonnages could be a viable enterprise. Substantial metallurgical test work and a feasibility study will have to be undertaken to determine the optimal metallurgical process. The purchase price of 4 cents per ton for the slimes is in my opinion justified. The Modder B dam (5L26) must be considered a marginal propostion - a calculated business risk based on the future gold price'.

This view was conveyed by East Dagga to AAC in the week that Ergo began test work which would reward East Dagga's venture of faith in acquiring slimes dams 7L2 and 5L26. On 9 August 1982, the General Manager of Ergo reported that 'results from the recent pilot plant

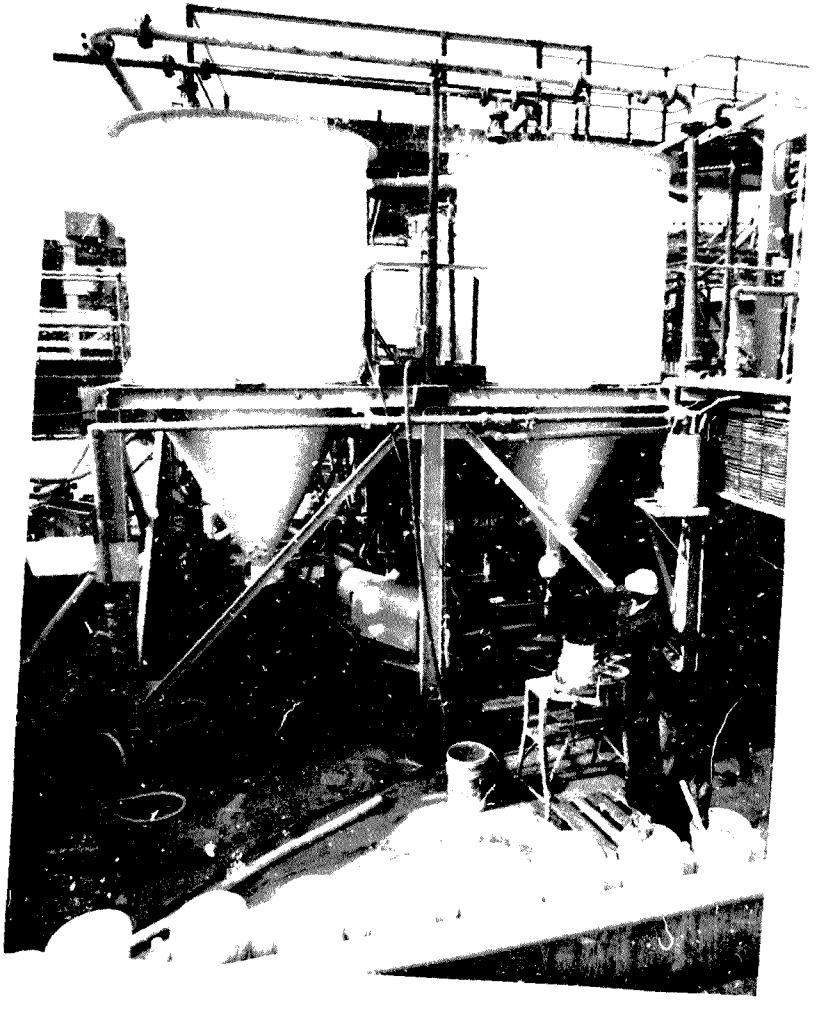


Figure 3.1 The pilot plant at the Ergo Division where research into the carbon-in-leach process was conducted.

test work have indicated that the operation of a carbon-in-leach process, as opposed to the orthodox carbon-in-pulp plant, i.e. cyanide leach followed by carbon adsorption, is technically feasible and results in lower capital and operating costs than that previously estimated for the carbon-in-pulp circuit. From 3 June 1982, carbon-in-leach was run in parallel with carbon-in-pulp. With the subsequent lowering of the cyanide addition, recoveries equivalent to the carbon-in-pulp process are now being obtained. Since the reduction of the cyanide addition has such a large influence on the overall operating costs, a re-evaluation of the process is being undertaken. If the project were to proceed it would be desirable to build a new tailings dam so that the existing dam would not be diluted by the lower gold content tailings to be produced'.

Thus on that day, the idea was put forward of erecting a carbon-in-leach plant at Ergo to treat the flotation tailings and also of re-treating the Ergo tailings dam. The carbon-in-leach process would in time be adopted for the treatment of East Dagga's slimes dams.

During the latter half of 1982, Ergo continued its test work to lower the cyanide addition in the carbon-in-leach process as it had critical cost and pollution implications. It was recognised, however, that all the work had been done on current tailings and 'test work is therefore still required on all dams so that the estimated recoveries of each individual dam can be used in the detailed analysis'. Actual laboratory leach recoveries were obtained from drill core samples by 24 January 1983.

On the same day it was agreed that the detailed design of the carbon-in-leach plant at the Ergo Division should proceed and that the project should be considered by the Ergo board at its next meeting.

It can be seen from the events described in this chapter that 1982 was an important year for both Ergo and East Dagga. Years of research finally paid off for Ergo with the development of the carbon-in-leach process. East Dagga, on the other hand, consolidated its position on the Far East Rand by acquiring slimes dam 7L2.

4. THE ORIGINS OF ERGO'S DAGGAFONTEIN DIVISION

In December 1982 East Dagga proposed to Ergo that its slimes dams be treated through the same plant as those belonging to Ergo on the Far East Rand. Ergo undertook to consider the proposal and to reply by the end of February 1983.

It was clear that East Dagga's shareholders were keen to continue benefiting from AAC's technical expertise. They let it be known, however, that they were willing to raise new capital to finance the proposed project.

For Ergo the proposal made sense, as the slimes dams on the Far East Rand to which it had the rights were of low grade and it was thus unable to justify the erection of a plant. With the higher grade East Dagga dams covering the construction cost of a plant, however, these low grade dams could be economically treated.

Ergo was well placed to respond to East Dagga's proposal as the tonnages and grades of all the dams on the Far East Rand were known. Consideration was given to treating the slimes dams Ergo had the right to acquire from Grootvlei (6L16 and 6L17) and from Marievale (7L5, 7L6 and 7L7), the slimes dam it had acquired from East Geduld (6L14) and the slimes dam Ergo had created from its tailings - the Withok slimes dam. Also considered was the East Geduld slimes dam (6L13) which Ergo had endeavoured to acquire many years earlier. It had been prevented from doing so as Impala Platinum deposited its refinery effluent on this slimes dam. All of these slimes dams, except for Withok, were created by mines administered by Union Corporation.

In the preliminary evaluation, two alternative metallurgical processes were compared, namely carbon-in-leach to recover gold only (Case A) and flotation for uranium, acid and gold recovery followed by

Table 4.1 A schedule of Ergo's reserves showing the estimated tonnages and grades as at March 31 1985

Chamber of Mines code	Dam	Tons millions	Gold g/t	Uranium kg/t	Sulphur %
Ergo Division Reserves:					
5L10	*Brakpan 1	26,0	0,68	0,040	1,21
6L1	*Modderfontein East	28,1	0,56	0,033	0,90
5L27	*GGMA 1	23,9	0,55	0,031	0,94
5L28	GGMA 2	15,6	0,46	0,053	0,76
6L3	GGMA 3	13,6	0,41	0,051	0,66
5L31	*S A Lands 1	32,5	0,40	0,055	1,19
5L32	S A Lands 2	18,5	0,33	0,037	0,93
6L12	Geduld 1	26,0	0,59	0,027	0,96
5L26	Modder B	23,1	0,40	0,014	0,55
5L1	New Kleinfontein 1	13,3	0,33	0,025	0,82
5L2	New Kleinfontein 2	3,3	0,31	0,025	1,07
5L3	New Kleinfontein 3	5,3	0,31	0,021	0,83
5L4	New Kleinfontein 4	12,2	0,38	0,015	0,67
5L5	New Kleinfontein 5	2,6	0,27	0,023	0,79
5L6/7	New Kleinfontein 6/7	9,4	0,30	0,021	0,87
5L29	Van Dyk	22,5	0,24	0,051	0,86
—	†Withok	124,9	0,39	0,039	0,19
5A2	Brakpan sand	14,2	0,82	0,023	0,80
‡Simmergo Division Reserves:					
—	Sand Dumps	18,8	0,87	—	0,84
†Daggafontein Division Reserves:					
7L	Daggafontein	39,3	0,53	0,042	0,23
6L	Daggafontein	24,7	0,51	0,071	0,61
6L19	Daggafontein	17,1	0,39	0,102	0,51
6L20	East Daggafontein	27,6	0,46	0,057	0,40
6L16	Grootvlei 1	43,3	0,24	0,065	0,74
6L17	Grootvlei 2	37,5	0,23	0,068	0,76
6L13	East Geduld 1	46,9	0,38	0,046	0,80
6L14	East Geduld 2	8,5	0,32	0,042	0,70
7L7	Marievale 1	24,1	0,28	0,073	0,63
7L6	Marievale 2	11,2	0,25	0,083	0,48
7L5	Marievale 3	6,6	0,26	0,111	0,43

*Dams currently being monitored
‡Dumps owned by Simmer and Jack Mines Limited
†Dams owned by Dumpco Limited

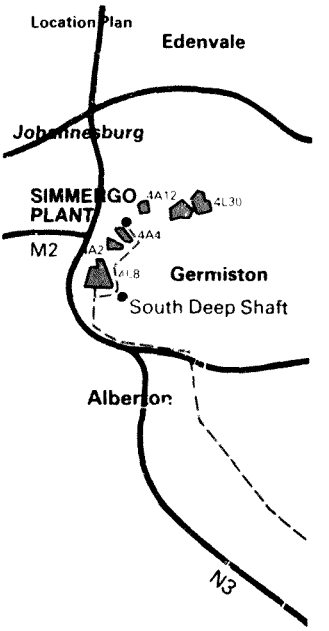
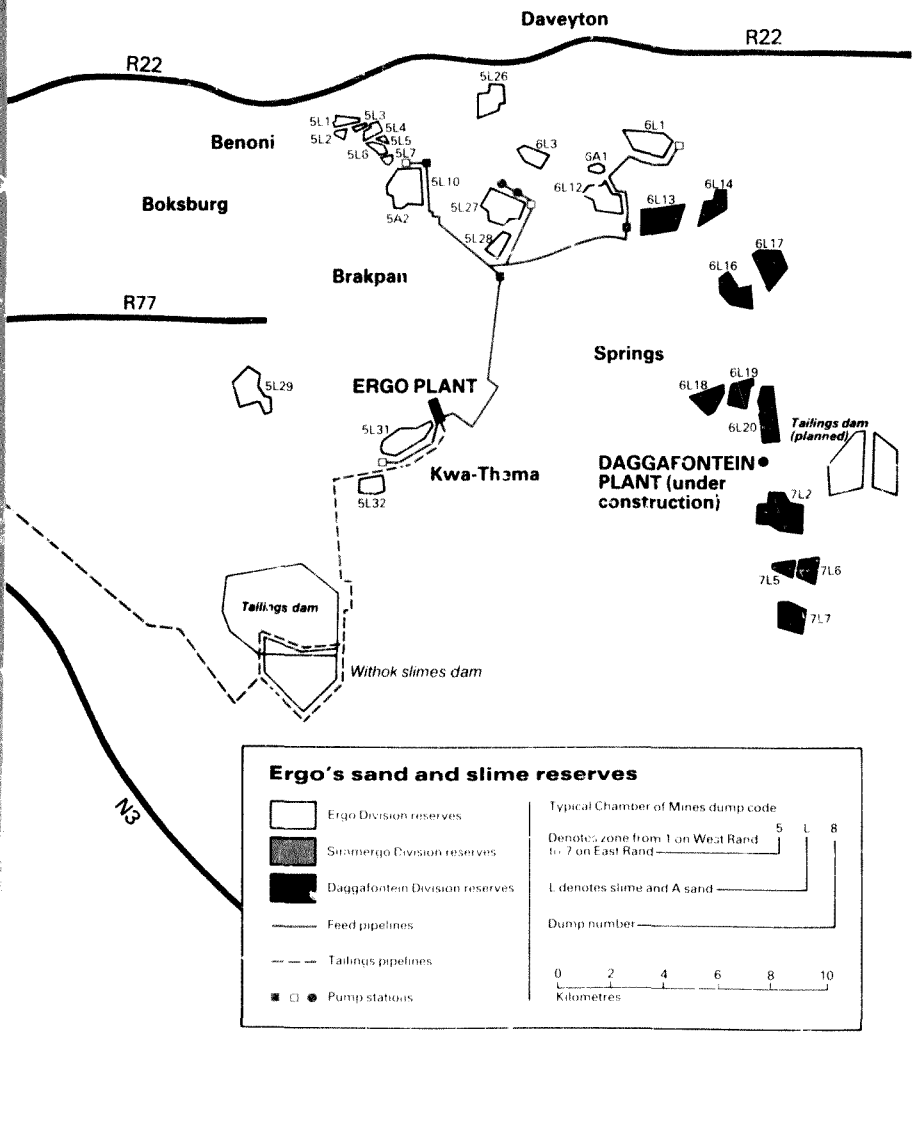


Figure 4.1 A plan showing the location of Ergo's reserves and plants.


Daveyton
R22
R22
5L26
5L1
5L2
5L3
5L4
5L5
5L6
5L7
Benoni
6L3
6L1
3A1
6L12
6L13
6L14
5L10
5A2
5L27
5L28
Boksburg
Brakpan
6L16
6L17
R77
Springs
6L18
6L19
6L20
Tailings dam (planned)
5L29
ERGO PLANT
5L31
Kwa-Thema
5L32
DAGGAFONTEIN PLANT (under construction)
7L2
7L5
7L6
7L7
Tailings dam
Withok slimes dam
N3
Ergo's sand and slime reserves
Ergo Division reserves
Sharpergo Division reserves
Daggafontein Division reserves
Feed pipelines
Tailings pipelines
Pump stations
Typical Chamber of Mines dump code
Denotes zone from 1 on West Rand to 7 on East Rand
5 L 8
L denotes slime and A sand
Dump number
0 2 4 6 8 10
Kilometres

carbon-in-leach to recover a small quantity of additional gold (Case B). For each case the treatment rate was set at 800 000 tons a month as this was the size of one module of the proposed carbon-in-leach plant at the Ergo Division. The financial evaluation indicated that the higher grade dams were more profitable when treated solely by carbon-in-leach while the lower grade dams were better when treated by flotation and carbon-in-leach.

Because the material in slimes dam 7L2 and the Withok slimes dam had already been treated by flotation, consideration was also given to erecting a carbon-in-leach plant at the Withok slimes dam to treat both of these dams (Case C). This alternative entailed the pumping of slimes dam 7L2 over a considerable distance and thus thought was also given to treating solely the Withok slimes dam through this plant (Case D). If Case C were chosen, the plan would then be to install an 800 000 tpm flotation plant at Daggafontein to treat the remaining slimes dams, producing a flotation concentrate for treatment at Ergo (Case E).

On February 21 1983, the Consulting Metallurgist to Ergo reported that treatment of previously floated residues in a single carbon-in-leach plant and flotation of the remaining residues had the advantages of increasing the net present value of the project. As a result exercises A & B should be disregarded and only cases C, D & E investigated further.

He cautioned, however, that although Case E was significantly more attractive than cases A & B, the Ergo plant would have to be expanded to accept the additional pyrite concentrate. A large proportion of the profitability depended on revenue from acid and uranium.

A report by the Senior Divisional Metallurgist for the East Rand also cautioned that in view of the limited information relating to the metallurgical characteristics of the materials in question, it was advisable that a programme of test work be scheduled to confirm the provisional estimates for gold recovery and reagent requirements.

The report continued to state that although there was a strong indication that the most attractive route for treatment of dumps other than 7L2, was by flotation, there was a need to confirm flotation and carbon-in-leach recoveries of these materials, and it was recommended that representative samples be collected from the dumps for laboratory test work. further consideration affecting the project, would be the timing of a plant to treat these materials, since for many of the dumps, combined revenue from uranium and acid production exceeded that for gold. In view of the depressed condition of the uranium market, it appeared prudent to postpone a decision on these dumps until better information on their treatment characteristics was available.

In spite of its caution, this report expressed an important philosophy which was to endure. The report stated:

'Although a number of treatment alternatives have been considered, the preferred approach takes cognisance of the following:

- The historical origin of slimes dam 7L2 renders it metallurgically different from the other sources of slimes. The dump has a relatively high gold content, and a low sulphur and uranium content. The preferred method of treatment entails direct recovery of gold by the carbon-in-leach process.

- Uranium and sulphur recoveries make a significant contribution to the revenue potential of all dumps other than 7L2. Although the grades of the different slimes dams vary considerably and although uranium recoveries are generally low, it is clear that a flotation treatment route producing a pyrite concentrate for treatment at Ergo considerably enhances the profitability of dump materials, due to the fact that this route provides low cost uranium, revenue from acid and enhanced gold production from calcine.'

These findings were presented to representatives of East Dagga and this led to a follow-up report by the Consulting Metallurgist on February 23 1984 which discussed the results of three additional cases (Cases F, G & H).

The three cases examined were as follows:

- construction of a carbon-in-leach plant at the Withok slimes dam to treat all payable slimes sources (Case F);

- the same plant to treat slimes dams 7L2 and Withok (Case G); and

- construction of a flotation plant at Daggafontein to treat all slimes sources other than slimes dams 7L2 and Withok (Case H).

These three cases constituted what were considered to be the three possible ways in which Ergo and East Dagga could collaborate to recover gold and other values from slimes dam materials.

The results of the follow-up report were presented to East Dagga representatives on February 28 1983. These results were compared with those obtained by East Dagga and it was evident that East Dagga would be better off treating its slimes dams through the same plants as Ergo's, as both companies required two separate processes for materials of different nature.

Ergo and East Dagga entered into an agreement on March 4 1983 which was announced in the press by Ergo on March 9 1983 as follows:

'Part of the original programme for treatment of Ergo's slimes dams envisaged the erection of a separate plant on the Far East Rand to treat the dams in that area, none of which were scheduled to be treated in Ergo's main treatment plant. As these dams are relatively rich in uranium and sulphur, Ergo deferred their exploitation until the uranium market improved.

Recently, East Daggafontein Mines Limited (East Dagga) have informed Ergo that they are considering the erection of a 500 000 tons a month plant to treat their slimes reserves for the recovery of gold. East Dagga's reserves on the Far East Rand are three slimes dams deposited by them and Daggafontein Mines Limited and one they acquired from Egoli Consolidated Mines Limited in mid-1982. The latter slimes dam, which has a relatively high gold content but low uranium and sulphur content, would play an important part in any slimes treatment project.

It has been suggested that a joint undertaking, involving the pooling of certain slimes reserves, might be of benefit to both companies. Because the Ergo dams being considered for the pooling arrangement were not scheduled to be treated through the existing Ergo plant, the proposed scheme will not shorten the life of the current operation.

The result of the pooling arrangement would be the establishment of a combined reserve of approximately 450 million tons of slimes initially which would support the erection of a carbon-in-leach plant and at a later date a flotation plant, both for the joint undertaking. Each of these plants would have a capacity of approximately 800 000 tons of slime a month. The carbon-in-leach plant would only recover gold whereas the flotation plant would involve the production of gold, uranium and sulphuric acid. The viability and the timing of the erection of the flotation plant would depend upon the ability to market the uranium and acid at acceptable prices.

It has been agreed that Ergo will conduct test work over the next four months on its own and East Dagga's slimes dams, in order to assess the overall viability of the scheme. Preliminary theoretical exercises have indicated that this company's participation in the proposed project would be approximately 50 per cent. However, the extent of each company's participation will be finally determined when the studies have been completed and the viability established'.

Brendan Ryan of the Daily Mail commented that 'this was a development which would benefit a number of companies. The life of the Ergo operation would be considerably extended and East Dagga would turn to account slimes reserves at a fraction of the cost if they had to go ahead with the scheme themselves. The company which would actually treat the dumps was the one best able to do so as Ergo pioneered the concept'.

The investigations of Ergo's metallurgists described in this chapter indicated that it would be beneficial for Ergo and East Dagga to co-operate in treating their slimes reserves as each company required both the carbon-in-leach and the flotation process to treat its reserves. An economic evaluation confirmed that both parties would be better off if their slimes were treated through the same plant.

5. THE ECONOMIC EVALUATION OF THE SIMMERGO DIVISION PLANT EXTENSION

During the latter half of 1982 and the first half of 1983, Ergo gave consideration not only to carbon-in-leach plants at its Ergo and Daggafontein Divisions but it also considered the extension of its Simmergo Division plant and ore reserves. In terms of the agreement with Simmer and Jack, Ergo was entitled to extend its Simmergo Division plant to treat material other than that emanating from the Simmer and Jack lease area.

In 1981, AAC acquired certain rights to two sand dumps on the Central Rand. Further material was needed, however, to justify the extension of the plant and thus from mid-1982 I worked on acquiring further sand dumps on the Central Rand.

The two sand dumps to which AAC had already acquired certain rights were the Ferreira Deep sand dump (3A13A), on which the Top Star drive-in currently stands, and the Driefontein sand dump (4A6). The first dump had been accurately sampled and assayed and thus its tonnage and grade were known. The latter dump had not been surveyed and sampled and so it was necessary to undertake this exercise. Eight other sand dumps were identified as potential sources of material and surveys of them were also ordered.

While this geological and surveying work was being done, I initiated negotiations to acquire the sand dumps which were potential sources of material for the Simmergo Division plant extension. I discovered, however, that the right to remove and treat sand dumps on the Central Rand was a hotly contested issue with mining companies both big and small involved.

The Wolhuter sand dump (3A16) was offered to AAC by a party claiming to have acquired the rights from Wolhuter Estates, which was the successor-in-title of the company which had created the dump. By virtue of the fact that certain claims originally owned by the creator of the dump were still in its possession, Wolhuter Estates claimed the right to remove and treat the dump in terms of Section 161 (4) of the Mining Rights Act of 1967. This claim was disputed, however, by

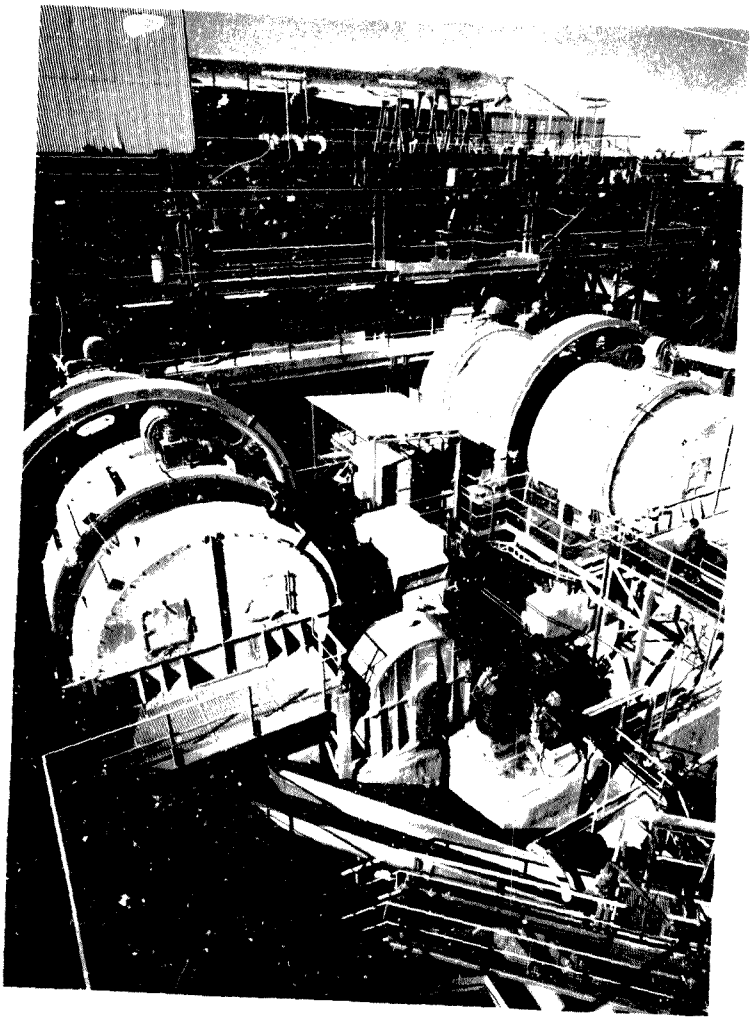


Figure 5.1 The Simmergo Division plant as it appeared soon after commissioning in March 1983. The milling section is shown in the foreground with the partly reclaimed sand dump in the background.

Village Main gold mine which operates a dump reclamation plant nearby on the Central Rand. A number of years earlier, Village Main had apparently been advised by the Mining Commissioner that title to the Wolhuter sand dump belonged to it and it had extended its plant as a result. The title offered to AAC was inadequate and thus AAC withdrew. Village Main and Wolhuter Estates subsequently reached agreement on the treatment of the dump and Village Main began reclaiming it early in 1985.

The rights to the Glencairn sand dump (4A16) were also offered to AAC but it too was legally encumbered. The Glencairn company acquired the right to mine the dump by way of tribute from Waverley Gold Mine but a dispute arose and the matter was argued before the Supreme Court. The court ruled in favour of Glencairn but counsel was of the opinion that the tributor, Glencairn, could not remove the material from the site and treat it elsewhere. AAC negotiated to pay a lump sum to Waverley for the royalty and the right to remove the dump but the offer to sell was withdrawn by the vendors of the Glencairn tribute. In early 1984, Waverley bought the Glencairn company and is now treats the dump by sending it to Sallies and by heap leaching it.

Tenders for the removal and treatment of the Croesus sand dump (3A2) were called for by the Johannesburg City Council in late 1982. AAC's assay results showed that the dump had a very low grade which made treatment uneconomical at the Simmergo Division plant. The dump stands not far from Rand Mines Properties (RMP) sand reclamation plant at Crown Mines and RMP bid successfully to treat the dump in exchange for a royalty.

Despite these setbacks, interest in extending the Simmergo Division plant remained high. Negotiations for the Primrose (4A15), Benrose (-), Rietfontein (-), Nourse (3A19) and Wemmer (3L27) dumps were in progress and it appeared that together with the dumps which AAC had already acquired, a 100 000 tpm extension could be justified. The extension had been set at this size as an additional mill would add this capacity and the remainder of the plant could be easily modified to accommodate the additional throughput.

On the basis of the survey and assay results and a preliminary design of the plant extension, the following economic evaluation was done in January 1983. The expected return on the project to Ergo was calculated from the following estimates and assumptions:

Life of Operation:	23,3 million tons at 100 000 tpm giving an 18,6 year life from 1986 to 2005.
Recovered Grade:	0,74 grams per ton declining to 0,45 grams per ton with the average being 0,51 grams per ton.
Operating Cost:	R4,35 per ton in April 1983 money terms for treatment plus transport averaging R1,90 per ton.
Gold Price:	R15 182 per kilogram.
Capital:	R19,62 million in April 1983 money terms.
Royalty:	50% royalty payable to dump owners.

The results of the economic evaluation exercise, which was carried out on an unescalated basis, are shown below in Table 5.1 .

Table 5.1. The expected return to Ergo from an extension to the Simmergo Division plant in constant April 1983 money terms.

Initial Investment in April 1983 money	R19,6 million
After-tax cost of initial investment	R 6,1 million
Net cash flow	R 9,2 million
NPV 10%	R 1,2 million
DCF yield (real terms)	14,0 per cent
Break-even gold price	R12,5 per gram
Payback from April 1983	7,0 years
Start construction	1983
End reclamation	2005

The economic evaluation showed that the project satisfied the criterion of a DCF yield (real terms) in excess of 10 per cent. For an investment of R6,1 million, it was expected that the Ergo shareholders would receive a net cash flow of R9,2 million in constant April 1983 money terms.

Thus, early in 1983, Ergo's management had the extension of the Simmergo plant to consider along with the proposed Ergo Division carbon-in-leach plant and Daggafontein Division plants.

6. THE ECONOMIC EVALUATION OF THE ERGO DIVISION CARBON-IN-LEACH PLANT

Detailed design work on the proposed carbon-in-leach at the Ergo Division was completed in mid-1983. The design showed that it would be feasible to erect a 1,85 million tpm carbon-in-leach plant, adjacent to the flotation plant, to treat the flotation plant tailings.

The technical advisers report by AAC dated February 22 1984, which was circulated to Ergo shareholders, explained that the thickened flotation tailings would be pumped to de-sanding screens. The screen undersize would be pumped to the first stage of carbon-in-leach, where lime and cyanide would be added. The carbon-in-leach adsorption would take place in two parallel streams, each comprising four mechanically-agitated adsorpotion tanks. Gold would be leached from the solids in these tanks and adsorbed on the activated carbon present in the pulp. Cyanide destruction would take place in a further seven stages of adsorption tanks. The adsorbed gold would be subsequently stripped from the loaded carbon, using a high-temperature elution sequence, and the eluate would be pumped into the existing gold plant for gold recovery.

In the quarterly press announcement made by Ergo in July 1983, it was revealed that the estimated cost of the plant was R52 million in April 1983 money terms. It was subsequently stated in the abovementioned technical advisers report that the operating cost was anticipated to be R1,00 a ton in April 1984 money terms (escalated from R0,90 in April 1983 money terms). This operating cost was relatively low as the carbon-in-leach plant was to be an addition to an existing plant and hence no additional reclamation, deposition or administration costs were to be incurred. The average recovered grade over the life of the project was given as 0,10 grams per ton and hence the break-even gold price required to cover capital and operating costs was calculated to be about R10 000/kg.

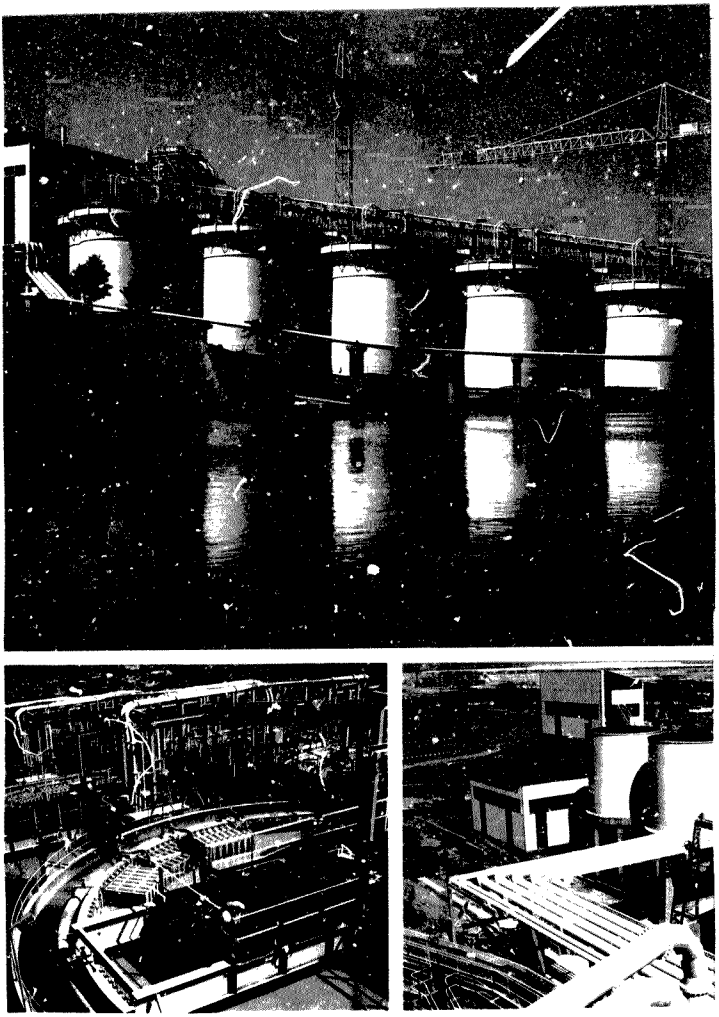


Figure 6.1 The Ergo Division carbon-in-leach plant in February 1985. The leaching and carbon contact tanks are shown in the upper and lower left pictures. The carbon elution building is on the left in the upper picture and the carbon-handling plant is featured at lower right.

These inputs, which are summarised below, were used to calculate the return on the project:

Life of operation:	412,9 million tons at 1,85 million tons per month gives an 18,6 year life from 1984 to 2002.
Recovered grade:	0,12 grams per ton declining to 0,08 grams per ton gives an average recovered grade of 0,10 grams per ton.
Operating costs:	R0,90 per ton in April 1983 money terms.
Gold price:	R15 000 per kilogram.
Capital:	R52 million in April 1983 money terms.

Calculating the return on the project on an unescalated basis, the following return to Ergo was obtained.

Table 6.1 The expected return to Ergo from the Ergo Division carbon-in-leach plant in constant April 1983 money terms.

Initial investment in April 1983 money	R52,0 million
After-tax cost of the initial investment	R16,1 million
Net cash flow	R78,2 million
NPV 10%	R28,0 million
DCF yield (real terms)	32,4 per cent
Break-even gold price	R10,0 per gram
Payback from April 1983	3,9 years
Start construction	1984
End reclamation	2001

The cash flow projection from which these results are drawn is attached as Appendix A. A graphical depiction of the return is shown overleaf.

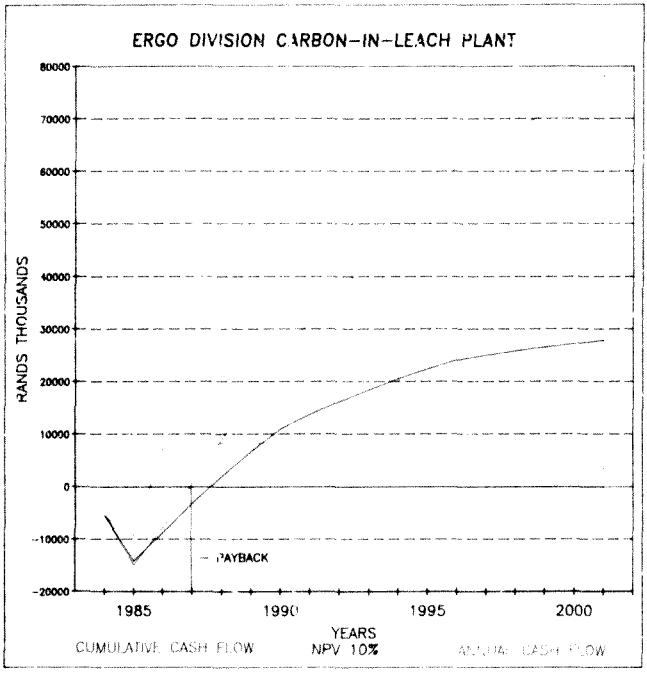


Figure 6.2 The cash flow diagram in April 1983 money terms for the Ergo Division carbon-in-leach plant.

The economic evaluation of the Ergo Division carbon-in-leach plant showed that this was an attractive investment. For an unescalated initial outlay of R16,1 million, the Ergo shareholders would receive a net cash flow of R78,2 million in April 1983 money terms. The DCF yield was well in excess of the 10 per cent hurdle rate required in a constant money exercise. The break-even gold price was calculated to be R10 000/kg. which was well below the prevailing price of R15 000/kg. The project offered a very short pay back period which meant that the initial investment would be repaid to shareholders or be available for re-investment very quickly. It therefore appeared that the research efforts into carbon-in-leach technology were to be richly rewarded.

7. THE ECONOMIC EVALUATION OF THE DAGGAFONTEIN AND WITHOK PROJECTS

The period of four months up to the end of June 1983 which Ergo had requested from East Dagga to conduct test work on the slimes dams and to assess the overall viability of the East Dagga proposal culminated in the presentation of a feasibility study to the AAC Executive Committee on June 28 1983.

In the feasibility study the Consulting Metallurgist reported that a six week campaign on the Ergo pilot plant, and an intensive programme of laboratory test work carried out by the Anglo American Research Laboratory (AARL), had provided information on the cyanide leaching and flotation characteristics of the various slimes dams.

The test work programme had three main thrusts:

- Cyanidation and carbon-in-pulp test work was carried out on a bulk sample of material from slimes dam 7L2. The metallurgical test results were consistent and it was possible to predict a mean residue equal to 0,26 g/t. The change from a 4-hour carbon-in-leach operation to an 8-hour cyanidation and carbon-in-pulp operation appeared to have little influence on gold recovery. The increase in cyanide addition had a significant effect on recovery but the trade-off between increased cyanide addition and improved recovery would need to be quantified during actual operations.

- Cyanidation and carbon-in-pulp test work was also carried out on blended samples of material collected from boreholes in the slimes dams. Care was taken to prepare composites approximating to the survey grades of the dumps. The results gave no clear indication regarding the merits of carbon-in-leach versus direct cyanidation, and it appeared that either route would be appropriate. It was shown, as expected, that recoveries were

strongly influenced by head grade and it was established that a significant correlation existed between head grade and recovery.

The laboratory results for the slimes dam 7L2 material showed that a residue of approximately 0,23 g/t was obtained. This was similar to the residue of 0,24 g/t achieved on the pilot plant when operating at a similar level of cyanidation. This agreement indicated that the laboratory work provided an acceptable measure of the performance achievable on a continuous plant.

- Flotation test work was carried out at AARL on the same composite samples. The test work indicated flotation recoveries which were significantly lower than those used in the preliminary study, which were taken from the test work done for the original Ergo plant. The reason for the difference was largely due to the fact that, in the earlier work, unrealistically high concentrate masses were recovered, resulting in an unacceptable debasement of the sulphur grade. The recoveries obtained in the later test work, which were constrained by the need to produce a roaster grade sulphide concentrate, presented a more realistic estimate of likely flotation behaviour on a plant scale. The small sample size nevertheless warranted further test work.

The following section of the Consulting Metallurgist's report was on process selection and he opened by stating that the preliminary study demonstrated that a two-stage metallurgical treatment process could not cover associated operating costs. For this reason, the approach followed was to identify for each slimes source its likely contribution when treated either by carbon-in-leach or flotation.

The results showed that should a single treatment route be selected, then carbon-in-leach should be that route. This would exclude, however, some of the slimes sources. Slimes dam 7L2 and the Withok slimes dam could be treated only by carbon-in-leach as they had previously been floated. Slimes dams 6L18 and 6L20 would be best treated by carbon-in-leach, while 6L13 could be treated by either route with little effect on overall profitability. The remaining slimes dams would have to rely on flotation to provide a viable treatment route.

It was logical to group the dams into the preferred treatment routes. In treating dams by their preferred recovery route, it was possible to increase the overall contribution by 28 per cent compared with any single treatment option. Furthermore, as the higher gold grade dams were of particular attraction during the earlier years of the project, consideration could be given to the introduction of improved recovery methods if the uranium market improved in the future.

Having established the advisability of separate carbon-in-leach and flotation treatment, consideration was then given to accommodating these requirements in an overall project plan. The geographical location of the slimes dams, the potential plant and tailings dam sites, production constraints such as pyrite treatment capacity at the Ergo plant and the sales forecasts for uranium and acid were taken into account.

The initial approach followed in the preliminary study was to schedule slimes dam 7L2 and the Withok slimes dam for treatment in a carbon-in-leach plant to be sited at Withok. A more detailed evaluation of this proposal resulted in its rejection as the cost of the slimes and return water pipelines between slimes dams 7L2 and Withok was out of proportion with other project costs. Furthermore, the metallurgical test work showed that slimes dams 6L18 and 6L20 required carbon-in-leach treatment and this added weight to the argument that the plant should be sited in the Daggafontein area, closer to the monitoring sites.

It was thus proposed that a carbon-in-leach plant be built at Daggafontein to treat those dams for which carbon-in-leach treatment was indicated, except the Withok slimes dam. Once these dams were reclaimed, or at any time that the flotation process became more attractive, the proposal was to convert the carbon-in-leach plant to a flotation plant and to treat the remaining dams by a process of flotation.

The advantages of this proposal were cited by the Consulting Metallurgist to be as follows:

- the siting of the plant and tailings dam close to the initial monitoring sites would reduce the initial capital outlay;
- there was no spare capacity in the Ergo plant for the treatment of pyrite until about 1999, which made it logical to bring the flotation plant on line at about that time; and
- the sharing of facilities would permit a substantial degree of economy in capital expenditure.

It was further proposed that a carbon-in-leach plant be established at Withok to recover the material in the Withok slimes dam.

For the purpose of costing in the feasibility study, it was assumed that the first carbon-in-leach plant would be erected at Daggafontein to accept 800 000 tons a month of reclaimed slime. Conventional Ergo monitoring practice would be followed and slimes dam 7L2 would be reclaimed first. Monitoring would proceed in five phases, linked to geographical location.

The monitored slimes would be thickened to a density of 1,48 in two 137m. diameter thickeners and the thickened product would be pumped into a degritting tank ahead of the carbon-in-leach circuit. The screened slurry would pass to the first of six 2000m^3 agitator tanks, which together would provide an 8-hour residue time.

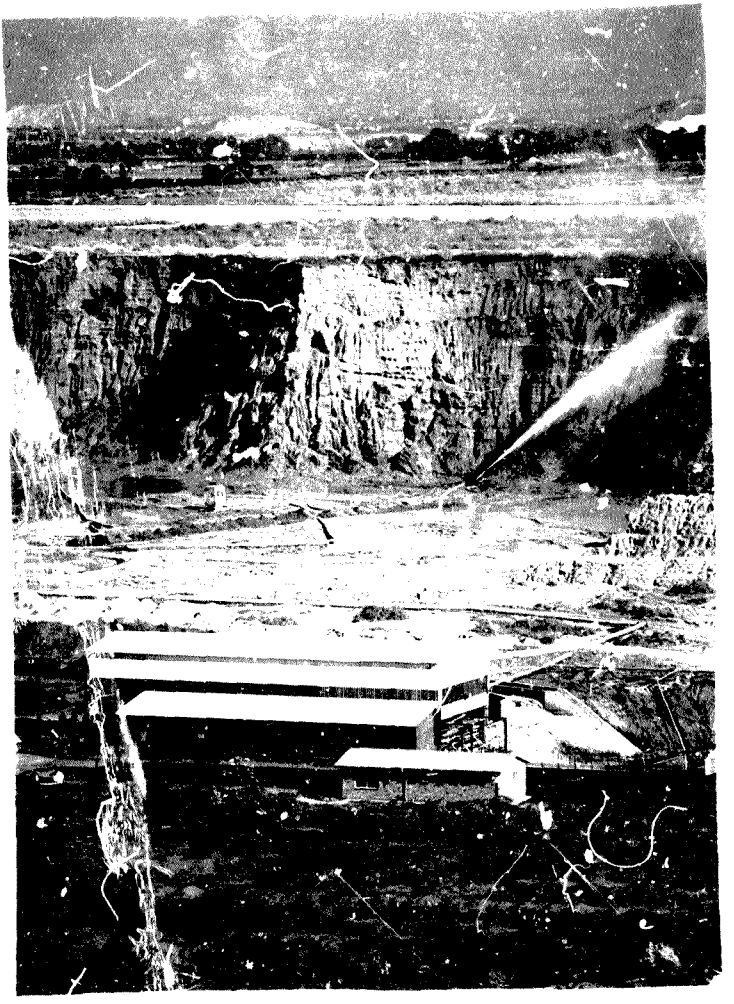


Figure 7.1 Conventional Ergo monitoring practice is demonstrated here at slimes dam 6L1. The high-pressure water monitors the slimes which are pumped from the pump station in the foreground to the Ergo Division plant for treatment.

Lime and cyanide would be added at the head of the circuit to solubilise the gold and activated carbon contained within each tank would be progressively loaded as it was transferred counter-current to the main slurry flow by a system of pumps or air lifts. Test work at Ergo indicated that a final carbon loading of 4 000 g/t could be expected and thus 18 tons of carbon would be removed from the circuit each day. The carbon would be worked and treated by conventional elution procedures to recover the gold from the carbon. The gold could be finally recovered by electro-winning or by a zinc precipitation circuit. The stripped carbon from the elution process would be re-activated by regeneration within a rotary kiln or other suitable furnace.

The plant size was initially set at 800 000 tons a month as this was the size of the carbon-in-leach modules proposed for Ergo. It was indicated by the engineers and metallurgists, however, that it might be better to erect a 1 million tons a month plant as it would result in the plant at East Dagga producing pyrite in the year in which Ergo was able to accept it.

The following information on the project was contained in a press announcement made by Ergo on July 1 1983:

'A carbon-in-leach (CIL) plant with a capacity of approximately 1 000 000 tons per month (tpm) will be erected on the Far East Rand to produce gold from approximately 150 million tons of slimes averaging 0,235 grams per ton recovered. The total operating cost is forecast to be R1,91 per ton treated, in April 1983 money terms, which equates to a cost of production of R8 128 per kilogram of gold ($233 per ounce at R1 = $0,92) Where possible, the highest grade dams will be processed first. In due course the plant will be extended to incorporate a flotation process to treat a further 140 million tons of lower gold content material and the pyrite recovered will be transported to the existing Ergo plant for the recovery of gold,

uranium and sulphur. The proposed plant on the Far East Rand has been planned in this manner to save capital expenditure and to take account of the future pyrite requirements of the Ergo plant and the anticipated improvement in the uranium market in the 1990s. It is expected that the CIL plant on the Far East Rand will be commissioned during the first half of 1986.

The existing Ergo tailings dam will also form part of the project reserves. This dam will comprise 125 million tons at an in situ grade of 0,39 grams of gold per ton when Ergo ceases depositing on it at the end of 1984. It will be treated either through an 800 000 tpm CIL plant to be erected adjacent to it in the late 1980s or at the Ergo plant in the late 1990s.

The total tonnage of the reserves available to the project is 415 million tons which is slightly lower than the previously published figure of approximately 450 million tons, due to a reassessment of the material contained in the dams.

Ergo will construct and manage the plants. The initial capital outlay will be of the order of R83 million, in April 1983 money terms, which comprises an amount of R72 million for the CIL plant on the Far East Rand and R11 million which is required for a new slimes deposition dam to preserve the Ergo tailings dam from dilution by current arisings after the end of 1984. The after-tax cost will be approximately R28 million and will be funded equally by Ergo and East Dagga.

East Dagga will receive an amount equal to half of the benefit arising from the project.

Further announcements with respect to the financing arrangements will be made by both companies in due course.'

Using the data published in the press announcement and the computer programme that was used at the time, the expected return on the carbon-in-leach plant at the Daggafontein Division is calculated below:

Life of operation:	150 million tons treated by the carbon-in-leach process at 1 million tons per month gives a 150 month or 12,5 year life.
Recovered grade:	0,235 g/t on average. East Dagga stated in its 1982 annual report that it had 116 million tons of material at an average grade of 0,5 g/t. On the assumption that these dams would be treated first because of their proximity to the proposed plant site and that the remaining 34 million tons to be supplied by Ergo for carbon-in-leach treatment would have a grade equal to the lowest value of the East Dagga dams, namely 0,40 g/t, one obtains an average head grade for the 150 million tons of 0,48 g/t and thus an average residue grade of 0,245 g/t. In the financial exercise which follows, the residue grade was assumed to remain constant and the recovered grade to vary in line with head grade.
Operating Costs:	R1,91 per ton treated in April 1983 money terms.
Capital:	R72 million in April 1983 money terms for the carbon-in-leach plant.

Commissioning date: April 1986.

Gold price: R15 000 per kilogram.

Assuming that Ergo would incur half the costs and receive half of the benefits from the Daggafontein Division carbon-in-leach project, the return to Ergo was calculated, in the cash flow projection presented as Appendix B, to be as follows. Ergo's investment and return is 50 per cent of the project return shown in Appendix B. A graphical depiction of Ergo's return is shown overleaf in Figure 7.1.

Table 7.1 The expected return to Ergo from a Daggafontein Division carbon-in-leach plant in constant April 1983 money terms.

Initial investment in April 1983 money	R36,0 million
After-tax cost of the initial investment	R11,2 million
Net cash flow	R39.7 million
NPV 10%	R16,2 million
DCF yield (real terms)	34,6 per cent
Break-even gold price	R8,8 per gram
Payback from construction start	3,8 years
Start construction	1984
End reclamation	1999

The economic evaluation of the proposed carbon-in-leach plant at the Daggafontein Division revealed that it would be a worthwhile undertaking. The project offered a 34,6 per cent DCF yield in real terms on an unescalated initial investment of R11,2 million after-tax. The net cash flow from the project was forecast at R39,7 million with the net present value, discounted at the hurdle rate of 10 per cent, being R16,2 million in April 1983 money terms. The break-even gold price at R8 800 per kilogram was well below the ruling price. The payback for the start of construction was calculated to be less than 4 years. The economic evaluation showed that the research into carbon-in-leach technology had yielded a second major project for Ergo.

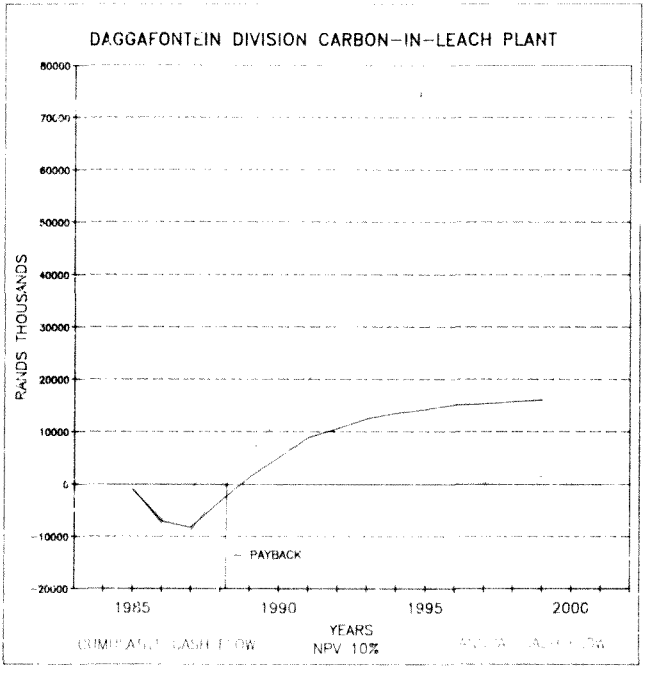


Figure 7.2. The cash flow diagram in April 1983 money terms for the Daggafontein Division carbon-in-leach plant.

Again using the data published at the time and certain assumptions, the expected return on a carbon-in-leach plant to treat the Withok slimes dams is calculated below:

Life of operation:	125 million tons treated by the carbon-in-leach process at 800 000 tpm gives a 13 year life.
Recovered grade:	A head grade of 0,390 g/t less the residue grade of 0,245 g/t calculated above gives a recovered grade of 0,145 g/t.
Operating	R1,91 per ton treated in April 1983 money terms (as for the Daggafontein Division plant).
Capital:	R72 million in April 1983 money terms.
Gold price:	R15 000 per kilogram.

Also assuming here that Ergo would incur half the costs and receive half of the benefits from the reclamation of the Withok slimes dam, the return to Ergo was calculated to be as follows.

Table 7.2 The expected return to Ergo from a carbon-in-leach plant at Withok in April 1983 money terms.

Initial investment in April 1983 money	R36,0 million
Initial investment after-tax	R11,7 million
Net cash flow	R 7,3 million
NPV 10%	-R 1,4 million
DCF yield (real terms)	6,8 per cent
Break-even gold price	R13,1 per gram
Payback from April 1983	13,0 years
Start construction	1983
End reclamation	2001

The cash flow projection from which these results are drawn appears as Appendix C. Ergo's investment and return is half of the project return shown in the spread sheet. A graphical depiction of Ergo's return is shown overleaf.

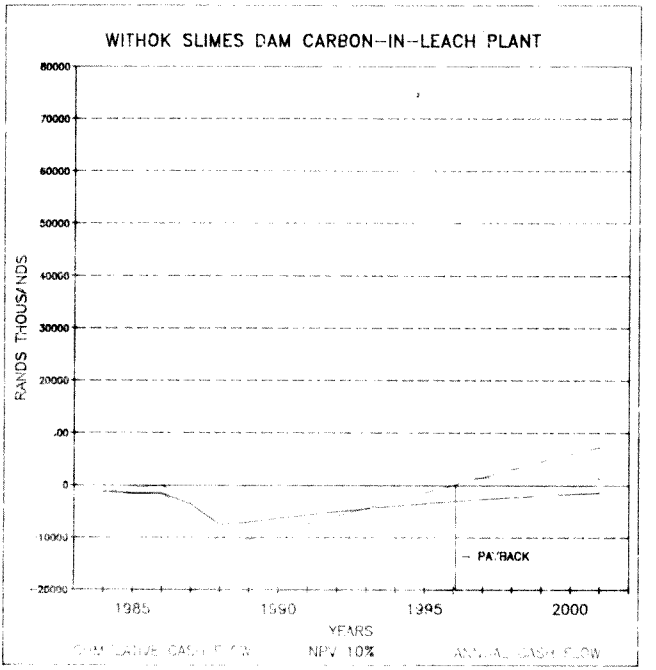


Figure 7.3. The cash flow diagram in April 1983 money terms for a carbon-in-leach plant at Withok.

The economic evaluation of a carbon-in-leach plant at Withok showed that this was a risky investment for Ergo. On an unescalated, initial investment of R11,2 million, it offered a DCF yield of 6,8 per cent in real terms, which was below the hurdle rate of return. The break-even gold price of R13 100/kg was only 12,7 per cent below the prevailing gold price. The payback period at 13 years meant that the initial investment would be recovered over a long period of time. This project was clearly less attractive than the other two carbon-in-leach plants that Ergo was considering.

In this chapter I have described the detailed metallurgical test work that was done to confirm the viability of the proposed reclamation operation on the Far East Rand. The economic evaluation exercise based on the results of this test work showed that the proposed carbon-in-leach and subsequent flotation plants at Daggafontein would be a worthwhile investment. On the other hand, similar test work and evaluation exercises indicated that a carbon-in-leach plant at Withok would be a questionable investment. It was therefore stated in the circular to shareholders that the Withok slimes dam may be treated at the Ergo plant.

8. SELECTION OF NON-MUTUALLY EXCLUSIVE PROJECTS FOR ERGO

Thus in mid-1983 the management of Ergo had four non-mutually exclusive projects to consider. The quantifiable information available to facilitate the investment decision is presented below.

Table 8.1 Economic evaluation of the four projects considered by Ergo in mid-1983 showing the investment required from Ergo and the return to Ergo at an unescalated gold price of R15 000/kg.

	Simmergo Division Plant Extension	Ergo Division CIL Plant	Daggafontein Division CIL Plant	Withok Slimes Dam CIL Plant
Initial investment in April 1983 money (Rm)	19,2	52,0	36,0	36,0
After-tax cost of initial Investment (Rm)	6,1	16,1	11,2	11,2
Net Cash flow (Rm)	9,2	78,2	39,7	7,3
NPV 10% (Rm)	4,6	28,0	16,2	-1,4
DCF yield (real terms) (%)	14,0	32,4	34,6	6,8
Break-even price (R/gram)	12,5	10,0	8,8	13,1
Payback (years)	7,0	3,9	3,8	13,0
Start construction	1983	1984	1984	1983
End reclamation	2005	2001	1999	2001

The carbon-in-leach plant at the Ergo Division was the most attractive project available to Ergo's management. The total net cash flow at R78,2 million in constant April 1983 money terms was virtually double that of the next project. The NPV at a 10 per cent discount rate was 73 per cent better at R28,0 million. The DCF yield (real terms) at 32,4 per cent was bettered by that of another project but it was still an excellent return. The payback at 3,9 years indicated that the shareholders would get their investment back very rapidly.

In addition to giving the best financial return, the carbon-in-leach plant at the Ergo Division was the most attractive project as Ergo could proceed with the project immediately. The detailed design of the plant was complete and it was to be built on property owned by Ergo but not required by the mining title holder. The tailings could be deposited in an existing tailings dam.

Although the carbon-in-leach plant required the largest initial investment, Ergo and its shareholders were able to afford it. As Ergo's operating income is subject to mining taxation, it can expense its capital expenditure on plant in the year in which it is incurred. Ergo receives a tax-free depletion allowance equal to 8 per cent of its revenue each year, however, and Ergo's management limits its capital expenditure to the difference between its current earnings and the depletion allowance. This meant that about 70 per cent of the project would be financed from current earnings and the remainder from another source. Ergo's current earnings after deducting the depletion allowance were more than sufficient to finance 70 per cent of the carbon-in-leach plant. It was also well within Ergo's capability to raise a bank or shareholders loan for the remaining 30 per cent.

Thus the Ergo board agreed at its meeting on July 21 1983 to proceed with the construction of the carbon-in-leach plant at its Ergo Division to recover gold from the flotation plant tailings.

The next most attractive project to Ergo's management was the establishment of its Daggafontein Division with the DCF yield being far better than that for the other projects being considered. The second carbon-in-leach plant offered a very attractive DCF yield in real terms of 34,6 per cent and a short pay-back period of 3,8 years from the start of construction. The net present value at a 10 per cent discount rate of R16,2 million indicated that the project was worth undertaking.

Construction on this project could not start immediately, however, as the detailed design had not been completed. Ergo owned the land on which the plant was to be built and East Dagga was the mining title holder. Thus land for the plant presented no problems. A 500 hectare tailing deposition site would have to be acquired, however, before the

project could proceed. The project was also delayed by Ergo's inability to finance the major portion of it immediately from its post-depletion-allowance current earnings.

The Ergo board was confident nevertheless that these aspects of the Daggafontein Division project would be satisfactorily resolved and thus it entered into an agreement with East Dagga on July 1 1983. It was agreed that the slimes owned by the two parties would be treated through the same plant and that the project would rank second after the Ergo Division carbon-in-leach plant for financing from Ergo's current earnings.

The Simmergo Division plant extension was seemingly the third best undertaking as the DCF yield and net present value exceeded those for the Withok slimes dam reclamation project. It was not appropriate, however, for Ergo's management and board to consider undertaking this project in mid-1983 for a number of reasons. Firstly, difficulty was being experienced in commissioning the Simmergo Division plant and thus it was not appropriate to consider extending it. The recovery was low and the operating costs were high relative to those used in the evaluation of the extension. Until the recoveries and costs stabilised, an accurate evaluation was not possible. Secondly, it would not be possible for Ergo to finance the project from its post-depletion-allowance current earnings for at least four to five years and hence the decision whether to invest in this project could be delayed until that time. Finally, ownership of the right to remove and treat certain of the sand dump reserves on which this project had been based were contested. Until ownership was decided by the authorities, investment in the plant extension could not be justified.

The Withok slimes dam reclamation project did not give an acceptable return as the net present value at a 10 per cent discount rate, the hurdle rate of return, was negative. Ergo's management and board were not able to postpone a decision on this project, however, as they were with the Simmergo Division plant extension. The first stage of the project entailed building a new tailings dam for the Ergo Division to prevent the slimes in the existing tailings dam, the Withok slimes

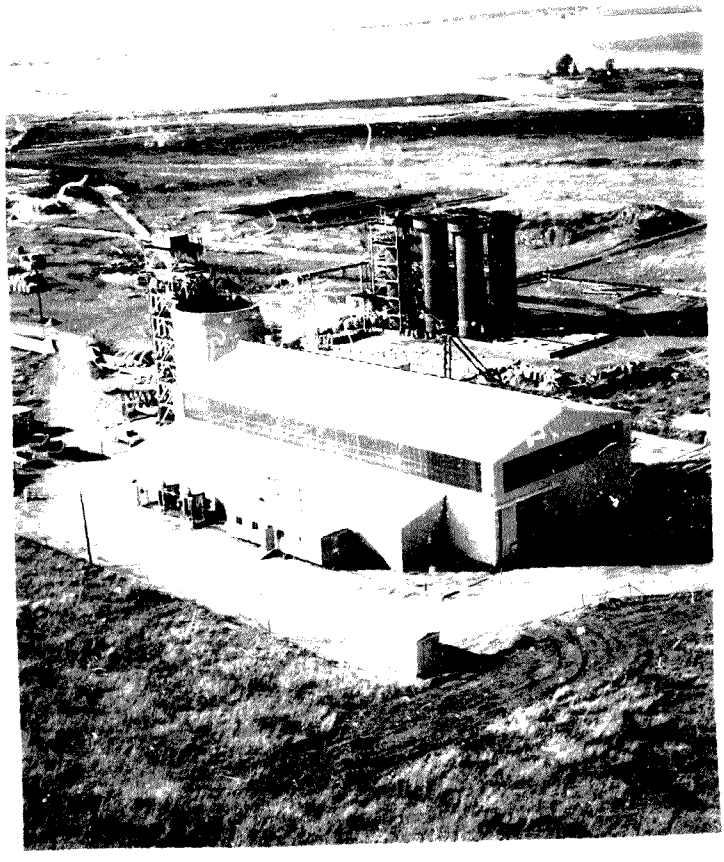


Figure 8.1 The Withok slimes dam with the tailings pump station and carbon columns, which adsorb gold from the tailings dam effluent, in the foreground.

dam, from being diluted by the low-grade tailings emanating from the carbon-in-leach plant. It was also feared that the fine carbon in the carbon-in-leach tailings would contaminate the existing flotation tailings and render carbon-in-leach treatment impossible.

Ergo's management and board took the view that improved commodity prices and metallurgical recoveries had so often changed economic evaluations of residue reclamation projects in the past that there was a reasonable likelihood that changed circumstances would make this break-even project more attractive in the future. They decided therefore to proceed with the building of a new tailings dam for the Ergo Division so that the Withok tailings dam was preserved for possible future reclamation.

It was possible to stagger the expenditure on the new tailings dam over a period of four years. This made it affordable within the limits of Ergo's capital budget which was determined by its post-depletion-allowance current earnings. It was necessary to proceed with this project immediately as the new tailings dam had to be ready to receive tailings from the carbon-in-leach plant at the Ergo Division when it came on stream.

Ergo's management and board decided therefore to proceed with the two projects which gave Ergo an attractive return and to keep their options open on the other two projects which they could not undertake because of the capital budget limit.

9. SELECTION OF MUTUALLY EXCLUSIVE PROJECTS AT DAGGAFONTEIN

Before the financing arrangements referred to in the closing paragraph of the announcement of 1 July 1983 could be addressed, a detailed agreement for the combined Daggafontein Division and Withok slimes dam project had to be reached by East Dagga and Ergo so that both companies could approach their shareholders and underwriters with a 'bankable' agreement.

On 22 August 1983, it was recommended that Ergo should operate the proposed venture in the same manner that Sallies conducted its sand and rock dump reclamation business. Sallies went into the reclamation business in 1977, when its underground operations ceased to be viable, by purchasing material from suppliers and treating the material in its plant. By 1983, most of Sallies business was conducted on the basis of long term contracts with suppliers.

It was important that the plant be operated and owned by Ergo for a number of reasons. The process to be used initially had been developed by AAC and Ergo metallurgists and thus it was essential that an AAC administered company apply the technology under the guidance of AAC consultants. The aim was to maximise the chance of success and to keep the expertise 'in-house'. The second reason for Ergo operating and owning the plant was that Ergo could use its post-depletion-allowance current earnings to finance the plant and thus less new capital would have to be raised if Ergo, rather than a new company, built the plant.

It was proposed therefore that Ergo finance and construct the carbon-in-leach plant on the land that it owned at Daggafontein and that East Dagga acquire the slimes dams to be treated in the new plant. This idea received the support of the chairman of Ergo and his financial advisers on 2 September 1983. They recommended, however, that the slimes dams be placed in a separate company. On the same day, AAC's mining titles manager was advised on the agreements that had to be drafted to put this proposal into effect.

When the drafts of the agreements were completed, they were circulated for comment on 30 September 1983, under cover of a note which included

the following comments:

1. Dumpco, a dump owning company and wholly owned subsidiary of East Dagga, is to be established and it is to own all of the slimes dams considered in the feasibility study. Ergo is to purchase the slime contained in the dams. To ensure that the material is kept secure so that it is available to be sold to Ergo, AAC is to administer Dumpco and it is to appoint directors to Dumpco's board. These directors will have a power of veto such that they will be able to prevent Dumpco from selling the dumps, conducting any other business through Dumpco, seeking a listing and from doing anything else which is considered detrimental to Ergo's position. If East Dagga so wishes, it could seek a listing for a company established as Dumpco's holding company.

2. Dumpco is to acquire the slimes dams considered in the feasibility study by purchasing

   2.1 6L18, 6L19, 6L20 and 7L2 from East Dagga and a subsidiary;

   2.2 6L13 from Gencor for 250 000 Ergo shares;

   2.3 the rights to Gencor's 6L16, 6L17, 7L5, 7L6 and 7L7 from Ergo; and

   2.4 Ergo's tailings dam 6L14.

3. In order to make the treatment of 6L13 possible, Impala Platinum must abandon its surface right permit and dispose of its effluent elsewhere. Ergo is to undertake to dispose of this effluent. The quantity and the nature of the effluent is to be specified in the agreement.

4. In order to protect the Ergo tailings dam from pollution by fine carbon emanating from Ergo's tailings leach plant, Ergo is to undertake to build another tailings dam at an initial capital cost of about R23 million.

5. Ergo is to undertake to purchase the slimes in Dumpco's dams. The slime best suited to carbon-in-leach treatment has been scheduled for treatment in the Daggafontein Plant. Ergo is to

construct this plant at an initial capital cost of about R90 million. The slime which is more suited to flotation treatment (6L14, 6L16, 6L17, 7L5, 7L6 and 7L7) will be treated at the existing Ergo plant from about 1997.

6. The purchase price payable by Ergo to Dumpco for the slimes purchased is to be determined by the formula:

$$P = k(R-C)$$

where

P = the purchase price

k = 0,50 for slimes treated at the Daggafontein plant and 0,25 for slimes treated at the Ergo plant.

R = the revenue derived from the treatment of the slime.

C = the cost of treatment. Costs include all capital after the initial capital amounts referred to above have been spent, operating costs and fees.

7. As security for its undertakings and commitments, Dumpco is to pledge the slimes dams to Ergo and to register notarial bonds over them in favour of Ergo.

8. If the above-mentioned agreements are acceptable to East Dagga, the agreement signed on July 1 1983 will be cancelled.

This note reflects a further proposal, namely that the slimes more suited to flotation treatment should be treated at the existing Ergo plant from about 1997, when there would be capacity in the Ergo flotation plant, rather than at a new flotation plant at Daggafontein.

It was reasoned that when capacity was available in the Ergo acid plant to treat pyrite from Daggafontein there would also be capacity in the flotation plant at Ergo. As Ergo's existing pipelines passed very close to some of the slimes dams scheduled for treatment by flotation at Daggafontein, there appeared to be a strong argument for treating these dams and the others suited to flotation at Ergo.

It had become evident, however, that in order to judge the relative merits of these alternative proposals, it was necessary to develop a more detailed computer model of the project. The new computer model was designed to cater for all the treatment permutations that had been proposed.

Negotiations with East Daggafontein took place during October and November 1983, and by the end of November three alternative ways of carrying out the total project were being considered. The details of the three alternatives, named after the months in which they were conceived, were as follows:

1. June Scheme:
   (a) Treatment by carbon-in-leach at Daggafontein of slimes dams 7L2, 6L18, 6L19, 6L20 and part of 6L13;
   (b) Treatment by flotation at Daggafontein of slimes dam 6L13, 6L14, 6L16, 6L17, 7L5, 7L6 and 7L7; and
   (c) Treatment by carbon-in-leach at Withok of the Withok slimes dam.

2. August Scheme:
   (a) As for the June Scheme;
   (b) Treatment by flotation at Ergo; and
   (c) Treatment by carbon-in-leach at Ergo of the Withok slimes dam.

3. November Scheme:
   (a) As for the June Scheme;
   (b) As for the June Scheme; and
   (c) Treatment by carbon-in-leach at Ergo of the Withok slimes dam.

The treatment by carbon-in-leach at Daggafontein was common to all three alternatives but the location of the flotation treatment and treatment of the Withok dam were at issue. The computer model had been modified so that it could consider each aspect of each of the above-mentioned three alternatives and thereby facilitate the choosing of the correct way to carry out the total project.

The computer exercises were done using the latest available data on dump tonnages and grades, recovery grades, capital and operating costs and commodity prices. Whereas earlier economic evaluations had been done on an unescalated basis, costs were escalated for five years at rates advised by the appropriate AAC experts and prices were escalated at a range of rates. After five years, all prices and costs were escalated at 10 per cent. Profits were deflated at the rate of inflation to obtain real returns.

An example of the output of the computer model used is presented as Appendix D. It shows the results of the total project for the August Scheme. All of the results obtained are summarised in Table 9.1 below. The returns for each of the three aspects of the total project for all three alternatives were obtained by using only the input for the aspect in question. The returns shown in Table 9.1 were obtained by adding the returns to both Ergo and East Dagga shown in Appendix D.

It will be noted that the initial investment for each total project is not the sum of the initial investments of the three aspects comprising that total project. The initial investment of R112,3 million for the total project for all three alternatives is the sum of the R89,2 million initial investment for the CIL treatment plant plus the R23,1 million required for the preservation of the Withok slimes dam, both of which are common to all three alternatives. All other capital expenditure for the total project is financed from the cash flow of the project and hence it does not form part of the total project's initial investment.

The net real cash flow and the NPV for the total project for each alternative also do not equal the sum of the parts. This is because some of the aspects are not in a tax paying position in every year and these aspects reduce the tax payable by those with taxable income when added together for the total project. With South African mining taxation, the total after-tax income for a project is always greater than the sum of the after-tax income of the parts when some of the parts do not generate taxable income in certain years. As illustrated below, the total project cash flow for the August scheme is R55,3 million whereas the sum of the cash flows from the three aspects comprising the August scheme is R28,7 million.

Table 9.1: Forecast project returns for the combined Daggafontein plant and Withok project for alternative treatment routes assuming a base gold price of R15 000/kg. escalating at 10% p.a. i.e below inflation

	June Scheme	August Scheme	November Scheme
CIL Treatment	at Dagga	at Dagga	at Dagga
Initial investment in April 83 money	R 89,2 million		
Initial investment after-tax	R 2[illegible],7 million		
Net real cash flow	R 74,2 million	as for June	as for June
NPV 10% real terms	R 24,5 million	Scheme	Scheme
DCF yield real terms	29,5 percent		
Payback from 1984	5,8 years		
Start construction	1984		
End reclamation	1998		
Flotation Treatment	at Dagga	at Ergo	at Dagga
Initial investment in April 83 money	R 23,5 million	R 12,3 million	
Initial investment after-tax	R 6,6 million	R 3,4 million	
Net real cash flow	R 10,4 million	-R40,6 million	as for June
NPV 10% real terms	-R 0,5 million	-	Scheme
DCF yield real terms	7,2 percent	-	
Payback from construction start	8,1 years	-	
Start construction	1997	1996	
End reclamation	2012	2017	
Withok Slimes Treatment	at Withok	at Dagga	at Ergo
Initial investment in April 83 money	R 92,1 million	R 53 million	R 46,1 million
Initial investment after-tax	R 28,2 million	R 17,3 million	R 15,3 million
Net real cash flow	R 22,1 million	-R 4,9 million	R 20,2 million
NPV 10% real terms	-R1,3 million	-	-R5,3 million
DCF yield real terms	8,7 percent	-	5,3 percent
Payback from 1984	10,2 years	-	19,3 years
Start dam construction	1984	1984	1984
Start plant construction	1987	n/a	n/a
Start reclamation	1989	1990	1997
End reclamation	1998	-	2006
Total Project			
Initial investment in April 83 money	R112,3 million	R112,3 million	R112,3 million
Initial investment after-tax	R 33,8 million	R 33,8 million	R 33,8 million
Net real cash flow	R115,6 million	R 55,3 million	R125,2 million
NPV 10% real terms	R 25,1 million	R 15,2 million	R 24,2 million
DCF yield real terms	20,0 percent	19,6 percent	20,9 percent
Payback from 1984	7,3 years	6,3 years	6,3 years
Start construction	1984	1984	1984
End reclamation	2012	2017	2012

The comparative study of the three mutually exclusive alternatives shown in Table 9.1 indicated that the August scheme in which the slimes were transported over considerable distances was the least attractive. The capital cost of the long pipelines and booster pump stations and the operating costs of pumping over long distances was outweighed by the cost of building a new flotation plant at Daggafontein and by treating the Withok slimes dam either at Withok or at Ergo.

Treating the Withok slimes dam in a new carbon-in-leach plant at Withok (June scheme) appeared to be slightly more favourable than treating it at Ergo from 1997 (November scheme). The net cash flow of the Withok plant alternative was 10 per cent higher at R22,1 million and the DCF yield in real terms was better at 8,7 per cent. The payback from 1984 was virtually halved at 10,2 years. The Withok plant required an initial investment of R92,1 million in April 1983 money terms, however, which was double the R46,1 million needed for treating the Withok dam at Ergo.

The former alternative was not immediately available to Ergo's management and board, however, as Ergo's post-depletion-allowance current earnings were committed to financing the two carbon-in-leach plants. It was therefore decided to [illegible] the agreements on the basis of the November scheme, in the knowledge that Ergo and East Dagga could agree to an alternative scheme at a later stage.

The economic evaluation techniques discussed in this chapter proved to be invaluable in assisting Ergo's management to decide which treatment routes to choose at Daggafontein and Withok. It was clearly shown that the flotation treatment should take place at Daggafontein rather than Ergo. The evaluation indicated that the Withok slimes dam ought to be treated in a new carbon-in-leach plant at Withok but Ergo could not finance this proposal. The less costly alternative of treating the Withok slimes dam at Ergo was thus chosen. The exercises showed that the capital and operating costs of transporting slimes outweighed the cost of building new treatment facilities.

10. SENSITIVITY ANALYSIS OF THE DAGGAFONTEIN AND WITHOK PROJECT

Once it had been decided that the reclamation of the Daggafontein and Withok slimes dams ought to be assessed on the basis of the scheme put forward in November 1983, it was necessary to do a sensitivity analysis on the proposed project.

A project with a long life tends to be most sensitive to fluctuations in operating profit. Variations in the capital cost tend to have a much more limited impact on the return of such a project. As percentage changes in price and metallurgical recovery have a greater effect than variations of an equivalent percentage in operating cost, the project was evaluated at a number of gold prices to determine whether it was a marginal project or not.

The model used to evaluate the project assumed a base gold price, unit operating cost and initial capital cost. These items were escalated at varying rates recommended by the appropriate AAC experts for a period of five ye whereafter escalation for all three items continued for the fe of the project at 10 per cent per annum. Different inflatio rates were used in the first five years to deflate the results to real terms and then 10 per cent was used thereafter.

The document, prepared to assist the Ergo boa in its discussion of the project prior to the signing of the revise greements with East Dagga, showed varying returns to Ergo depend on the assumptions made with respect to gold price escalation. sensitivity analysis is shown below in Table 10.1.

Table 10.1 Forecast real returns to Ergo from the combined Daggafontein Division and Withok slimes dam project at different gold price assumptions.

Gold Price Escalation Assumption	Real Gold Price (R/kg)	Gold Price Variation (%)	NPV 10% Real Terms (Rm)	DCF Yield Real Terms (%)	Payback after start-up (Years)
Break-even gold price	11 840 ($310/oz)	-21,1	-4,7	10,4	8,0
10% p.a. ie. below inflation	14 381 ($380/oz)	-4,1	13,9	21,1	3,5
Equal to inflation	15 000 ($400/oz)	-	17,3	23,1	3,0
Inflation +2½% for 5 years	16 744 ($470/oz)	11,6	26,6	27,9	2,5
Inflation +5% for 5 years	18 673 ($525/oz)	24,5	35,8	32,3	2,0

The exercise showed that the project was viable at a gold price well below the ruling gold price and thus the project was likely to survive. A gold price increase of almost 25% doubled the NPV, which indicated that very good profits could be expected with an upward movement in the gold price.

In general, the project showed sensitivity to variations in the gold price but not the excessive variations seen with a marginal project. Thus it was possible to proceed with the project in the knowledge that the downside risk was low and that there was reasonable potential for above average profits to be made.

On the basis of this sensitivity analysis, the AAC Executive Committee agreed to recommend to the Ergo board that it proceed with the Daggafontein and Withok project.

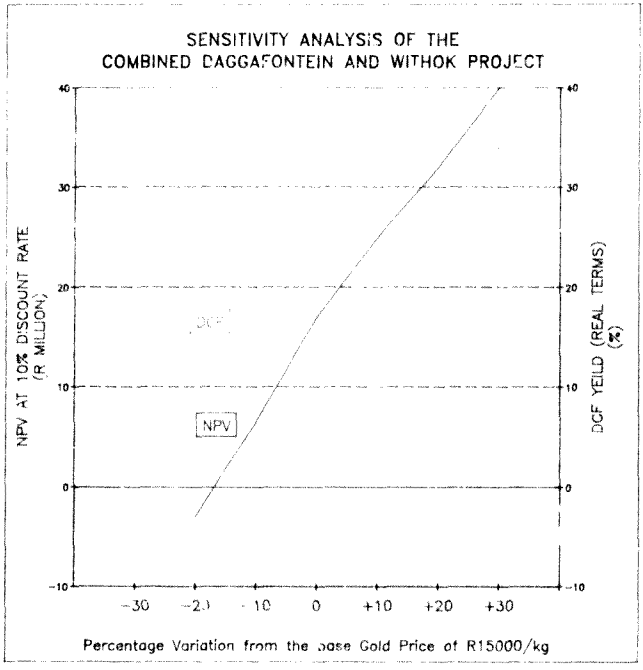


Figure 10.1 Sensitivity analysis of the combined Daggafontein and Withok project.

11. AGREEMENTS BETWEEN ERGO AND EAST DAGGA

The proposed terms of agreement were approved by the Ergo board on December 20 1984 and shareholders were advised accordingly in a circular dated December 23 1984 which read as follows:

'On July 1 1983, Ergo and East Daggafontein Mines Limited (EDM) issued a joint company announcement regarding a proposed project for the treatment of certain slimes dams on the Far East Rand and the Withok slimes dam. As a result of further discussions which have taken place between Ergo and EDM, the preliminary agreement dated July 1 1983 is to be replaced by the revised arrangements set out below.

An agreement will be entered into between EDM and Anglo American Corporation of South Africa Limited ("AAC") providing for the formation, as a subsidiary of EDM, of a company to be known as Dumpco Limited ("Dumpco"), its main purpose being to carry on the business of selling the material contained in certain specified slimes dams.

Ergo, for whom AAC acts as administrative and technical advisers and secretaries, has undertaken, in terms of the revised arrangements, to purchase the material contained in Dumpco's slimes dams for treatment and recovery of the mineral content thereof.

The attention of members is directed to the AAC Technical Advisers' Report. The directors of Ergo have accepted the recommendations contained therein, and have decided to construct a one million ton a month plant on the Far East Rand ("the Daggafontein plant") which will utilise the carbon-in-leach (CIL) process to treat approximately 150 million tons of material for the recovery of gold. It is expected that this plant will be commissioned by the end of 1986. The slimes dams considered most suitable for CIL treatment are those known, according to the Chamber of Mines coding, as 7L2, 6L18, 6L19, 6L20 and a certain portion of 6L13.

Certain of the slimes dams to be acquired by Dumpco contain material which will be best treated by the flotation process, rather than the CIL process. It is therefore proposed to modify the Daggafontein plant to a flotation plant to treat a further 140 million tons of such material, and the conversion is expected to occur during 1997. The pyrite recovered would be transported to the existing Ergo plant for the recovery of gold, uranium and sulphur. The slimes dams to be treated in this manner would be those known as 6L14, 6L16, 6L17, 7L5, 7L6, 7L7 and the remaining portion of 6L13.

As announced in the directors' report for the quarter ended June 30 1983, the board has decided to erect a CIL plant adjacent to the existing Ergo plant. It is expected to be commissioned at the end of 1984. The Ergo tailings will thereafter contain fine carbon which would inhibit further treatment and it is therefore necessary to establish a new slimes dam for the deposition of those tailings.

Pursuant to the revised arrangements, Dumpco will acquire from Ergo the dump permit in respect of the slimes dam known as 6L14, as well as Ergo's rights to acquire and treat the slimes dams known as 6L16, 6L17, 7L5, 7L6 and 7L7, for a total payment by EDM to Ergo of R24,0 million. Dam 6L14 and the rights to the other dams were acquired shortly after Ergo's incorporation, but the latter dams have hitherto not been included in the reserves of Ergo because of their remote situation from the Ergo plant. Dumpco is also to acquire from Ergo the Withok slimes dam for R600 000.

Dumpco's other slimes dams, viz 7L2, 6L18, 6L19, 6L20 and 6L13, will be acquired from EDM, Johannesburg Exploration and Mining Corporation Limited (EDM's wholly-owned subsidiary company) and Geduld Investments Limited.

In terms of the main agreement to be entered into between Ergo and Dumpco, the latter company will commit exclusively to Ergo for purchase and treatment all of the material contained in the twelve slimes dams mentioned above. Ergo, for its part, undertakes to construct the Daggafontein plant, the estimated initial capital cost

of which is R118 million in escalated money terms, while the estimated initial capital cost of the new Ergo tailings dam is R31,5 million. As security for its undertakings and commitments in terms of the agreement, Dumpco undertakes to pledge and/or register notarial bonds in favour of Ergo over the slimes dams committed to Ergo.

The board of Ergo proposes to finance the after-tax capital cost of the Daggafontein plant, the new tailings dam and Ergo's carbon-in-leach plant from internal cash flows, by selling the Withok slimes dam and the rights to the other slimes dams to Dumpco for R24,6 million and by raising funds in the form of convertible debentures offered to all ordinary shareholders on terms to be announced after the agreements with EDM have been signed.

Ergo will endeavour to treat a minimum of three million tons of slimes per production quarter at the Daggafontein plant. Treatment of material from the Withok slimes dam is expected to commence during the latter half of the 1990's, when spare capacity becomes available at Ergo's existing plant.

The purchase price payable by Ergo to Dumpco for material acquired by Ergo in terms of the agreement will be calculated in terms of the formula:

$$P = K(R-C)$$

where: P = the purchase price of material

K = 0,50

R = revenue derived from the sale of gold and any other minerals recovered by Ergo

C = the cost of treatment of the material including all capital expenditure except for the initial capital costs.

In an arrangement quite separate from the formation of Dumpco, Ergo has reached agreement with EDM and another wholly-owned subsidiary of that company, namely East Daggafontein Mineral Holdings (Proprietary) Limited ("EDMH"), for the acquisition by Ergo from EDMH of slimes dam 5L26 (the old Modder B dam). Ergo will have capacity in its pipelines in the immediate vicinity of 5L26 after completing the treatment of

the GGMA dumps in the existing treatment plant in about 1990. Ergo has agreed to issue 375 000 shares of 50 cents each in the capital of Ergo, credited as fully paid up, to EDM (in lieu of to EDMH). Slimes dam 5L26 has been shown, on assay, to contain 23,10 million tons of slime at 0,40 g/t gold, 0,014 kg/t uranium and 0,55% sulphur.'

Ergo and East Dagga therefore reached agreement on the treatment of the Daggafontein and Withok slimes dams about one year after the project was first suggested. The complex agreements recognised that Ergo's expertise lay in the construction and operation of dump reclamation plants. Furthermore, the agreements consolidated most of the slimes reserves on the Far East Rand into a single dump owning company, namely Dumpco. The agreements also set out how each party was to benefit from the combined Daggafontein and Withok project.

12. THE FINANCING OF ERGO'S EXPANSION

The revised agreements to be entered into by East Dagga and Ergo required East Dagga to pay to Ergo an amount of R24,6 million for slimes dams owned by Ergo. As East Dagga did not have sufficient cash assets, it was necessary for East Dagga to raise the funds prior to the signing of the agreements or to have a financial institution guarantee the funds.

East Dagga opted to raise the funds by staging a rights issue. The company had other expenses to meet and thus it arranged to raise R26,1 million by way of a renounceable rights offer of 926 400 linked units at R28,80 per linked unit. Each linked unit comprised 6 new shares and 1 option to subscribe for shares at a later date. This meant that a total of 5 558 400 new shares would be issued, a 70 per cent increase in the East Dagga share capital. Attaching no issue price to the options, the issue price of the shares was equivalent to 470 cps.

The arrangements agreed to by Ergo and East Dagga proved to be 'bankable' as the East Dagga rights issue was underwritten by UAL Merchant Bank Limited, who advised East Dagga on the terms of the offer. The technical advisers to the company, Southern Prospecting (Pty) Ltd., recommended the project to the East Dagga shareholders after examining in detail certain documents made available by Ergo. AAC's technical advisers report to Ergo dated November 30 1983 was quoted extensively in the East Dagga circular to shareholders.

In mid-January 1984 when the terms were settled, East Dagga shares were trading at 600 cps. The terms of the offer proved to be popular for UAL reported in late February that the offer was 97,3 per cent subscribed.

As stated in the circular to shareholders dated December 23 1983, Ergo planned to finance its new projects from internal cash flows, by selling the Withok slimes dam and the rights to other slimes dams to Dumpco for R24,6 million and by raising funds in the form of convertible debentures. The funds were to be raised in the form of debentures as Ergo's principal shareholders, AAC and Amgold, wanted interest rather than dividend income. The convertible aspect was introduced so that shareholders could maintain their investment in Ergo rather than being repaid if they so wished. A convertible issue was attractive as the potential dilution in dividends was less than that of a normal rights issue because the conversion price could be pitched higher than a normal rights issue price.

Ergo shareholders were advised in a further circular dated February 9 1984, that the company's new projects were expected to cost R209,5 million. Expenditure on the Ergo Division carbon-in-leach plant was estimated at R60 million. The cost of the Daggafontein Division carbon-in-leach plant was forecast to be R118 million and the new Ergo tailings dam was expected to cost R31,5 million. Ergo's management decided that current earnings would finance capital expenditure worth about R150 million, the proceeds from Dumpco R24,6 million and the remaining R35 million would be raised in the rights offer.

The rights offer was set at this level as a smaller offer was regarded as inappropriate for a company of Ergo's size. If less money was required, a loan from AAC would have been more appropriate. On the other hand, Ergo's management did not want to service an excessively large loan as this could impact on its profits. It would also limit its ability to spend capital as this was governed by the company's post-depletion-allowance current earnings. It was considered desirable to maintain Ergo's dividend of the previous year of 62,5 cents.

The purpose of the February 1984 circular was to convene a general meeting at which members would be asked to increase the company's authorised capital from 45 million shares to 50 million shares. This was made necessary by the proposed issue of convertible debentures. The increase was approved on March 2 1984.

The terms of the convertible debenture issue were decided on the same day in the light of the prevailing market conditions. At that time the Ergo share was trading at 1'40 cents per share which was close to its highest level in three years. Conversion was thus set at R12 per share. The Barclay's Business brief of February 1984 showed that company debentures had been offered in a narrow band from 14 to 16 per cent from 1981, although they had begun to rise above that level in line with the increase in other interest rates. Because of the convertible aspect it was decided to pitch the rate at 15½ per cent, about 1½ per cent lower than the rate for an ordinary debenture issue at that time. Consideration was given to a variable rate but such an instrument would have been novel and no agreement could be reached on how the rate should vary.

It was considered appropriate to raise R34,44 million by offering the debentures on the basis of 7 debentures for every 100 ordinary shares held. This meant that 2 870 000 debentures were to be offered.

Conversion of the shares into debentures was set for June 1987 and June 1988 as it was expected that the two carbon-in-leach plants would be operational prior to the first conversion date. If all went according to plan, Ergo's profitability and hence share price would be on the increase and debenture holders would be encouraged to convert.

The redemption dates for those debenture holders who did not convert were set at the end of each year from 1988 to 1991. By the beginning of this period, the new plants built with the debenture funds were expected to be fully operational and producing profits sufficient to repay the debenture loans.

The convertible debenture issue was designed to minimise the immediate impact of the new projects on the shareholders of Ergo. Sufficient funds were to be borrowed so that the dividend was not reduced. Conversion and redemption were timed so that the additional dividends would be paid or loan repayments made when the new plants were in their most profitable periods and hence the existing shareholders would not experience a reduction in dividend. Although the market tends not to like a compulsory conversion as it is seen as a deferred rights issue, Ergo's management was not prepared to be saddled with a large debt burden longer than was necessary.

In this capital raising exercise, cash flow forecasts were produced to determine the Ergo dividend pattern for a number of scenarios. The first scenario was if the expansion projects were not done, then if they were undertaken but debenture finance was not raised and finally if the projects were undertaken and the finance was raised. Cash flow forecasts for the period to 1996 were calculated as Ergo's production plans were firm until 1996 and, it was beyond the redemption period of the dividends.

The cash flows were done on the basis of the official AAC forecasts for prices and costs. Escalation was forecast at 5% after 5 years and beyond and not higher so as to avoid the excessively favourable impact of high escalation when it came to redemption as the amount to be redeemed did not escalate.

The following conclusions could be drawn from the cash flow forecasts:

- that it was worthwhile for Ergo to undertake the new projects;
- that it was beneficial to Ergo shareholders for it to fund its expansion by means of borrowed funds if the gold price and costs escalated as forecast or at more favourable rates than forecast;
- that R35 million was the appropriate amount to borrow as it enabled Ergo to increase its dividend slowly but steadily throughout the expansionary period if the assumed escalation rates prevailed;
- that the financial years 1987 and 1988 were the correct years in which to set the conversion dates;
- that the redemption ought to be spread over four years to reduce the impact on the dividend;
- that Ergo would have substantial cash surpluses to deposit in the early years and thus it ought to secure re-investment rates at the outset.

Comment in the Rand Daily Mail by Brendan Ryan was that market reaction to the rights offer was favourable. He stated that the advantages to Ergo were that the interest paid on the convertible debentures could be written off above the line for tax purposes and the interest rate on the debentures would be lower than bank loan rates. Advantages to the Ergo shareholder were that dividend distributions from Ergo would not be penalised by the heavy capital expenditure or by the need to service a larger share capital through a straight rights issue.

The issue proved to be popular in the market and the Ergo nil paid letters traded at around the R3 level. Subscriptions were received for approximately 98 per cent of the debentures and the remainder were subscribed for by the underwriters.

The Ergo and East Dagga rights issues showed that the proposed carbon-in-leach plants were of interest to investors. Both companies obtained underwriting for their rights issues without any difficulty. The terms of the rights issues proved to be popular and as a result both rights issues were well subscribed. With the raising of the finance, Ergo's Daggafontein Division was launched.

13. LEGAL ASPECTS OF ERGO'S ESTABLISHMENT AND EXPANSION

In establishing the Daggafontein Division, both Ergo and East Dagga had to comply with a number of laws and regulations. The structure of the agreements between the two parties was influenced to a large extent by the way in which Ergo had been allowed to establish its original operation.

When the Ergo Division was established, the company pegged 1 261 gold claims in terms of Section 58(1) (Permission to peg claims on certain land and in certain places) of the Mining Rights Act No. 20 of 1967 (the Act). By virtue of these claims the company aimed to become a holder of mining title. As a holder of mining title the company would have been entitled to apply to the mining commissioner under Section 90 of the Act for Surface Right Permits (SRPs) on proclaimed land for mining and purposes incidental thereto. The purpose was to acquire Section 90 SRPs for pipeline routes and the plant site. Ergo was not recognised, however, as a holder of mining title and so its reclamation operations have had to be conducted by way of Section 92 (Surface Rights for purposes other than those contemplated in Sections 90 and 91) of the Act.

In similar vein, the company's operations were deemed to be 'works' in terms of the Mines and Works Act.

In determining the company's status for taxation, however, the company was deemed to be a company which carries on the trade of mining in terms of the definition of mining in Section 1 of the Income Tax Act No. 58 of 1962. Ergo is thus liable for taxation on the basis of the formula $Y = 60 - 480/x$, where Y is the rate and X is the ratio of profit to revenue expressed as a percentage. As the company's 'mining' operations do not take place in terms of a lease acquired from the State, Ergo is not liable for lease tax which is a severance tax payable by gold mines to the State. Since the establishment of Ergo, Section 32A (Additional provisions regarding the payment of shares of profits to the State in the case of certain mining leases) has come into being. Ergo is not liable to pay State's share in terms of this amendment.

Ergo obtained permission in terms of Section 5 (1)(a) of the Atomic Energy Act 1967 to recover source material from the slimes dams to be treated.

In terms of the Atmospheric Pollution Prevention Act, the company was advised by the head of the Air Pollution Section that it would not be held liable for the grassing of a slimes dam or for atmospheric pollution until it commenced operations at a particular dam. In certains specific instances, however, Ergo accepted immediate responsibility.

In establishing the Daggafontein Division, the right to mine was clearly the most important aspect. Thus securing for Dumpco 'the right to remove and treat' the slimes dams in question was of crucial importance. The acquisition of the title to each of the slimes dams is explained below :

East Daggafontein Slimes Dam (6L20): East Dagga created the slimes dam and when it partially abandoned its mining title in the late 1970s it was entitled to acquire a dump permit in terms of Section 161(4) of the Act.

Daggafontein Slimes Dams (6L18 and 6L19): Dagga created these slimes dams and when it abandoned its mining title, East Dagga was permitted to acquire Section 161 (3) dump permits.

Daggafontein Slimes Dam (7L2): Dagga created this slimes dam during the 1950s when it re-treated its Main Reef Leader slimes dam. East Dagga did not acquire the rights to this slimes dam initially as it was considered to be incapable of further re-treatment. An Egoli Consolidated Mines Ltd. subsidiary obtained a Section 161(3) dump permit and this subsidiary was sold to East Dagga in 1982 in exchange for shares. East Dagga was able to do this as a company is permitted to issue new shares in exchange for assets.

East Geduld Slimes Dam (6L13): This slimes dam was the most problematical to secure as Impala Platinum Ltd. has a Surface Right Permit in terms of Section 92 of the Act to deposit its refinery effluent on this slimes dam. Ergo undertook to compensate Impala for waiving its rights during the period that the slimes dam is reclaimed and Impala undertook to waive its rights. The mining commissioner undertook to issue a Section 161 dump permit to Geduld Investments Ltd., successor in title of East Geduld, on condition that Impala can continue to deposit until alternative arrangements are made and on condition that the stated requirements of the Department of Water Affairs are complied with. Dumpco acquired the dump permit from Geduld.

East Geduld Slimes Dam (6L14): In terms of a 1978 agreement with Union Corporation Limited, Ergo acquired the Section 161 dump permits to this slimes dam. As they are numbered 50/75 and 22/76, they were doubtless issued to a company in the Union Corporation group and transferred to Ergo in terms of Section 161(5)(a) of the Act.

Grootvlei and Marievale Slimes Dams (6L16, 6L17, 7L5, 7L6 and 7L7): Ergo acquired a personal right to obtain the right to remove and treat these slimes dams in terms of the above-mentioned 1978 agreement. It was not possible to obtain dump permits as the mining titles of both mines had not been abandoned. Ergo ceded its rights to Dumpco and Marievale and Grootvlei sold the slimes dams to Dumpco. The step was taken to take delivery of these 'movable objects' by means of 'long hand' delivery. Before a notary public, a representative of the sellers, Grootvlei, Marievale and Ergo, pointed out the slimes dam in question and a representative of the purchaser, Dumpco, confirmed that that was what was being purchased. Copies of the appropriate Board resolutions by Marievale and Grootvlei directors were obtained prior to the signature of the agreements to ensure that the Board members were aware that the alienation agreements were being signed.

Figure 13.1 The Withok slimes dam being delivered by means of 'long hand' delivery by a representative of Ergo to a representative of Dumpco before a notary public.

Withok Slimes Dam: Ergo owns the Withok slimes dam as it created it and it lies on land owned by Ergo. Ergo cannot obtain a Section 161 permit, however, as the slimes dam does not lie on proclaimed land. Ergo sold the slimes dam to Dumpco and delivery was again made at the site of the slimes dam by pointing out the 'movable object' before a notary public. Thus the deed of sale was notarially executed.

All of the above-mentioned dump permits were transferred to Dumpco in terms of Section 161 (5)(a) of the Act. Transfer duty is payable on the transfer of the dump permits as they are a real right in land and as such are 'property' as contemplated in Section 1 (vi)(a) of the Transfer Duty Act No. 40 of 1949.

Prior to signing the deeds of alienation for slimes dams 6L18, 6L19, 6L20 and 7L20, East Dagga convened a general meeting of members and passed an ordinary resolution authorising the directors to sign the relevant agreements. This was in compliance with Section 228 (1) of the Companies Act No. 61 of 1973 (the Companies Act) which states '... the directors of a company shall not have the power, save with the approval of a general meeting of the company, to dispose of - (b) the whole or the greater part of the assets of the company'.

During the course of the negotiations, Ergo and East Dagga observed the stock exchange requirement that members be kept informed by publishing announcements in the press and by posting the announcements to members.

In raising funds for the venture by way of rights issues, both companies had to comply with the companies Act and the London (LSE) the Johannesburg Stock Exchange (JSE) regulations. For the rights issues both companies had to increase their authorised share capitals and this was done in terms of Section 75 of the Companies Act which states '... a company having a share capital, if so authorised by its articles, may by special resolution - (a) increase its share capital by new shares ...'

The passing of a special resolution is governed by Section 199 to Section 203 of the Companies Act and the articles of the company. One of the requirements is that a circular be sent to members giving notice of the meeting and together with the circular were sent forms of proxy which are required in terms of Section 189 (Representation of members at meetings by proxy) of the Companies Act.

Ergo was permitted to raise funds by a rights issue of convertible debentures in terms of its articles as the amount to be borrowed was within its borrowing limit. The issuing of debentures is covered in Section 116 to Section 131 of the Companies Act.

The requirements of the Companies Act with respect to an 'Offering of shares and prospectus' are set out in Chapter VI, i.e. Section 142 to Section 169. For a rights offer one is not obliged to issue a prospectus but the London Stock Exchange requirements as set out in Schedule 11 Part B demand a clear and detailed explanation of the offer. The circular to members has to be approved by both the LSE and JSE and the letter of allocation which accompanies the circular has first to be lodged with the Registrar of Companies together with a rights offer document which complies with the JSE committee's requirements.

The Daggafontein Division plant site chosen for technical and economic reasons lies on a portion of the land owned by Ergo on the farm Daggafontein 125 IR. Thus Ergo was not faced with the problem of purchasing land for its plant site but, with the land being proclaimed land, it had to negotiate to use its land with the mining title holder.

The mining title over the land in question was held by East Dagga but the SRPs were controlled by Springs Dagga Gold Mines Limited, in which East Dagga had a 25% shareholding. Discussions were held with Springs Dagga to accommodate the surface use requirements of both parties.

It was agreed that East Dagga would abandon its SRP 49/70 (RMT 0171/69) and partially abandon its SRP 4/70 (RMT 093/69) and that the mining title holder would undertake to grant all consents as requested by the mining commissioner in respect of Ergo's application for Section 92 SRPs to use the land in question.

In return Ergo, as owners of the land, undertook to consent to Springs Dagga's applications for Section 90 SRPs for a plant site, hostel, roads, pipelines and power lines.

An Escom powerline traverses the proposed Daggafontein Division plant site but Escom have agreed to give up their statutory servitude, which is a praedial servitude, and to move the power line if Ergo, as land owner, grants a servitude along the perimeter of its plant site.

The site selected for the tailings dam lies across the Blesbokspruit from the plant site on land owned by Rand Rietfontein Estates. The land is proclaimed land and thus Rand Rietfontein conducts its farming activities in terms of SRP 83/43 (RMTSR 236) issued in terms of the Precious and Base Metals Act No. 35 of 1908 and SRP 171/72 (RMT 0160/71) issued in terms of Section 91 (surface rights for agriculture and afforestation) of the Act.

In addition, Rand Rietfontein is the holder of Trading Site SRP No. 51 (RMT 199) and Owners Reservation OR 119 No. 48 and OR 117 No. 49, all issued in terms of the 1908 Act.

Furthermore, Escom holds power line permits No. B11/66 (RMTSR 692) and B15/38 (RMTSR 164), both issued in terms of the 1908 Act, and the Transvaal Roads Department holds Road Servitude Permit No. B41/78 (SR PP 2414 (TPA)), which traverse the proposed slimes dam area.

Ergo has applied for a Section 92 SRP for tailings deposition purposes with Rand Rietfontein's consent and if this is granted, Rand Rietfontein will abandon its SRPs, owners reservation and trading site. Ergo is to pay compensation to Rand Rietfontein for abandoning these rights and it is to attempt to purchase the land, with the unsevered base mineral rights, if this is permitted in terms of the laws governing the sub-division of agricultural land.

The mining title holders have agreed to consent to Ergo's application, and negotiations with Transvaal Roads and Escom are in progress.

The land in question is leased to a farmer and Ergo will have to compensate the lessee as the maxim 'huur gaat voor koop' pertains, i.e. the lessee's rights endure in spite of the sale.

At the time of writing, all of the legal steps necessary for the establishment of the Daggafontein Division had been addressed but not all had been completed.

It can be seen from the contents of this chapter that many laws and regulations have to be complied with in establishing a dump reclamation project, especially those laws contained in the Mining Rights Act. Raising finance by way of a rights issue requires one to comply with the Companies Act, the articles of the company and stock exchange regulations.

14. CONCLUSION

The economic evaluation techniques, used to determine the returns from the proposed dump reclamation projects, proved to be invaluable in determining which projects ought to be undertaken and the order in which they should be done. The return from each of the projects was clearly shown and this left the management and board of Ergo in no doubt as to which projects to choose.

The Ergo Division carbon-in-leach plant was seen in the comparative study in chapter 8 to be the most attractive project on almost all counts. When the comparative study was done in mid-1983 it did not rank highest on the DCF yield criterion. A subsequent upward revision of the Daggafontein Division's capital requirements resulted, however, in the Ergo Division project being ranked first on the DCF yield criterion also.

On the strength of the economic evaluation exercises, Ergo's management and board opted for the Ergo Division carbon-in-leach plant as its first undertaking. The plant was completed almost on time and on budget in early 1985. The designed throughput of 66 000 tons per day was reached soon afterwards and by July equipment adjustments were being made to ensure a steady throughput with optimum recoveries. There was also every indication that the operating costs would be within budget.

Although the project was slightly behind schedule, the accurate capital cost estimate and the operating costs and recoveries achieved during commissioning indicated that the forecast project returns would be achieved. It is premature to declare that the project is a success but there is reason to be confident that the shareholders will receive the returns indicated in the economic evaluation exercise.

The economic evaluation exercises indicated that the Daggafontein Division project was the next most attractive. It was shown in chapter 9 that a number of alternative treatment methods and transportation routes were considered. Economic evaluation techniques facilitated the choosing of the most appropriate alternative.

It was stated in Ergo's annual report for 1985, published in June 1985, that construction of the carbon-in-leach plant at the Daggafontein Division began in January 1985. The rate of progress was reported to be dependent on the company's ability to finance the project mainly from current earnings and it was expected that commissioning of the first 500 000 tpm stream would commence early in 1987 - somewhat later than first expected. The second stream was expected to follow sometime in 1988. As a result of this deferment, the estimated escalated capital cost of the project increased from R118 million to R154 million.

The economic evaluation models again proved their worth as it was possible to re-evaluate the Daggafontein project using the updated estimates. This re-evaluation exercise was done to check that it was correct to continue with the project. The revised exercise indicated that the increase in the capital cost did not have a major impact. The delay, as well as an increase in mining taxation, did reduce the DCF yield and NPV and extend the pay-back period. Nevertheless, the project remained very attractive. The revised evaluation exercises were presented to the Ergo board in July 1985 and, as a result, they decided that the project should continue.

The economic and financial evaluation models proved to be most useful in determining how Ergo's expansionary projects should be financed. The economic evaluation exercises provided the basis for the financial evaluation exercise. The financial evaluation model facilitated the investigation of a number of alternatives. The level of borrowing and the timing of the conversion and redemption periods were optimised using the finanical evaluation model.

The results of the economic and financial evaluation exercises were published in a series of circulars to shareholders. More detailed evaluation information was given to the underwriters of the rights issues staged by Ergo and East Dagga. On the basis of the information published, mining analysts with financial institutions were able to conduct their own evaluation exercises. Most analysts were enthusiastic about the proposed projects and recommended that their clients follow their rights. The evaluation exercises played an important role in communicating the benefits of the projects and hence in persuading both the shareholders and the underwriters to invest in the project.

Other aspects besides the economic and financial issues had to be taken into account in deciding which projects Ergo should undertake. The economic evaluation exercises played the major role, however, in guiding the management and board of Ergo in their investment decision making. Now two years after the initial economic valuations were done, and, in spite of a number of changes in the capital and operating parameters, the management and board of Ergo appear to have made sound investment decisions. It will be five to ten years before one will know with certainty whether these projects provided a satisfactory return on the investments but there is no doubt that the economic evaluation techniques were invaluable in interpreting the technical, marketing and financial information available to the decision makers.

ERGO CARBON-IN-LEACH PLANT - FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983

YEAR ENDING MARCH

BASE CASE = TAX SHIELD AND NO GEARING

INFLATED CASE = GOLD PRICE = R15 000/KG

			1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
INPUT												
1 TONS TREATED		(T*000)	0	0	22200	22200	22200	22200	22200	22200	22200	22200
2 RECOVERED GRADE		(G/T)	.00	.00	.12	.12	.12	.12	.12	.10	.10	.10
3 GOLD PRODUCTION		(KG)	0	0	2664	2664	2664	2664	2664	2220	2220	2220
4 OPERATING COST		(R/T)	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
5 GOLD PRICE		(R*000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
6 CAPEX(PRE -TAX)		(R*000)	18200	30200	3600	250	250	250	250	250	250	250
7 CAPEX(POST-TAX)		(R*000)	5642	9362	1116	78	78	78	78	78	78	78
8 GOLD PRICE ESCALATION			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
9 COST ESCALATION			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10 CAPEX ESCALATION			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
11 INFLATION RATE			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
CALCULATIONS (CINF)												
12 CUMULATIVE GOLD ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13 CUMULATIVE COST ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14 CUMULATIVE CAPEX ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15 CUMULATIVE INFLATION ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
16 GOLD PRICE ESCALATED	(5*12)	(R*000)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
17 WORKING COSTS ESCALATED	(4*13)	(R/T)	.90	.90	.90	.90	.90	.90	.90	.90	.90	.90
18 LOAN		(R*000)	0	0	0	0	0	0	0	0	0	0
19 DEPOSIT		(R*000)	0	0	0	0	0	0	0	0	0	0
20 REVENUE	(3*16)	(R*000)	0	0	39960	39960	39960	39960	39960	33300	33300	33300
21 WORKING COSTS	(1*17)	(R*000)	0	0	19980	19980	19980	19980	19980	19980	19980	19980
22 INT PAID ON LOAN	(15.5%)	(R*000)	0	0	0	0	0	0	0	0	0	0
23 INT RECEIVED ON DEPOSIT	(14%)	(R*000)	0	0	0	0	0	0	0	0	0	0
24 TOTAL PROFIT BEFORE TAX		(R*000)	0	0	19980	19980	19980	19980	19980	13320	13320	13320
25 TAX RATE (60-(480/100P/R))*1.15		(%)	0	0	58	58	58	58	58	55	55	55
26 TAX		(R*000)	0	0	11580	11580	11580	11580	11580	7353	7353	7353
27 TAX ON INTEREST RECEIVED	(24*28)	(R*000)	0	0	0	0	0	0	0	0	0	0
28 TOTAL TAX	(26+27)	(R*000)	0	0	11580	11580	11580	11580	11580	7353	7353	7353
29 PROFIT AFTER TAX	(24-28)	(R*000)	0	0	8400	8400	8400	8400	8400	5967	5967	5967
30 REPAYMENT ON LOAN		(R*000)	0	0	0	0	0	0	0	0	0	0
31 CAPEX ESCALATED AFTER TAX	(7*14)	(R*000)	5642	9362	1116	78	78	78	78	78	78	78
32 YEARLY CASH FLOW		(R*000)	-5642	-9362	7284	8322	8322	8322	8322	5890	5890	5890
33 NPV 0% ESCALATED TERMS		(R*000)	-5642	-15004	-7720	602	8924	17246	25568	31458	37348	43238
34 CASH FLOW REAL TERMS	(32/15)	(R*000)	-5642	-9362	7284	8322	8322	8322	8322	5890	5890	5890
35 NPV 0% REAL TERMS		(R*000)	-5642	-15004	-7720	602	8924	17246	25568	31458	37348	43238
36 NPV 10% REAL TERMS		(R*000)	-5642	-14153	-4704	-3086	2077	6770	11037	13781	16275	18543
38 NPV 20% REAL TERMS		(R*000)	-5642	-13644	-9358	-5352	-2014	768	3086	4453	5591	6540
39 DCF IN REAL TERMS		(%)	.00	.00	.00	1.33	14.46	21.76	26.12	28.12	29.49	30.44

ENGO CARBON-IN-LEACH PLANT FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983

BASE CASE - TAX SHIELD AND NO GEARING

UNESCALATED CASE - GOLD PRICE = $15 000/KG

YEAR ENDING MARCH			1994	1995	1996	1997	1998	1999	2000	2001	TOTALS
INPUT											
1 TONS TREATED		(T*000)	22200	22200	22200	22200	22200	22200	22200	22200	355200
2 RECOVERED GRADE		(G/T)	.10	.10	.10	.08	.08	.08	.08	.08	.10
3 GOLD PRODUCTION		(KG)	2220	2220	2220	1776	1776	1776	1776	1776	35520
4 OPERATING COST		(R/T)	.90	.90	.90	.90	.90	.90	.90	.90	
5 GOLD PRICE		(R*000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	
6 CAPEX(PRE -TAX)		(R*000)	250	250	250	250	250	250	250	250	
7 CAPEX(POST-TAX)		(R*000)	78	78	78	78	78	78	78	78	17283
8 GOLD PRICE ESCALATION			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
9 COST ESCALATION			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
10 CAPEX ESCALATION			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
11 INFLATION RATE			.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
CALCULATIONS	(LINE)										
12 CUMULATIVE GOLD ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
13 CUMULATIVE COST ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
14 CUMULATIVE CAPEX ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
15 CUMULATIVE INFLATION ESCALATION			1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
16 GOLD PRICE ESCALATED	(5*12)	(R*000)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	
17 WORKING COSTS ESCALATED	(6*13)	(R/T)	.90	.90	.90	.90	.90	.90	.90	.90	
18 LOAN		(R*000)	0	0	0	0	0	0	0	0	
19 DEPOSIT		(R*000)	0	0	0	0	0	0	0	0	
20 REVENUE	(4*16)	(R*000)	33300	33300	33300	26640	26640	26640	26640	26640	532800
21 WORKING COSTS	(1*17)	(R*000)	19980	19980	19980	19980	19980	19980	19980	19980	319680
22 INT PAID ON LOAN	(15,5&)	(R*000)	0	0	0	0	0	0	0	0	0
23 INT RECEIVED ON DEPOSIT	(1&6)	(R*000)	0	0	0	0	0	0	0	0	0
24 TOTAL PROFIT BEFORE TAX		(R*000)	13320	13320	13320	6660	6660	6660	6660	6660	213120
25 TAX RATE (&0-(&&0/100P/H))*1.15		(&)	55	55	55	47	47	47	47	47	
26 TAX		(R*000)	7393	7393	7393	3125	3125	3125	3125	3125	117642
27 TAX ON INTEREST RECEIVED	(&&,26)	(R*000)	0	0	0	0	0	0	0	0	0
28 TOTAL TAX	(26+27)	(R*000)	7393	7393	7393	3125	3125	3125	3125	3125	117642
29 PROFIT AFTER TAX	(24-28)	(R*000)	5927	5927	5927	3535	3535	3535	3535	3535	95478
30 REPAYMENT ON LOAN		(R*000)	0	0	0	0	0	0	0	0	0
31 CAPEX ESCALATED AFTER TAX	(7*14)	(R*000)	78	78	78	78	78	78	78	78	17283
32 YEARLY CASH FLOW		(R*000)	5850	5850	5850	3458	3458	3458	3458	3458	78195
33 NPV 0% ESCALATED TERMS		(R*000)	49127	55017	60907	64365	67822	71280	74738	78195	
34 CASH FLOW REAL TERMS	(32/15)	(R*000)	5850	5850	5850	3458	3458	3458	3458	3458	78195
35 NPV 0% REAL TERMS		(R*000)	49127	55017	60907	64365	67822	71280	74738	78195	
36 NPV 10% REAL TERMS		(R*000)	20605	22479	24183	25091	25917	26668	27350	27971	
38 NPV 20% REAL TERMS		(R*000)	7330	7989	8538	8806	9030	9216	9371	9500	
39 DCF IN REAL TERMS		(%)	31.11	31.58	31.93	32.04	32.19	32.27	32.33	32.37	

APPENDIX 8

DAGGAFONTEIN DIVISION CARBON-IN-LEACH PLANT

BASE CASE

CONSTRUCTION START:SEP 1984 — TONS TREATED 1:1000000 TPM
COMMISSIONING DATE:OCT 1986 — GOLD PRICE R15000/KG
INITIAL CAPEX:R72.0 MILLION

YEAR ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO SEPTEMBER 1.1983

		1985	1986	1987	1988	1989	1990	1991	1992
GOLD									
TONS TREATED	(000)	0	0	6000	12000	12000	12000	12000	12000
RECOVERY GRADE	(G/T)	0	0	.2500	.3350	.3350	.3350	.3350	.2650
GOLD PRODUCED	(KG)	0	0	1500	4020	4020	4020	4020	2940
REVENUE PER KILOGRAM	(R)	0	0	15000	15000	15000	15000	15000	15000
COST PER KILOGRAM	(R)	0	0	7640	5701	5701	5701	5701	7796
COST PER TON TREATED	(R)	1.910	1.910	1.910	1.910	1.910	1.910	1.910	1.910
CAPEX (PRE -TAX)	(R)	5000,000	8330,000	23000,000	500,000	500,000	5000,000	500,000	5000,000
CAPEX (POST-TAX)	(R)	1860,000	13330,000	7140,000	93,000	93,000	1550,000	93,000	1550,000
GOLD PROFIT	(R'000)	0	0	11040	37380	37380	37380	37380	21180
TAXATION	(R'000)	0	0	6376	22464	22464	22464	22464	12180
NET PROFIT	(R'000)	0	0	4664	14916	14916	14916	14916	9000
CAPITAL EXPENDITURE	(R'000)	1860	13330	7140	93	93	1550	93	1550
NET CASH FLOW		-1860	-13330	-2476	14823	14823	13366	14823	7450
NPV 0%	(R'000)	-1860	-15190	-17666	-2842	11981	25347	40171	47621
NPV 10%	(R'000)	-1860	-13974	-16346	-6268	2950	10408	18010	21613
NPV 20%	(R'000)	-1860	-12984	-15220	-8081	-2131	2241	6373	8036
IRR	(%)	.00	.00	.00	.00	15.11	24.17	29.97	31.66

APPENDIX A

DAGGAFONTEIN DIVISION CARBON-IN-LEACH PLANT

BASE CASE

CONSTRUCTION START:SEP 1986
COMMISSIONING DATE:OCT 1986

TONS TREATED :1000000 TPM
GOLD PRICE :R150000/KG
INITIAL CAPEX:R72.0 MILLION

YEAR ENDING MARCH

FINANCIAL RESULTS DISCOUNTED TO SEPTEMBER 1.1983

		1993	1994	1995	1996	1997	1998	1999	TOTAL
GOLD									
TONS TREATED	(000)	12000	12000	12000	12000	12000	12000	12000	150000
RECOVERY GRADE	(G/T)	.2450	.1950	.1950	.1950	.1550	.1550	.1550	
GOLD PRODUCED	(KG)	2940	2340	2340	2340	1860	1860	1860	36060
REVENUE PER KILOGRAM	(R)	15000	15000	15000	15000	15000	15000	15000	
COST PER KILOGRAM	(R)	7795	9795	9795	9795	12323	12323	12323	
COST PER TON TREATED	(R)	1.910	1.910	1.910	1.910	1.910	1.910	1.910	
CAPEX (PRE -TAX)	(R)	300.000	300.000	5000.000	300.000	5000.000	300.000	300.000	94400.000
CAPEX (POST-TAX)	(R)	93.000	93.000	1550.000	93.000	1550.000	93.000	93.000	
GOLD PROFIT	(R*000)	21180	12180	12180	12180	6980	6980	6980	254600
TAXATION	(R*000)	12180	6467	6467	6467	1496	1496	1496	145678
NET PROFIT	(R*000)	9000	5713	5713	5713	3086	3086	3086	108922
CAPITAL EXPENDITURE	(R*000)	93	93	1550	93	1550	93	93	
NET CASH FLOW		8907	5620	4163	5620	1536	2993	2993	79458
NPV 0%	(R*000)	56538	62158	66322	71942	73478	76467	79458	
NPV 10%	(R*000)	25186	27850	28755	30542	30942	31727	32461	
NPV 20%	(R*000)	9756	10681	11140	11808	11922	12154	12347	
IRR	(%)	33.15	33.79	34.09	34.42	34.46	34.55	34.62	

WIDMA SCIMES DAM CASE (M3 FEASIBILITY STUDY) — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983

(UNESCALATED)

		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
****** INPUT ********											
1 TONS TREATED	(T*000)	0	0	0	0	0	9600	9600	9600	9600	9600
2 GOLD PRODUCED	(KG)	0	0	0	0	0	1285	1603	1603	1603	1603
3 COSTS	($/T)	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
4 CAPEX (BEFORE TAX)	($*000)	4000	4000	0	20000	41000	1000	1000	1000	1000	1000
5 CAPEX (AFTER TAX)	($*000)	2480	2480	0	6200	12710	310	310	310	310	310
6 GOLD PRICE	($*000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
7 GOLD ESCALATION RATE	($)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
8 WORKING COST ESCALATION RATE	($)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
9 CAPITAL ESCALATION RATE	($)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
10 INFLATION RATE	($)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
******* CALCULATIONS *********											
11 CUMULATIVE GOLD ESCALATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
12 CUMULATIVE COST ESCALATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
13 CUMULATIVE CAPITAL ESCALATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
14 CUMULATIVE INFLATION/DEFLATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
15 GOLD PRICE ESCALATED	($*000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
16 WORKING COST ESCALATED	($/T)	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85
17 CAPEX AFTER TAX ESCALATED	($*000)	2480.00	2480.00	0.00	6200.00	12710.0	310.00	310.00	310.00	310.00	310.00
18 GOLD REVENUE	($*000)	0	0	0	0	0	19275	24045	24045	24045	24045
19 TOTAL REVENUE	($*000)	0	0	0	0	0	19275	24045	24045	24045	24045
20 WORKING COSTS	($*000)	0	0	0	0	0	15280	17760	17760	17760	17760
21 TOTAL PROFIT BEFORE TAX(PBT)	($*000)	0	0	0	0	0	2995	6285	6285	6285	6285
22 EARNINGS PER SHARE (PBT/SIM)	($)	.00	.00	.00	.00	.00	.07	.15	.15	.15	.
23 TAX RATE	($)	0	0	0	0	0	33	48	48	48	48
24 TAX	($*000)	0	0	0	0	0	1003	3009	3009	3009	3009
25 NET PROFIT AFTER TAX	($*000)	0	0	0	0	0	1992	3276	3276	3276	3276
26 NET PROFIT PER SHARE(NPS/SIM)	($)	.00	.00	.00	.00	.00	.05	.08	.08	.08	.08
27 NET CASH FLOW IN CURRENT TERMS	($*000)	-2480	-2480	0	-6200	-12710	1682	2966	2966	2966	2966
28 NPV 0% CURRENT TERMS	($*000)	-2480	-4960	-4960	-11160	-23870	-20634	-17672	-14706	-11741	-8775
29 NPV 10% CURRENT TERMS	($*000)	-2255	-4278	-4023	-7254	-15150	-14200	-12678	-11295	-10037	-8894
30 NPV 8% CURRENT TERMS	($*000)	-2296	-4424	-4247	-8725	-18026	-16415	-14555	-12960	-11453	-10179
31 NPV 5% CURRENT TERMS	($*000)	-2367	-4714	-4711	-9702	-20410	-19267	-17819	-16230	-14155	-12676
32 NPV 3% CURRENT TERMS	($*000)	-2404	-4858	-4858	-9829	-20852	-19703	-18211	-16867	-15588	-13872
33 GRAF REAL TERMS	($*000)	-2480	-4960	0	-6200	-12710	1682	2966	2966	2966	2966
34 NPV 0% REAL TERMS	($*000)	-2480	-4960	-4960	-11160	-23870	-20634	-17672	-14706	-11741	-8775
35 NPV 5% REAL TERMS	($*000)	-2367	-4735	-4735	-9835	-21265	-17709	-14902	-12948	-10983	-9162
36 NPV 10% REAL TERMS	($*000)	-2255	-4023	-4023	-7254	-15150	-14200	-12678	-11295	-10037	-8894
37 NPV 15% REAL TERMS	($*000)	-2157	-3860	-3860	-6405	-12726	-11996	-10881	-9912	-9069	-8336
38 NPV 20% REAL TERMS	($*000)	-2067	-3714	-3713	-5702	-10810	-10267	-9519	-8730	-8155	-7676
39 IRR REAL TERMS	($)	.00	.00	.00	.00	.0	.00	.00	.00	.00	.00

APPENDIX C

WITHOK SLIMES DAM (JUNE '83 FEASIBILITY STUDY) FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983

UNESCALATED

		1994	1995	1996	1997	1998	1999	2000	2001	TOTAL
****** INPUT ******										
1 TONS TREATED	(T*000)	9600	9600	9600	9600	9600	9600	9600	8300	122700
2 GOLD PRODUCED	(KG)	1603	1603	1603	1603	1603	1603	1603	1386	20514
3 COSTS	(R/T)	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	
4 CAPEX (BEFORE TAX)	(R*000)	1000	1000	1000	1000	1000	1000	1000	1000	85000
5 CAPEX (AFTER TAX)	(R*000)	310	310	310	310	310	310	310	310	26350
6 GOLD PRICE	(R*1000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	
7 GOLD ESCALATION RATE	(%)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
8 WORKING COST ESCALATION RATE	(%)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
9 CAPITAL ESCALATION RATE	(%)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
10 INFLATION RATE	(%)	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	
******* CALCULATIONS *********										
11 CUMULATIVE GOLD ESCALATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
12 CUMULATIVE COST ESCALATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
13 CUMULATIVE CAPITAL ESCALATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
14 CUMULATIVE INFLATION/DEFLATION		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
15 GOLD PRICE ESCALATED	(R*1000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	
16 WORKING COST ESCALATED	(R/T)	1.85	1.85	1.85	1.85	1.85	1.85	1.85	1.85	
17 CAPEX AFTER TAX ESCALATED	(R*000)	310.00	310.00	310.00	310.00	310.00	310.00	310.00	310.00	
18 GOLD REVENUE	(R*000)	24045	24045	24045	24045	24045	24045	24045	20790	304560
19 TOTAL REVENUE	(R*000)	24045	24045	24045	24045	24045	24045	24045	20790	
20 WORKING COSTS	(R*000)	17760	17760	17760	17760	17760	17760	17760	15355	226995
21 TOTAL PROFIT BEFORE TAX(PBT)	(R*000)	6285	6285	6285	6285	6285	6285	6285	5435	77565
22 EARNINGS PER SHARE (PBT/4(M))	(R)	.15	.15	.15	.15	.15	.15	.15	.13	
23 TAX RATE	(%)	48	48	48	48	48	48	48	48	
24 TAX	(R*000)	3009	3009	3009	3009	3009	3009	3009	2603	36709
25 NET PROFIT AFTER TAX	(R*000)	3276	3276	3276	3275	3276	3276	3276	2832	40857
26 NET PROFIT PER SHARE(NPZ/(M))	(R)	.08	.08	.08	.08	.08	.08	.08	.07	
27 NET CASH FLOW IN CURRENT TERMS	(R*000)	2966	2966	2965	2966	2966	2966	2966	2522	
28 NPV 0% CURRENT TERMS	(R*000)	-5809	-2844	122	3088	6053	9019	11984	14507	
29 NPV 5% CURRENT TERMS	(R*000)	-7854	-6949	-6050	-5269	-4559	-3914	-3327	-2873	
30 NPV 10% CURRENT TERMS	(R*000)	-7806	-7122	-6516	-5980	-5595	-5087	-4715	-4436	
31 NPV 15% CURRENT TERMS	(R*000)	-7211	-6664	-6667	-6436	-6243	-6083	-5944	-5855	
32 NPV 20% CURRENT TERMS	(R*000)	-6207	-6030	-5982	-5405	-5848	-5806	-5770	-5747	
33 NPAT REAL TERMS	(R*000)	2966	2966	2965	2966	2966	2965	2966	2522	
34 NPV 0% REAL TERMS	(R*000)	-5809	-2844	122	3088	6053	9019	11984	14507	
35 NPV 5% REAL TERMS	(R*000)	-7428	-5777	-4294	-2706	-1280	74	1373	2621	
36 NPV 10% REAL TERMS	(R*000)	-7854	-6999	-6050	-5259	-4559	-3914	-3327	-2873	
37 NPV 15% REAL TERMS	(R*000)	-7098	-7134	-6662	-6043	-5679	-5562	-5286	-5082	
38 NPV 20% REAL TERMS	(R*000)	-7211	-6766	-6667	-6436	-6243	-6083	-5949	-5855	
39 IRR REAL TERMS	(%)	.00	.00	.10	2.19	3.80	5.07	6.08	6.79	

APPENDIX D

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST '83 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1.1983. GOLD PRICE ESCALATION = 10% (E. BELOW INFLATION

			1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
****** INPUT ********												
DAGGAFONTEIN PLANT												
TREATMENT RATE												
1 STREAM 1:7L2	(HEAD GRADE:0.536/T)	(T*000)	0	0	0	3600	6000	6000	6000	6000	6000	5700
2 6L13	(HEAD GRADE:0.446/T)	(T*000)	0	0	0	0	0	0	0	0	0	300
3 WITHOK	(HEAD GRADE:0.396/T)	(T*000)	0	0	0	0	0	0	0	0	0	0
4 6L14		(T*000)	0	0	0	0	0	0	0	0	0	0
5 6L16		(T*000)	0	0	0	0	0	0	0	0	0	0
6 STREAM 2:6L18	(HEAD GRADE:0.51G/T)	(T*000)	0	0	0	3600	6000	6000	6000	3100	0	0
7 6L20	(HEAD GRADE:0.496/T)	(T*000)	0	0	0	0	0	0	0	2900	6000	6000
8 6L19	(HEAD GRADE:0.436/T)	(T*000)	0	0	0	0	0	0	0	0	0	0
9 WITHOK	(HEAD GRADE:0.436/T)	(T*000)	0	0	0	0	0	0	0	0	0	0
10 6L17		(T*000)	0	0	0	0	0	0	0	0	0	0
11 7L5		(T*000)	0	0	0	0	0	0	0	0	0	0
12 7L7		(T*000)	0	0	0	0	0	0	0	0	0	0
13 7L6		(T*000)	0	0	0	0	0	0	0	0	0	0
14 TOTAL TONS TREATED		(T*000)	0	0	0	7200	12000	12000	12000	12000	12000	12000
15 GOLD RECOVERY GRADE STREAM 1		(G/T)	.000	.000	.000	.253	.274	.274	.274	.274	.274	.271
16 GOLD RECOVERY GRADE STREAM 2		(G/T)	.000	.000	.000	.244	.265	.265	.265	.250	.235	.235
17 GOLD PRODUCED		(KG)	0	0	0	1749	3234	3234	3234	3144	3054	3036
18 U3O8 PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
19 ACID PRODUCED		(TONS)	0	0	0	0	0	0	0	0	0	0
20 COSTS		(R/T)	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
21 CAPEX UNESCALATED		(R*000)	14000	7000	32000	16231	500	4000	1000	5000	3000	500
ERGO PLANT												
TREATMENT RATE												
22 STREAM 1: 6L14		(T*000)	0	0	0	0	0	0	0	0	0	0
23 6L17		(T*000)	0	0	0	0		0	0	0	0	0
24 6L16		(T*000)	0	0	0	0		0	0	0	0	0
25 7L5		(T*000)	0	0	0	0		0	0	0	0	0
26 7L7		(T*000)	0	0	0	0		0	0	0	0	0
27 7L6		(T*000)	0	0	0	0	0	0	0	0	0	0
28 TOTAL TONS TREATED		(T*000)	0	0	0	0	0	0	0	0	0	0
29 GOLD PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
30 U3O8 PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
31 ACID PRODUCED		(TONS)	0	0	0	0	0	0	0	0	0	0
32 COSTS		(R/T)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
33 CAPEX UNESCALATED		(R*000)	0	0	0	0	0	0	0	0	0	0
WITHOK PLANT												
34 TONS TREATED		(T*000)	0	0	0	0	0	0	0	0	0	0
35 GOLD PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
36 COSTS		(R/T)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
37 CAPEX UNESCALATED		(R*000)	0	0	0	0	0	0	0	0	0	0

ERGOS DAGGAFONTEIN PROJECT — PUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST '83 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
****** INPUT *******												
38 GOLD PRICE		(R'000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
39 URANIUM PRICE		(R/KG)	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
40 ACID PRICE		(R/TON)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
41 PRICE ESCALATION RATE		($)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
42 COST ESCALATION RATE		($)	.1200	.1255	.1332	.1267	.1241	.1000	.1000	.1000	.1000	.1000
43 CAPITAL ESCALATION RATE		($)	.1056	.1056	.1056	.1108	.1275	.1000	.1000	.1000	.1000	.1000
44 INFLATION RATE		($)	.1100	.1150	.1100	.1100	.1000	.1000	.1000	.1000	.1000	.1000
****** CALCULATIONS *******												
45 CUMULATIVE PRICE ESCALATION			1.10	1.21	1.33	1.46	1.61	1.77	1.95	2.14	2.35	2.59
46 CUMULATIVE COST ESCALATION			1.11	1.24	1.40	1.58	1.78	1.95	2.15	2.37	2.60	2.86
47 CUMULATIVE CAPITAL ESCALATION			1.10	1.21	1.34	1.49	1.68	1.85	2.03	2.24	2.46	2.71
48 CUMULATIVE INFLATION/DEFLATION			1.11	1.24	1.37	1.52	1.68	1.85	2.03	2.23	2.45	2.70
49 GOLD PRICE ESCALATED		(R'000/KG)	16.50	18.15	19.97	21.96	24.16	26.57	29.23	32.15	35.37	38.91
50 URANIUM PRICE ESCALATED		(R/KG)	66.00	72.60	79.86	87.85	96.63	106.29	116.92	128.62	141.48	155.62
51 ACID PRICE ESCALATED		(R/TON)	44.00	48.40	53.24	58.55	64.42	70.86	77.95	85.74	94.32	103.75
52 DAGGA PLANT-GOLD REVENUE		(R'000)	0	0	0	39294	78126	85938	94532	101092	108018	118119
53 U3O8 REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
54 ACID REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
55 TOTAL REVENUE		(R'000)	0	0	0	39294	78126	85938	94532	101092	108018	118119
56 OPERATING COSTS		(R'000)	0	0	0	21741	40731	44804	49285	54213	59635	65598
57 OPERATING PROFIT		(R'000)	0	0	0	17553	37395	41134	45248	46878	48383	52521
58 INITIAL CAPEX (PRE-TAX)		(R'000)	15488	8479	59795	24200	0	0	0	0	0	0
59 INITIAL CAPEX (POST TAX)		(R'000)	4755	2629	21547	7502	0	0	0	0	0	0
60 NEW WITHIN DAM CAPEX(P)		(R'000)	4293	4845	1478	0	0	0	0	0	0	0
61 ONGOING CAPEX (PRE-TAX)		(R'000)	0	0	0	0	861	7397	2034	11188	7396	1356
62 PROFIT BEFORE TAX		(R'000)	-19048	-7114	-23515	10051	36554	33737	43213	35690	40989	51165
63 ERGO PLANT- GOLD REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
64 U3O8 REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
65 ACID REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
66 TOTAL REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
67 OPERATING COSTS		(R'000)	0	0	0	0	0	0	0	0	0	0
68 OPERATING PROFIT		(R'000)	0	0	0	0	0	0	0	0	0	0
69 CAPEX		(R'000)	0	0	0	0	0	0	0	0	0	0
70 PROFIT BEFORE TAX		(R'000)	0	0	0	0	0	0	0	0	0	0
71 WITHOUT - GOLD REVENUE		(R'000)	0	0	0	0	0	0	0	0	0	0
72 OPERATING COSTS		(R'000)	0	0	0	0	0	0	0	0	0	0
73 OPERATING PROFIT		(R'000)	0	0	0	0	0	0	0	0	0	0
74 INITIAL CAPEX (PRE-TAX)		(R'000)	0	0	0	0	0	0	0	0	0	0
75 INITIAL CAPEX (POST TAX)		(R'000)	0	0	0	0	0	0	0	0	0	0
76 NEW TAIL. DAM CAPEX(P)		(R'000)	0	0	0	0	0	0	0	0	0	0
77 ONGOING CAPEX (PRE-TAX)		(R'000)	0	0	0	0	0	0	0	0	0	0
78 PROFIT BEFORE TAX		(R'000)	0	0	0	0	0	0	0	0	0	0

EKOUS DANGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST 1983 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION INVESTMENT AT EKOU. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1ST 1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	EAST DAGGA:											
79	INITIAL INVESTMENT	(R'000)	-4500	-4500	-12000	-4600	0	0	0	0	0	0
80	SALE PROCEEDS	(R'000)	0	0	0	8776	18277	18968	21607	17865	20499	25584
81	TAX	(R'000)	0	0	0	4055	8444	7793	9982	8246	9471	11820
82	NET PROFIT AFTER TAX	(R'000)	-4500	-4500	-12000	122	9833	9075	11624	9601	11029	13764
83	CASH FLOW ESCALATED TERMS	(R'000)	-4500	-9000	-20000	-19878	-10045	-970	10654	20255	31284	45048
84	INR ESCALATED TERMS	(%)	.00	.00	.00	.00	.00	.00	12.32	18.63	23.06	26.44
85	NPAT REAL TERMS	(R'000)	-4056	-7828	-8735	80	5862	4918	5727	4300	4491	5095
86	NPV 0% REAL TERMS	(R'000)	-4056	-6882	-15617	-15537	-9675	-4757	971	5271	9762	14857
87	NPV 5% REAL TERMS	(R'000)	-3861	-6426	-13972	-13906	-9113	-5643	-1572	1338	4233	7361
88	NPV 10% REAL TERMS	(R'000)	-3686	-6024	-12585	-12541	-8481	-6115	-3176	-1170	735	2699
89	NPV 15% REAL TERMS	(R'000)	-3529	-5666	-11487	-11361	-7867	-6120	-4167	-2762	-1485	-226
90	NPV 20% REAL TERMS	(R'000)	-3378	-5342	-10397	-10359	-7303	-5856	-4757	-3757	-2887	-2064
91	INR REAL TERMS	(%)	.00	.00	.00	.00	.00	.00	1.65	7.39	11.42	14.52
	EKOU:											
92	INITIAL INVESTMENT	(R'000)	-4548	-3614	-11515	-2906	0	0	0	0	0	0
93	TOTAL REVENUE	(R'000)	0	0	0	19294	78126	85938	96532	101092	108018	118119
94	LESS: TOTAL OPERATING COSTS	(R'000)	0	0	0	21741	60731	66806	69285	74213	79635	85598
95	TOTAL CAPEX COSTS	(R'000)	0	0	0	0	841	7397	2034	11188	7384	1354
96	AMOUNT PAID TO EKOU	(R'000)	0	0	0	8776	18277	18968	21607	17865	20499	25584
97	PROFIT BEFORE TAX	(R'000)	0	0	0	8776	18277	18968	21607	17865	20499	25584
98	TAX	(R'000)	0	0	0	3867	8054	8895	9690	8733	8142	11133
99	NET PROFIT AFTER TAX	(R'000)	-4548	-3614	-11515	1388	9978	9973	11915	11112	12317	14451
100	CASH FLOW ESCALATED TERMS	(R'000)	-4548	-8161	-19676	-17648	-7710	2263	14179	25291	37609	52060
101	INR ESCALATED TERMS	(%)	.00	.00	.00	.00	.00	3.68	16.41	22.46	27.08	30.11
102	NPAT REAL TERMS	(R'000)	-4097	-2920	-8382	1304	5949	5405	5871	4977	5015	5369
103	NPV 0% REAL TERMS	(R'000)	-4097	-7017	-15399	-14095	-8146	-2741	3130	8107	13122	18472
104	NPV 5% REAL TERMS	(R'000)	-3902	-6550	-13791	-12718	-8057	-4024	148	3517	6750	10034
105	NPV 10% REAL TERMS	(R'000)	-3725	-6138	-12435	-11545	-7451	-4900	-1787	-25	2662	4724
106	NPV 15% REAL TERMS	(R'000)	-3563	-5770	-11282	-10536	-7579	-5242	-3035	-1408	18	1340
107	NPV 20% REAL TERMS	(R'000)	-3414	-5442	-10292	-9664	-7273	-5483	-3825	-2667	-1695	-831
108	INR REAL TERMS	(%)	.00	.00	.00	.00	.00	.00	5.32	11.18	15.04	17.82

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST 1983 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983. GOLD PRICE ESCALATION = 15% IE. BELOW INFLATION

			1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
****** INPUT ********												
DAGGAFONTEIN PLANT												
TREATMENT RATE												
1 STREAM 1:7L2	(HEAD GRADE:0.53G/T)	(T*000)	0	0	0	0	0	0	0	0	0	0
2 6L13	(HEAD GRADE:0.44G/T)	(T*000)	6000	6000	6000	6000	6000	6000	6000	4600	0	0
3 WITHOK	(HEAD GRADE:0.39G/T)	(T*000)	0	0	0	0	0	0	0	1400	6000	6000
4 6L14		(T*000)	0	0	0	0	0	0	0	0	0	0
5 6L16		(T*000)	0	0	0	0	0	0	0	0	0	0
6 STREAM 2:6L1A	(HEAD GRADE:0.51G/T)	(T*000)	0	0	0	0	0	0	0	0	0	0
7 6L20	(HEAD GRADE:0.49G/T)	(T*000)	6000	6000	700	0	0	0	0	0	0	0
8 6L19	(HEAD GRADE:0.49G/T)	(T*000)	0	0	5300	6000	5800	0	0	0	0	0
9 WITHOK	(HEAD GRADE:0.39G/T)	(T*000)	0	0	0	0	200	6000	6000	6000	6000	6000
10 6L17		(T*000)	0	0	0	0	0	0	0	0	0	0
11 7L5		(T*000)	0	0	0	0	0	0	0	0	0	0
12 7L7		(T*000)	0	0	0	0	0	0	0	0	0	0
13 7L6		(T*000)	0	0	0	0	0	0	0	0	0	0
14 TOTAL TONS TREATED		(T*000)	12000	12000	12000	12000	12000	12000	12000	12000	12000	12000
15 GOLD RECOVERY GRADE STREAM 1		(G/T)	.205	.205	.205	.205	.205	.205	.206	.197	.167	.167
16 GOLD RECOVERY GRADE STREAM 2		(G/T)	.235	.235	.183	.176	.176	.167	.167	.157	.167	.167
17 GOLD PRODUCED		(KG)	2668	2668	2338	2292	2292	2238	2238	2184	2004	2004
18 U3O8 PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
19 ACID PRODUCED		(TONS)	0	0	0	0	0	0	0	0	0	0
20 COSTS		(R/T)	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91	1.91
21 CAPEX UNESCALATED		(R*000)	500	1000	7000	7000	2000	6000	6000	2000	500	500
ERGO PLANT												
TREATMENT RATE												
22 STREAM 1: 6L14		(T*000)	0	0	1001	6433	6867	0	0	0	0	0
23 6L17		(T*000)	0	0	0	0	5148	6415	6415	6433	6415	6415
24 6L16		(T*000)	0	0	0	0	0	0	0	0	0	0
25 7L5		(T*000)	0	0	0	0	0	0	0	0	0	0
26 7L7		(T*000)	0	0	0	0	0	0	0	0	0	0
27 7L6		(T*000)	0	0	0	0	0	0	0	0	0	0
28 TOTAL TONS TREATED		(T*000)	0	0	1001	6433	6415	6415	6415	6433	6415	6415
29 GOLD PRODUCED		(KG)	0	0	168	1083	925	894	895	897	896	895
30 U3O8 PRODUCED		(KG)	0	0	11187	71921	99214	104696	104696	104986	104696	104696
31 ACID PRODUCED		(TONS)	0	0	14109	90705	104023	123518	123518	123858	123518	123518
32 COSTS		(R/T)	.00	.00	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
33 CAPEX UNESCALATED		(R*000)	0	1500	2600	4000	2400	200	200	200	1700	1000
WITHOK PLANT												
34 TONS TREATED		(T*000)	0	0	0	0	0	0	0	0	0	0
35 GOLD PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
36 COSTS		(R/T)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
37 CAPEX UNESCALATED		(R*000)	0	0	0	0	0	0	0	0	0	0

EKOTS DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST 1983 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT EKOO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
****** INPUT *******												
38 GOLD PRICE	(R*000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
39 URANIUM PRICE	(R/KG)	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
40 ACID PRICE	(R/TON)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
41 PRICE ESCALATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
42 COST ESCALATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
43 CAPITAL ESCALATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
44 INFLATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
****** CALCULATIONS *******												
45 CUMULATIVE PRICE ESCALATION		2.85	3.14	3.45	3.80	4.19	4.61	5.07	5.58	6.14	6.75	7.42
46 CUMULATIVE COST ESCALATION		2.85	3.14	3.45	3.80	4.19	4.61	5.07	5.58	6.14	6.75	7.42
47 CUMULATIVE CAPITAL ESCALATION		2.85	3.14	3.45	3.80	4.19	4.61	5.07	5.58	6.14	6.75	7.42
48 CUMULATIVE INFLATION/DEFLATION		2.47	2.72	2.99	3.29	3.62	3.98	4.38	4.82	5.30	5.83	6.41
49 GOLD PRICE ESCALATED	(R*000/KG)	42.80	47.04	51.78	56.95	62.65	68.92	75.82	83.40	91.74	100.91
50 URANIUM PRICE ESCALATED	(R/KG)	171.19	188.31	207.14	227.85	250.63	275.70	303.27	333.60	366.95	403.65
51 ACID PRICE ESCALATED	(R/TON)	114.12	125.54	138.09	151.90	167.09	183.80	202.18	222.40	244.64	269.10
52 DAGGA PLANT-GOLD REVENUE	(R*000)	113240	124564	120869	130558	143614	158253	169679	182143	183864	202229
53 U308 REVENUE	(R*000)	0	0	0	0	0	0	0	0	0	0
54 ACID REVENUE	(R*000)	0	0	0	0	0	0	0	0	0	0
55 TOTAL REVENUE	(R*000)	113240	124564	120869	130558	143614	158253	169679	182143	183864	202229
56 OPERATING COSTS	(R*000)	72158	79374	87311	96042	105646	116211	127832	140615	154677	170144
57 OPERATING PROFIT	(R*000)	41082	45191	33559	34515	37969	41842	41847	41528	29186	32084
58 INITIAL CAPEX (PRE-TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
59 INITIAL CAPEX (POST TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
60 NEW MITHOK TAIL DAM CAPEX(M)	(R*000)	0	0	0	0	0	0	0	0	0	0
61 ONGOING CAPEX (PRE-TAX)	(R*000)	1484	1276	25221	27744	8721	28780	31558	11608	3193	3511
62 PROFIT BEFORE TAX	(R*000)	39593	43914	8338	6767	29248	13062	10289	29920	25975	28573
63 EKOO PLANT- GOLD REVENUE	(R*000)	0	0	8721	61677	57980	51669	67945	74837	82056	90303
64 U308 REVENUE	(R*000)	0	0	2317	16387	24866	28865	31751	35022	38619	42261
65 ACID REVENUE	(R*000)	0	0	1948	13778	14050	22702	24973	27546	30217	33239
66 TOTAL REVENUE	(R*000)	0	0	12987	91843	100896	113216	124569	137405	150891	165802
67 OPERATING COSTS	(R*000)	0	0	12579	88951	97577	107335	118069	130233	142963	157150
68 OPERATING PROFIT	(R*000)	0	0	407	2892	3319	5881	6501	7171	7928	8652
69 CAPEX	(R*000)	0	11794	8669	15857	10023	959	1056	1161	10853	7023
70 PROFIT BEFORE TAX	(R*000)	0	-11794	-8262	-12965	-6711	4921	5445	6011	-3025	1629
71 MITHOK - GOLD REVENUE	(R*000)	0	0	0	0	0	0	0	0	0	0
72 OPERATING COSTS	(R*000)	0	0	0	0	0	0	0	0	0	0
73 OPERATING PROFIT	(R*000)	0	0	0	0	0	0	0	0	0	0
74 INITIAL CAPEX (PRE-TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
75 INITIAL CAPEX (POST TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
76 NEW TAIL. DAM CAPEX(M)	(R*000)	0	0	0	0	0	0	0	0	0	0
77 ONGOING CAPEX (PRE-TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
78 PROFIT BEFORE TAX	(R*000)	0	0	0	0	0	0	0	0	0	0

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST 1983 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			1984	1985	1986	1987	1988	1989	2000	2001	2002	2003
	EAST DAGGA:											
79	INITIAL INVESTMENT	(R'000)	0	0	0	0	0	0	0	0	0	0
80	SALE PROCEEDS	(R'000)	19797	18009	2103	142	12965	5862	6456	16463	12231	14694
81	TAX	(R'000)	9146	8320	971	66	5981	2708	2983	7606	5651	6789
82	NET PROFIT AFTER TAX	(R'000)	10651	9689	1131	76	6965	3154	3473	8857	6580	7905
83	CASH FLOW ESCALATED TERMS	(R'000)	55599	65347	66518	66595	73559	76713	90186	89043	95623	103529
84	INR ESCALATED TERMS	(%)	28.19	29.20	29.29	29.29	29.82	29.92	29.99	30.09	30.18	
85	NPAT REAL TERMS	(R'000)	3584	2966	315	19	1601	659	660	1529	1033	1128
86	NPV 0% REAL TERMS	(R'000)	18491	21405	21719	21739	23339	23999	24658	26199	27221	28349
87	NPV 5% REAL TERMS	(R'000)	9656	11107	11276	11283	12053	12355	12643	13279	13547	14113
88	NPV 10% REAL TERMS	(R'000)	3955	4900	4991	4995	5379	5523	5653	5928	6097	6265
89	NPV 15% REAL TERMS	(R'000)	585	1004	1150	1153	1389	1420	1481	1605	1677	1746
90	NPV 20% REAL TERMS	(R'000)	-1582	-1249	-1220	-1218	-1114	-1079	-1049	-992	-959	-930
91	INR REAL TERMS	(%)	16.07	17.05	17.13	17.13	17.43	17.54	17.62	17.78	17.88	17.96
	ERGO:											
92	INITIAL INVESTMENT	(R'000)	0	0	0	0	0	0	0	0	0	0
93	TOTAL REVENUE	(R'000)	113240	126544	138851	222601	266510	267669	294249	319548	334536	348030
94	LESS: TOTAL OPERATING COSTS	(R'000)	72158	77374	89890	144943	203226	223566	265901	270868	276560	327294
95	TOTAL CAPEX COSTS	(R'000)	1489	15078	13476	43685	18751	29739	32713	12769	14064	10534
96	AMOUNT PAID TO EAST	(R'000)	19797	18009	2103	142	12965	5862	6456	16463	12231	14694
97	PROFIT BEFORE TAX	(R'000)	19797	12112	-2018	-6341	9590	8322	9178	19468	10713	15509
98	TAX	(R'000)	7407	1441	0	0	0	0	0	0	0	0
99	NET PROFIT AFTER TAX	(R'000)	12388	10671	-2018	-6341	9590	8322	9178	19468	10713	15509
100	CASH FLOW ESCALATED TERMS	(R'000)	66988	75078	74060	66720	76110	86632	93910	113278	123997	139506
101	INR ESCALATED TERMS	(%)	31.77	32.71	32.80	32.84	32.88	32.97	33.04	33.34	33.45	33.57
102	NPAT REAL TERMS	(R'000)	4169	3252	-561	-1703	2204	1739	1743	3362	1683	2213
103	NPV 0% REAL TERMS	(R'000)	22440	25803	25331	23728	25932	27671	29415	32777	34459	36673
104	NPV 5% REAL TERMS	(R'000)	12672	14282	13985	13175	14235	15032	15793	17190	17966	18690
105	NPV 10% REAL TERMS	(R'000)	6185	7231	7059	6837	7164	7543	7888	8492	8764	9057
106	NPV 15% REAL TERMS	(R'000)	2236	2866	2753	2526	2797	2983	3145	3417	3535	3670
107	NPV 20% REAL TERMS	(R'000)	-270	95	42	-83	61	155	233	359	412	470
108	INR REAL TERMS	(%)	19.34	20.32	20.10	19.40	20.16	20.35	20.53	20.79	20.89	21.01

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST 1983 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1983. GOLD PRICE ESCALATION = 10% RE. BELOW INFLATION

			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
****** INPUT ********												
DAGGAFONTEIN PLANT												
TREATMENT RATE												
1 STREAM 1:	DEAD GRADE:	(T*000)	1	0	0	0	0	0	0	0	0	0
2	DEAD GRADE:	(T*000)	0	0	0	0	0	0	0	0	0	0
3 WITHOR	DEAD GRADE:	(T*000)	5000	5000	5000	5000	5000	5000	3500	0	0	0
4		(T*000)	0	0	0	0	0	0	0	0	0	0
5		(T*000)	0	0	0	0	0	0	0	0	0	0
6 STREAM 2:	DEAD GRADE:	(T*000)	0	0	0	0	0	0	0	0	0	0
7	DEAD GRADE:	(T*000)	0	0	0	0	0	0	0	0	0	0
8	DEAD GRADE:	(T*000)	0	0	0	0	0	0	0	0	0	0
9 WITHOR	DEAD GRADE:	(T*000)	5000	5000	5000	5000	5000	5000	3500	0	0	0
10		(T*000)	0	0	0	0	0	0	0	0	0	0
11		(T*000)	0	0	0	0	0	0	0	0	0	0
12		(T*000)	0	0	0	0	0	0	0	0	0	0
13		(T*000)	0	0	0	0	0	0	0	0	0	0
14 TOTAL TONS TREATED		(T*000)	12000	12000	12000	12000	12000	12000	7000	0	0	0
15 GOLD RECOVERY GRADE STREAM 1		(G/T)	.167	.167	.167	.167	.167	.167	.167	.000	.000	.000
16 GOLD RECOVERY GRADE STREAM 2		(G/T)	.167	.167	.167	.167	.167	.167	.167	.000	.000	.000
17 GOLD PRODUCED		(KG)	2004	2004	2004	2004	2004	2004	1168	0	0	0
18 U3O8 PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
19 ACID PRODUCED		(T*95)	0	0	0	0	0	0	0	0	0	0
20 COSTS		(R/T)	1.91	1.91	1.91	1.91	1.91	1.91	1.91	.00	.00	.00
21 CAPEX UNESCALATED		(R*000)	500	500	500	500	500	500	500	0	0	0
ERGO PLANT												
TREATMENT RATE												
22 STREAM C:		(T*000)	0	0	0	0	0	0	0	0	0	0
23		(T*000)	59	0	0	0	0	0	0	0	0	0
24		(T*000)	6356	6433	6415	6415	6415	6433	6434	0	0	0
25		(T*000)	0	0	0	0	0	0	1581	5119	0	0
26		(T*000)	0	0	0	0	0	0	0	1296	6415	6433
27		(T*000)	0	0	0	0	0	0	0	0	0	0
28 TOTAL TONS TREATED		(T*000)	6415	6433	6415	6415	6415	6433	6415	6415	6415	6433
29 GOLD PRODUCED		(KG)	909	912	909	909	911	899	898	907	1022	1022
30 U3O8 PRODUCED		(KG)	80284	80277	80057	80057	80057	80277	88407	101363	56198	56353
31 ACID PRODUCED		(T*95)	120290	119154	120262	120262	120262	120594	107257	74587	100060	100337
32 COSTS		(R/T)	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30	3.30
33 CAPEX UNESCALATED		(R*000)	200	200	200	200	10000	10000	200	200	200	200
WITHOR PLANT												
34 TONS TREATED		(T*000)	0	0	0	0	0	0	0	0	0	0
35 GOLD PRODUCED		(KG)	0	0	0	0	0	0	0	0	0	0
36 COSTS		(R/T)	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
37 CAPEX UNESCALATED		(R*000)	0	0	0	0	0	0	0	0	0	0

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST '83 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
****** INPUT *******												
38	GOLD PRICE	(R*000/KG)	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
39	URANIUM PRICE	(R/KG)	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00	60.00
40	ACID PRICE	(R/TON)	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00
41	PRICE ESCALATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
42	COST ESCALATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
43	CAPITAL ESCALATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
44	INFLATION RATE	(%)	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000	.1000
****** CALCULATIONS *******												
45	CUMULATIVE PRICE ESCALATION		7.40	8.14	8.95	9.85	10.83	11.92	13.11	14.42	15.86	17.45
46	CUMULATIVE COST ESCALATION		8.17	8.98	9.88	10.87	11.96	13.15	14.47	15.91	17.50	19.25
47	CUMULATIVE CAPITAL ESCALATION		7.73	8.50	9.35	10.28	11.31	12.44	13.69	15.05	16.56	18.22
48	CUMULATIVE INFLATION/DEFLATION		7.71	8.48	9.33	10.26	11.28	12.41	13.65	15.02	16.52	18.17
49	GOLD PRICE ESCALATED	(R*000/KG)	111.00	122.10	134.31	147.75	162.52	178.77	196.65	216.31	237.95	261.74
50	URANIUM PRICE ESCALATED	(R/KG)	444.01	488.42	537.26	590.98	650.08	715.09	786.60	865.26	951.79	1046.96
51	ACID PRICE ESCALATED	(R/TON)	296.01	325.61	358.17	393.99	433.39	476.73	524.40	576.84	634.52	697.98
52	DAGGA PLANT-GOLD REVENUE	(R*000)	222452	244697	269166	296083	325691	358260	233168	0	0	0
53	U3O8 REVENUE	(R*000)	0	0	0	0	0	0	0	0	0	0
54	ACID REVENUE	(R*000)	0	0	0	0	0	0	0	0	0	0
55	TOTAL REVENUE	(R*000)	222452	244697	269166	296083	325691	358260	233168	0	0	0
56	OPERATING COSTS	(R*000)	182159	200375	220412	242453	266698	293368	196175	0	0	0
57	OPERATING PROFIT	(R*000)	40293	44322	48754	53629	58993	64892	36993	0	0	0
58	INITIAL CAPEX (PRE-TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
59	INITIAL CAPEX (POST TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
60	NEW WITHOK DAM CAPEX(*)	(R*000)	0	0	0	0	0	0	0	0	0	0
61	ONGOING CAPEX (PRE-TAX)	(R*000)	3864	4249	4674	5141	5655	6221	6843	0	0	0
62	PROFIT BEFORE TAX	(R*000)	31430	34573	38031	41834	46017	50619	30150	0	0	0
63	ERGO PLANT- GOLD REVENUE	(R*000)	100902	111315	122101	134296	148071	160752	176531	196198	243181	267468
64	U3O8 REVENUE	(R*000)	35647	39209	43011	47312	52044	57405	69541	87705	53488	59003
65	ACID REVENUE	(R*000)	45807	38704	43074	47382	52120	57490	56246	63025	63490	70033
66	TOTAL REVENUE	(R*000)	172156	189321	208187	228989	252235	275644	302317	326928	360160	396500
67	OPERATING COSTS	(R*000)	172465	190475	209166	230083	253091	278367	306240	336864	370550	407828
68	OPERATING PROFIT	(R*000)	-708	-1151	-979	-1095	-856	-3519	-3923	-9936	-10390	-12228
69	CAPEX	(R*000)	1565	1720	1889	2076	2283	2511	2737	3011	3312	3643
70	PROFIT BEFORE TAX	(R*000)	-2253	-3854	-2848	-3151	-113953	-127932	-6660	-12947	-13702	-15871
71	WITHOK - GOLD REVENUE	(R*000)	0	0	0	0	0	0	0	0	0	0
72	OPERATING COSTS	(R*000)	0	0	0	0	0	0	0	0	0	0
73	OPERATING PROFIT	(R*000)	0	0	0	0	0	0	0	0	0	0
74	INITIAL CAPEX (PRE-TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
75	INITIAL CAPEX (POST TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
76	NEW TAIL DAM CAPEX(*)	(R*000)	0	0	0	0	0	0	0	0	0	0
77	ONGOING CAPEX (PRE-TAX)	(R*000)	0	0	0	0	0	0	0	0	0	0
78	PROFIT BEFORE TAX	(R*000)	0	0	0	0	0	0	0	0	0	0

ERGO'S DAGGAFONTEIN PROJECT — PUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST 1983 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1.1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
	EAST DAGGA :											
79	INITIAL INVESTMENT	(R'000)	0	0	0	0	0	0	0	0	0	0
80	SALE PROCEEDS	(R'000)	15152	16523	18403	20129	-5481	-6674	13410	-3237	-3426	-3988
81	TAX	(R'000)	7000	7614	8456	9309	0	0	6195	0	0	0
82	NET PROFIT AFTER TAX	(R'000)	8152	8909	9947	10829	-5481	-6674	7215	-3237	-3426	-3988
83	CASH FLOW ESCALATED TERMS	(R'000)	111880	120570	130617	141247	135765	129092	136306	133070	129644	125676
84	IRR ESCALATED TERMS	(%)	30.25	30.30	30.35	30.39	30.39	30.36	30.37	30.37	30.37	30.36
85	NPAT REAL TERMS	(R'000)	1058	1049	1056	1056	-496	-538	529	-215	-207	-218
86	NPV 0% REAL TERMS	(R'000)	29408	40455	51511	62566	32041	31543	32971	31856	31649	31430
87	NPV 5% REAL TERMS	(R'000)	14492	14951	15195	15522	15179	15227	15364	15314	15263	15213
88	NPV 10% REAL TERMS	(R'000)	6608	6517	6553	6762	6717	6672	6712	6697	6686	6672
89	NPV 15% REAL TERMS	(R'000)	1902	1851	1893	1930	1915	1901	1913	1909	1905	1902
90	NPV 20% REAL TERMS	(R'000)	-467	-488	-472	-459	-466	-468	-465	-466	-467	-468
91	IRR REAL TERMS	(%)	18.02	18.08	18.12	18.15	18.15	18.13	18.14	18.14	18.14	18.13
	ERGO:											
92	INITIAL INVESTMENT	(R'000)	0	0	0	0	0	0	0	0	0	0
93	TOTAL REVENUE	(R'000)	396408	434018	477353	525071	577426	633908	535485	326928	360160	396500
94	LESS: TOTAL OPERATING COSTS	(R'000)	380023	396569	435628	479191	527110	580588	502415	330864	370550	408728
95	TOTAL CAPEX COSTS	(R'000)	5404	5948	6583	7197	11875	13063	9580	3011	3312	3643
96	AMOUNT PAID TO E.D.M	(R'000)	15152	16523	18403	20129	-5481	-6674	13410	-3237	-3426	-3988
97	PROFIT BEFORE TAX	(R'000)	14025	14927	16879	18554	-62461	-70640	10080	-9710	-10277	-11903
98	TAX	(R'000)	0	0	0	0	0	0	0	0	0	0
99	NET PROFIT AFTER TAX	(R'000)	14025	14927	16879	18554	-62461	-70640	10080	-9710	-10277	-11903
100	CASH FLOW ESCALATED TERMS	(R'000)	151531	165328	185407	203960	141500	70860	80940	71230	60953	49850
101	IRR ESCALATED TERMS	(%)	33.65	33.71	33.75	33.80	33.69	33.60	33.61	33.61	-4.02	-2.97
102	NPAT REAL TERMS	(R'000)	1420	1769	1810	1809	-5535	-5691	738	-966	-622	-655
103	NPV 0% REAL TERMS	(R'000)	38492	40261	42071	43880	38365	32654	33392	32746	32126	31489
104	NPV 5% REAL TERMS	(R'000)	19463	19968	20537	21098	19463	17863	18060	17895	17744	17593
105	NPV 10% REAL TERMS	(R'000)	9362	9540	9762	9966	9435	8957	9013	8969	8929	8892
106	NPV 15% REAL TERMS	(R'000)	4767	3869	3921	3986	3816	3666	3683	3670	3659	3649
107	NPV 20% REAL TERMS	(R'000)	509	541	569	592	534	494	489	485	482	479
108	IRR REAL TERMS	(%)	21.08	21.14	21.19	21.23	21.12	21.04	21.05	21.04	21.03	21.03

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST '83 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1,1983. GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			2014	2015	2016	2017
****** INPUT ********						
DAGGAFONTEIN PLANT						
TREATMENT RATE						
1 STREAM 1:7L2	(HEAD GRADE:0.53G/T)	(T*000)	0	0	0	0
2 6L13	(HEAD GRADE:0.44G/T)	(T*000)	0	0	0	0
3 WITHOK	(HEAD GRADE:0.39G/T)	(T*000)	0	0	0	0
4 6L14		(T*000)	0	0	0	0
5 6L16		(T*000)	0	0	0	0
6 STREAM 2:6L18	(HEAD GRADE:0.51G/T)	(T*000)	0	0	0	0
7 6L20	(HEAD GRADE:0.46G/T)	(T*000)	0	0	0	0
8 6L19	(HEAD GRADE:0.39G/T)	(T*000)	0	0	0	0
9 WITHOK	(HEAD GRADE:0.39G/T)	(T*000)	0	0	0	0
10 6L17		(T*000)	0	0	0	0
11 7L5		(T*000)	0	0	0	0
12 7L7		(T*000)	0	0	0	0
13 7L6		(T*000)	0	0	0	0
14 TOTAL TONS TREATED		(T*000)	0	0	0	0
15 GOLD RECOVERY GRADE STREAM 1		(G/T)	.000	.000	.000	.000
16 GOLD RECOVERY GRADE STREAM 2		(G/T)	.000	.000	.000	.000
17 GOLD PRODUCED		(KG)	0	0	0	0
18 U308 PRODUCED		(KG)	0	0	0	0
19 ACID PRODUCED		(TONS)	0	0	0	0
20 COSTS		(R/T)	.00	.00	.00	.00
21 CAPEX UNESCALATED		(R*000)	0	0	0	0
ERGO PLANT						
TREATMENT RATE						
22 STREAM 1: 6L14		(T*000)	0	0	0	0
23 6L17		(T*000)	0	0	0	0
24 6L16		(T*000)	0	0	0	0
25 7L5		(T*000)	0	0	0	0
26 7L7		(T*000)	6415	3265	0	0
27 7L6		(T*000)	0	3150	6415	1616
28 TOTAL TONS TREATED		(T*000)	6415	6415	6415	1616
29 GOLD PRODUCED		(KG)	1021	947	961	237
30 U308 PRODUCED		(KG)	58198	61716	63890	16086
31 ACID PRODUCED		(TONS)	100060	98603	75346	21273
32 COSTS		(R/T)	3.30	3.30	3.30	3.30
33 CAPEX UNESCALATED		(R*000)	200	200	200	200
WITHOK PLANT						
34 TONS TREATED		(T*000)	0	0	0	0
35 GOLD PRODUCED		(KG)	0	0	0	0
36 COSTS		(R/T)	.00	.00	.00	.00
37 CAPEX UNESCALATED		(R*000)	0	0	0	0

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED

AUGUST '83 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. DATA

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1983. GOLD PRICE ESCALATION = 10% IO. BELOW

			2014	2015	2016	2017
****** INPUT *******						
38 GOLD PRICE	(R*000/KG)		15.00	15.00	15.00	15.00
39 URANIUM PRICE	(R/KG)		60.00	60.00	60.00	60.00
40 ACID PRICE	(R/TON)		40.00	40.00	40.00	40.00
41 PRICE ESCALATION RATE	(%)		.1000	.1000	.1000	.1000
42 COST ESCALATION RATE	(%)		.1000	.1000	.1000	.1000
43 CAPITAL ESCALATION RATE	(%)		.1000	.1000	.1000	.1000
44 INFLATION RATE	(%)		.1000	.1000	.1000	.1000
****** CALCULATIONS *******						
45 CUMULATIVE PRICE ESCALATION			19.19	21.11	23.23	25.55
46 CUMULATIVE COST ESCALATION			21.18	23.30	25.63	28.19
47 CUMULATIVE CAPITAL ESCALATION			20.04	22.04	24.24	26.67
48 CUMULATIVE INFLATION/DEFLATOR			19.99	21.99	24.19	26.61
49 GOLD PRICE ESCALATED	(R*000/KG)		287.92	316.71	348.38	383.22
50 URANIUM PRICE ESCALATED	(R/KG)		1151.66	1266.83	1393.51	1532.86
51 ACID PRICE ESCALATED	(R/TON)		767.77	844.55	929.01	1021.91
52 DAGGA PLANT-GOLD REVENUE	(R*000)		0	0	0	0
53 U3O8 REVENUE	(R*000)		0	0	0	0
54 ACID REVENUE	(R*000)		0	0	0	0
55 TOTAL REVENUE	(R*000)		0	0	0	0
56 OPERATING COSTS	(R*000)		0	0	0	0
57 OPERATING PROFIT	(R*000)		0	0	0	0
58 INITIAL CAPEX (PRE-TAX)	(R*000)		0	0	0	0
59 INITIAL CAPEX (POST TAX)	(R*000)		0	0	0	0
60 NEW WITHOK DAM CAPEX(M)	(R*000)		0	0	0	0
61 ONGOING CAPEX (PRE-TAX)	(R*000)		0	0	0	0
62 PROFIT BEFORE TAX	(R*000)		0	0	0	0
63 ERGO PLANT- GOLD REVENUE	(R*000)		293961	296754	292985	90822
64 U3O8 REVENUE	(R*000)		64721	78183	89031	26855
65 ACID REVENUE	(R*000)		76823	74630	69997	21739
66 TOTAL REVENUE	(R*000)		435505	449567	452014	139416
67 OPERATING COSTS	(R*000)		448366	493202	542523	150332
68 OPERATING PROFIT	(R*000)		-12860	-43635	-90509	-13085
69 CAPEX	(R*000)		4007	4418	4849	5336
70 PROFIT BEFORE TAX	(R*000)		-16868	-47843	-95358	-18420
71 WITHOK - GOLD REVENUE	(R*000)		0	0	0	0
72 OPERATING COSTS	(R*000)		0	0	0	0
73 OPERATING PROFIT	(R*000)		0	0	0	0
74 INITIAL CAPEX (PRE-TAX)	(R*000)		0	0	0	0
75 INITIAL CAPEX (POST TAX)	(R*000)		0	0	0	0
76 NEW TAIL DAM CAPEX(M)	(R*000)		0	0	0	0
77 ONGOING CAPEX (PRE-TAX)	(R*000)		0	0	0	0
78 PROFIT BEFORE TAX	(R*000)		0	0	0	0

ERGO'S DAGGAFONTEIN PROJECT — DUMP ACQUISITION COSTS TREATED AS SUNK COSTS

AUGUST '83 SCHEME: CIP TREATMENT AT DAGGA AND FLOTATION TREATMENT AT ERGO. TOTAL OPERATION

YEARS ENDING MARCH — FINANCIAL RESULTS DISCOUNTED TO APRIL 1983. — GOLD PRICE ESCALATION = 10% IE. BELOW INFLATION

			2014	2015	2016	2017
	FAST DAGGA:					
79	INITIAL INVESTMENT	(R'000)	0	0	0	0
80	SALE PROCEEDS	(R'000)	-4217	-11961	-23840	-4605
81	TAX	(R'000)	0	0	0	0
82	NET PROFIT AFTER TAX	(R'000)	-4217	-11961	-23840	-4605
83	CASH FLOW ESCALATED TERMS	(R'000)	121459	109499	85659	81054
84	IRP ESCALATED TERMS	(%)	30.35	30.35	30.35	30.35
85	NPAT REAL TERMS	(R'000)	-215	-546	-986	-173
86	NPV 0% REAL TERMS	(R'000)	31219	30575	29690	29517
87	NPV 5% REAL TERMS	(R'000)	15166	15062	14855	14822
88	NPV 10% REAL TERMS	(R'000)	6661	6635	6592	6586
89	NPV 15% REAL TERMS	(R'000)	1499	1493	1483	1482
90	NPV 20% REAL TERMS	(R'000)	-869	-870	-873	-873
91	IRR REAL TERMS	(%)	18.13	18.13	18.12	18.12
	ERGO:					
92	INITIAL INVESTMENT	(R'000)	0	0	0	0
93	TOTAL REVENUE	(R'000)	435506	449767	452014	137216
94	LESS: TOTAL OPERATING COSTS	(R'000)	448366	491202	542523	150302
95	TOTAL CAPEX COSTS	(R'000)	4007	4404	4849	5334
96	AMOUNT PAID TO ERGO/M	(R'000)	-4217	-11961	-23840	-4605
97	PROFIT BEFORE TAX	(R'000)	-12651	-35882	-71519	-13815
98	TAX	(R'000)	0	0	0	0
99	NET PROFIT AFTER TAX	(R'000)	-12651	-35882	-71519	-13815
100	CASH FLOW ESCALATED TERMS	(R'000)	36399	517	-71002	-44817
101	IRR ESCALATED TERMS	(%)	-2.02	-.02	.00	2.78
102	NPAT REAL TERMS	(R'000)	-643	-1632	-2957	-519
103	NPV 0% REAL TERMS	(R'000)	88836	29204	26284	25729
104	NPV 5% REAL TERMS	(R'000)	17453	17111	16520	16421
105	NPV 10% REAL TERMS	(R'000)	8859	8782	8654	8634
106	NPV 15% REAL TERMS	(R'000)	3641	3622	3593	3589
107	NPV 20% REAL TERMS	(R'000)	477	472	465	464
108	IRR REAL TERMS	(%)	21.02	21.02	21.00	21.00

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