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A COMPUTERIZED ANALYSIS FOR THE NEGOTIATION OF A COAL AGREEMENT

By

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ABSTRACT

Before construction is started on a mine, the expected profitability of the project must be determined. To obtain a profitable status, the product, in this case coal, must be sold under the terms of a long-term contract agreement. The company personnel who negotiate and sign the agreement should be knowledgeable in the field of financial analysis. However, the complexity of mining agreements requires the involvement of various disciplines including legal and engineering, where knowledge of financial analysis is not required. This investigation was designed to present a procedure that could be used by non-financially oriented personnel for evaluating profitability.

A computer program was developed for computing a discounted cash flow rate of return analysis for the proposed coal mine. The values for the input factors to the program were based on previous experience or past trends with adjustments for future years. The net present value and the rate of return were computed for the base year. If the net present value is positive and the rate of return is larger than the minimum base rate set by management for investments, the project is considered to be profitable. However, because of the complexity of the mineral industry, the involved factors in the financial analysis do not remain constant over a long period of time.

To consider these variations, each factor was varied individually by a fixed percentage using a sensitivity analysis. The sensitivities of

the net present value and the rate of return to the variation of the factors are found from this analysis. The factors can then be used for input for the simulation and risk analysis.

The simulation and risk analysis utilized the discounted cash flow rate of return method and a simulation technique with random numbers to evaluate the chance of success for a project. The values of the factors are allowed to vary randomly within a pre-determined range. After many simulations the possibility of success or failure can be evaluated. Further analysis were conducted on negative net present values and rates of return less than the minimum discount rate set by the company to establish the influential factors for further assessment.

For this investigation, a base case utilizing a coal mine in Wyoming was developed for the financial analysis studies. A sensitivity analysis was conducted for those factors that affect the net present value and rate of return and are not expected to remain constant over long periods of time. Factors determined to be sensitive were varied within a pre-determined range using random numbers for 500 simulations. These results were used to determine the possible success or failure of the mine and whether the company should attempt to develop it.

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INTRODUCTION

Most companies when considering developing a mine try to obtain a long-term contract agreement to sell the mineral as soon as the deposit is declared of economic value. An agreement is important to both the buyer and the seller. For the buyer it insures a secure supply of a continuous quantity of a mineral with constant quality and a stable and predictable price. The seller is guaranteed the sale of a certain tonnage of the mineral over a long period of time enabling the company to protect its profits and rate of return.

Importance

The importance of developing an equitable agreement can only be realized if the complexity of the mining industry using coal as the representative mineral, is understood. The coal industry contains many influences, some of which exist in other industries, but not all in one industry. This combination of influences is what makes the mineral or coal industry unique. The influences include: (1) depletion of the individual deposits (raw material quantity), (2) heterogeneous distribution of the resource (raw material quality), (3) projects having high uncertainty and risk associated with them, (4) long time delay between discovery and production, (5) impacts on the environment, (6) capital intensiveness, (7) problems caused by the required location, (8)

policies on taxation, (9) government regulations, (10) need for all skilled labor, (11) involvement of international trade, (12) involvement of national security, (13) no secondary source of supply, and (14) both co-products and by-products may be involved.

Therefore, when analysts attempt to utilize the same techniques and procedures for analyzing a coal mining project as would be used for an industrial or manufacturing project, the results can be very misleading. Also, since the first long-term agreement between Peabody Coal Co. and Kansas City Power & Light Co. was signed in 1913, agreements have been getting more intricate.

Table 1 (1)[1] is a list by year of the increasing number of different clauses contained in agreements. Appendix A contains several clauses from actual agreements used in the coal industry. These clauses are not the most complex nor the simplest. In general, the statement can be made that as time passes, most clauses and therefore agreements become more complex. Only those clauses affecting economic factors, such as price, will be given.

As the list of clauses increases, the number and types of negotiators increase. Types of negotiatiors include lawyers, engineers, costing personnel, and administrators. Some of these negotiators will have little economic background and are unaware of how certain influences listed affect a long-term mining agreement.

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[1]Numbers in parentheses are references.

TABLE 1

MAJOR CLAUSES IN SAMPLE CONTRACTS (1)

CONTRACT CLAUSE	YEAR CONTRACT IS SIGNED							
	1965	1966	1967	1971	1972	1973	1974	1975
Source of Coal	X	X	X	X	X	X	X	X
Contract Length	X	X	X	X	X	X	X	X
Quantity and Delivery	X	X	X	X	X	X	X	X
Quality	X	X	X	X	X	X	X	X
Price	X	X	X	X	X	X	X	X
Price Adjustment	X	X	X	X	X	X	X	X
BTU Content Adjustment	X	X	X	X	X	X	X	X
Force Majeure	X	X	X	X	X	X	X	X
Gross Inequities	X	X	X	X	X	X	X	X
Transportation		X	X	X	X	X	X	X
Cancellation Clause		X	X	X	X	X	X	X
Taxes (Sales, Use, Other)		X	X	X	X	X	X	X
Compliance With Law				X	X	X	X	X
Records and Audits				X	X	X	X	X
Equal Employment					X	X	X	X
Inspection of Seller's Operation by Buyers						X	X	X
Price Renegotiation Clause			X	X				
Price Controls Eventuality								X
Efficiency Requirement In Equipment								X

X=Clause is contained in contract

Source: Analysis of Steam Coal Sales and Purchases, Energy Resource Development, Office of Coal, Federal Energy Administration, April 1975.

One of the more significant influences listed above, unique to a mine, is the long lead time from discovery to production. Not only do buildings have to be built, but the mine itself has to be developed which normally takes several years. The sequence of events during mine development requires the selection of the mining method and the establishment of the buyer of the coal as soon as the geologic characteristics of the deposit are determined and the amount of reserves are computed.

Following this selection is the time required for legal problems related to permitting and licensing. An Environmental Impact Statement of some type and all required hearings must be held along with the required engineering studies which can take up to several years.

Preliminary design to determine equipment needs is next. Delivery time according to several equipment manufacturers for surface mining varies from nine months to two years or longer depending on size and complexity of the equipment. The preparation plant will normally require about six months to a year for delivery of the equipment. Detailed design, construction of the surface structures, and mine development can take four or more years.

Although some of these events can take place simultaneously, it takes a surface mine from five to fifteen years from time of discovery to production of coal. In economic terms, the mine could be started in a period of prosperity and come on line in prosperity with a depression in the middle. This long lead time means the risks are high with many

uncertainties. A situation with long lead times requires any agreements to be long term establishing some form of stability. Anything leading to large unexpected expenditures can change the status of a property from economic to uneconomic if they are not planned for in advance. For instance, if a severance tax is enacted with no provisions for profit margins or if a law is passed requiring major changes in past procedures or equipment, the mine could easily become uneconomical.

The increased complexity and number of factors that affect a mine have led to many studies on mine costing by the U. S. Bureau of Mines. Most of these studies cover a particular mining situation or discuss methods for computing cash flows, net present values and rates of return and do not cover sensitivity or probability procedures nor agreements.

Objective

Based on the importance of the long term agreement and the requirement that all the negotiators understand the factors involved in the agreement, this thesis will combine an explanation of the economic factors in a typical agreement with a method for determining how the economic factors influence the net present value (NPV) and the rate of return (ROR). A secondary objective will be to make this thesis a useful tool for non-economists to use in understanding and assessing the economic factors in an agreement and their relationship to the potential profitability of the mine. Definitions of economic terms used in this

thesis are given in Appendix B. These objectives were developed because nearly all reports cover either discussions of agreements or financial analysis methods but rarely both. Also, most of these reports are written for economists and may not be easily understood by non-economists.

Scope

To obtain the objectives of this thesis, the economic factors and other influential non-economic factors contained in long-term coal agreements are investigated using a model of a surface coal mine located in Wyoming. Clauses from typical agreements showing the various factors are examined.

The non-economic factors covered are the quantity (production) of coal required, the quality of the coal, and the time involved to develop and put the mine into production. Economic factors described are the price, escalation values, capital costs, operating costs, loans, interest, minimum acceptable discount rate, depreciation, depletion, tax rate, royalty rate, and bonus payment. These factors are divided into factors that are controllable by the company and those that are uncontrollable.

To assess the influence of the factors, a discounted cash flow rate of return analyses (DCFROR) is performed on the values assigned to the various factors. A base case is first developed and then a sensitivity

analysis is conducted. Next, a simulation is completed with the factors being allowed to vary over certain ranges.

This type of approach should aid non-economists in assessing what happens to the various factors when an agreement is being negotiated. Also, this approach adjusted for different situations can be used as a tool for forecasting or planning other mines.

MINE MODEL AND AGREEMENT ECONOMIC FACTORS

In order to achieve the objective of the thesis a cash flow model of a coal mining investment is developed, controllable and uncontrollable factors are defined, and procedures to enable a non-eonomist to understand the influence of economic factors on the results of a financial analysis are discussed.

Mine Model

For this investigation, only a surface coal mine is modeled. A mine capable of an output of 5 million tons per year was selected for this study. A mine of this size can supply a 1,000 megawatt electric power-plant for 20 years. Mines of this size are normally located in the western states where the coal is subbituminous and low in sulfur. In this thesis, the coal has an average calorific value of 9,500 BTU per pound and a sulfur content averaging 0.5 percent by weight. The mine model is located in the Powder River Basin in the state of Wyoming. (2, 3)

Overall the Basin deposits are considered flat, less than 10° dip; however, the relief of an individual deposit may be irregular. The average thickness of the coal seam selected is 25 feet. Also a second seam 10 feet thick lies 15 feet below the first seam. For this mine, the

overburden is less than 120 feet. A stripping ratio of 3 to 1 will be used for cost analysis.

The mining operation will consist of topsoil removal, overburden removal, mining the coal, transportation to the tipple, and reclamation of the mined land. All of the overburden and coal will be drilled and blasted before it is removed by dragline and shovel-truck operations, respectively. The topsoil will be removed by a scraper-dozer operation. For the above operations, partially wet conditions will be assumed. This means water could be encountered during certain times of the year.

Reclamation and road construction will be accomplished with the same equipment that removed the topsoil. The original power transmission lines and the initial road construction are expensed.

The coal preparation plant will only clean and size the coal for loading into silos for transfer to unit trains for shipment to the customer's power plant. This thesis will not discuss transportation rates and will consider the price of the coal as FOB at the mine.

More details on dragline, shovel-truck and scraper-dozer operations can be found in many textbooks. (4, 5, 6) Further discussion of the mining method will not be given in this thesis; however, a list of equipment and related costs used in the mining and preparation of the coal is given for costing purposes in Appendix C. (3) These costs are in constant 1979 dollars. Apepndix C also includes the working capital required for construction which is included in the total capital cost.

Any operating mine will require an annual operating budget. A list of the personnel by title required to operate the mine with estimated benefits and wages is given in Appendix C with a separate table containing the total annual operating costs that are anticipated.

These tables in the Appendix list the basic mine cost data for establishing the model. Table 2 is a summary of the cost data in Appendix C. The data will be analyzed by an economic method entitled Discounted Cash Flow Rate of Return (DCFROR).

TABLE 2

SUMMARY COST DATA

Total Capital Cost	$145,825,811
Total Depreciable Cost	$ 49,634,664
Exploration	$ 2,000,000
Development	$ 4,000,000
Annual Operating Cost	$ 29,061,765
Annual Labor and Supervision	$ 2,629,400

Agreements

Several different types of agreements are being used in the mining industry. These agreements are called Base Price Plus Escalation, Market Price, Annual Price Nomination, and Cost-Plus. (7) Most widely used today is the Base Price Plus Escalation. A list of advantages and

disadvantages to the buyer and seller of this method are given in Table 3. The major reasons for rejecting the other types of agreements follow (Definitions of these agreements are in Appendix B). Market price agreements can seriously penalize an efficient operator for conditions beyond his control. Annual Price Nomination keeps both buyer and seller continuously at the negotiating table. A Cost-Plus agreement requires constant monitoring, auditing and knowledge of coal mining by the utility to insure efficiency.

After the type of agreement is selected, the clauses that are needed must be developed. A master list of clauses for this type of agreement is outlined in Table 4. Clauses of special interest to this thesis are those containing economic factors that affect the cost of mining the coal and the price of selling the coal. Examples of some of the clauses are given in Appendix A. (7)

The introduction, term, quantity and quality clauses affect the price but they do not contain economic factors and will not be discussed in detail. The same is true of the clauses covering contract reopeners, invoice and payment, force majeure, records and audits, arbitration, and legal technicalities.

Economic factors in the clauses concerning the base price, escalation, and invoice price are the main concern of this thesis. The next section will cover the important economic factors outlined in these clauses in Appendix A and in Table 4.

TABLE 3

ADVANTAGES AND DISADVANTAGES
OF BASE PRICE PLUS ESCALATION AGREEMENT (7)

UTILITY (BUYER)		COAL COMPANY (SELLER)	
Advantages	Disadvantages	Advantages	Disadvantages
Rate of price increase is controlled by controlled by contract escalation provisions (usually tied to government indices. Some Risks are assumed by buyer.	If producer's costs fall, or do not grow at rate of change of indices, overpricing relative to costs exists. If producer's costs exceed escalation treatment by a large margin, it may be necessary to renegotiate prices.	Assuming some risk, and carefully arranging profit components it may be possible to earn a higher return on investment. Less involvement in mine affairs by utility. Difficult-to-estimate costs such as compliance with legilsation.	If costs rise or grow faster than rate of change of indices, underpricing relative to costs exists. Can be difficult to administer if tied to many government indices. Requires experience to negotiate effectively.

TABLE 4

MASTER LIST OF

COAL PURCHASE AGREEMENT CLAUSES (7)

INTRODUCTION

- Recitals
- Agreement
- Dedication on Reserves
- Buyer's Obligation to Purchase
- Source of Seller's Coal
- Seller's Diligence (Efficient Miner)
- Place of Delivery and Sale

TERM

- Primary Term
- Extensions

QUANTITY

- Total Quantity
- Weighing
- Scheduling (Monthly - Weekly)
- Interruptions of Scheduled Shipments

QUALITY

- Typical
- Rejection Limits
- Sampling & Analysis
- Calculation of Average Calorific Value
- Premium/Penalty

BASE PRICE AND ESCALATION CLAUSES

- Introduction
- Costs Related to Labor Rates & Fringes
- Costs Related to
  - BLS Producer Price Indices
  - Materials & Supplies
  - Depreciation & Depletion
  - Insurance
  - Value of Reserves Depleted
  - Interest

TABLE 4 (Cont.)

- Income Taxes
- Return on Investment
- Costs Related to Energy
- Costs Related to Federal, State, and Local Taxes
- Costs Related to the Sales Price of Coal
  - Royalty
- New Costs
- Changes in Contract Services
- Changes in Parent Company Charges
- Changes in the Coal Depletion Allowance
- Changes in Indices
- Sample Calculations

INVOICE PRICE

- Adjusted Base Price
- Premium/Penalty and Quality Adjustment
- Spot Market Bonus
- Adjustment by Negotiation
- Final Invoice Price

CONTRACT REOPENER

- Mining Conditions-Productivity
- Market
- Gross Inequity
- Union Affiliation
- Changes in Laws

INVOICING & PAYMENT

FORCE MAJEURE

RECORDS & AUDITS

ARBITRATION

LEGAL TECHNICALITIES

Economic Factors

Several clauses in Appendix A include factors which are base values and directly affect the economics of the mine. Two such factors are the quantity and quality of the coal to be sold. The quantity of the coal to be sold on a per year basis (production) compared to the total reserves leased by the company determines the life of the mine which becomes a constant value in the determination of the cash flows for the mine. Production is a factor that could be fluctuated throughout the life of the mine but the need for stability in the agreement requires the production be set at the time of the negotiations.

The starting time for the development of the mine is normally controlled by the company and based on other factors that will allow the company to make the highest profit or rate of return. Between the starting time and production, the schedule is semi-rigid with only a small allowance for variations.

The quality will fluctuate within a certain range because of the variation of the characteristics of the coal. Coal characteristics which are most important to the quality of the coal are heat content (BTU), ash, moisture, and sulfur. This factor leads to penalty charges if the quality is lower than the range allows and to premiums if it is higher; therefore, directly affecting the price of the coal.

Since this thesis is examining the agreements at the time it is negotiated, all factors will be examined in the short term. This means

that at the time of the negotiations on an agreement, the factor may or may not be controllable by either the buyer or the seller. In the long term, all factors are controllable at some time either internally or by influencing external company contacts.

A list of controllable and uncontrollable factors is given in Table 5 and used in the clauses in Appendix A. The first factor, price, is semi-controllable. The base price is negotiated but is based on the prevailing market price. (1) Since the price must cover all costs for the seller to make a profit, price escalation clauses (Appendix A) must be included. These clauses are negotiation provisions for the mining companies as costs escalate.

Costs, whether exploration, development, capital or operating, are controllable by the seller. Equipment expenditures will determine capital costs and ultimately influence the companies' cash flow. How all of the economic factors (price, costs, etc.) are manipulated in a DCFROR analysis will be explained in the chapter entitled "Procedures". Operating costs include labor, benefits, supplies, and overhead expenses and affect the companies' cash flow on a yearly basis. For most companies, labor and benefits are the largest cost components followed by supplies.

The size or wealth of the mining company will determine if a loan is required to cover the capital costs. Therefore, the amount of any loan is controllable by the company but the interest rate on the loan is not. Interest rates are controlled by the economy and financial institutions.

TABLE 5

CONTROLLABLE AND UNCONTROLLABLE ECONOMIC FACTORS

	Controllable		Uncontrollable
1.	Price (Limited Controllability)	1.	Interest on Loans
2.	Capital Investment	2.	Depletion
3.	Operating Costs	3.	Tax Schedule
4.	Exploration Costs	4.	Escalation Factors
5.	Development Costs		
6.	Loans		
7.	Minimum Acceptable Discount Rate		
8.	Depreciation Method		
9.	Bonus Payment		
10.	Royalty Rate		

A minimum acceptable discount rate is completely controlled by the company. This rate is determined internally and is based on corporate financing costs and past experience, containing a management fee, a risk adjustment for inflation, and a financial market factor. (8) This discount rate is the percent return on investment that a company feels it can make on alternative projects.

Although there are several depreciation methods, the one which depreciates the equipment most rapidly will be used. The selected method will give the largest tax deductions in the beginning years of the mine resulting in a faster recovery of capital costs for the company.

There are two methods to compute depletion but only the one that gives the greatest tax deduction can be used. This factor is, therefore, listed as uncontrollable.

Tax rates are always uncontrollable by the company as they are set by the government. Royalty rates are mixed. If the mine is on government land, the royalty rate is set and uncontrollable. If the mine is on private land, the rate is negotiable but is generally about the same value as set by the government.

Escalation factors and indices are not controllable by the company but depend on the national economy or the market. These factors change with time and a multitude of unrelated factors not covered in this thesis.

When the DCFROR analysis is complete, the NPV for the coal mine is determined. From this value a bonus payment to the buyer can be made.

The payment can be part or all of the NPV but never more or the mine will be uneconomical.

Analytical Procedures

The procedures used in this investigation for the financial analysis of a coal mine model utilizes a computer program and the DCFROR method of analysis. The development of the program included starting with an existing program for a foreign coal mine and converting it to fit the coal mine model in this investigation. This was accomplished by changing the input of many of the variables and retaining only the formulas for the cash flow calculations. To this revised program a simulation section was added so that the economic factors could be changed within pre-determined limits using random numbers. With this revised program a single cash flow could be calculated or if the simulation procedure were used, a cash flow could be calculated for each iteration. The final program is given in Appendix D. This program is written in the fortran language using the Focal-10 procedures and run at the Colorado School of Mines Computer Center. (9)

This analysis takes into account the time value of money and allows for the expenditures and revenues to be made at various times throughout the life of the mine. (10) A cash flow is generated for each year of pre-production or development work and for each year the mine is in production. Pre-production cash flows are negative and production flows

are usually positive. These cash flows can then be discounted to a present value for the mining operation. If the mine is profitable, the present value is positive.

The determination of several of the factors described in the previous section will be explained; particularly, depreciation, depletion, investment tax credits, capitalized and expensed factors, and escalation factors. All costs related to the depreciation and depletion will be capitalized.

The method selected for the depreciation of the tangible property of the mine is called "Accelerated Cost Recovery System" (ACRS) and was developed for the 1981 U.S. Tax Law. The tangible property includes equipment and buildings used for managing the mine; and mining, cleaning, and storing the coal. The rates for determining the amount of depreciation are given in Table 6. The depreciable values computed by the computer program in Appendix D are based on the equipment costs and years of life given in Table C1.

Depletion will be computed both by the cost method and the percent method with the method giving the greater tax deduction being used. For coal the percentage depletion allowed is 10 percent. Depletion includes acquisition costs and lease costs.

The investment tax credit will be taken for this mine model. This tax credit will be taken on all of the equipment which is listed in Table C1. Since all of the equipment will be used for 5 years or more, the full 10 percent will be used.

TABLE 6

ACRS PROPERTY DEPRECIATION RATES (10)

PROPERTY PLACED IN SERVICE, 1981-84	Applicable Percentage			
If the recovery year is:	3-Year	5-Year	10-Year	15-Year Public Utility
1	25	15	8	5
2	38	22	14	10
3	37	21	12	9
4		21	10	8
5		21	10	7
6			10	7
7			9	6
8			9	6
9			9	6
10			9	6
11				6
12				6
13				6
14				6
15				6

All exploration and development costs will be expensed. Exploration costs consist of those expenses related to proving the coal exists, the quantity and the quality of the coal. Development costs fall between the exploration and the production phases.

The price was determined as an average for mines sited in Wyoming from a series of "Coal Week" pamphlets published by McGraw-Hill Publications located in New York City. The royalty is based on royalties from Federal and private leases, and the tax rate is an average value for mines located in Wyoming.

The minimum discount rate for this investigation was selected arbitrarily. In the past it has varied between 8 and 22 percent for long term projects. The lower the inflation rate and less risk, the lower will be the discount rate.

When all economic factors have set values, a base case will first be developed and the NPV and ROR determined. This analysis is only one solution and may or may not represent the optimal mine.

The next analysis will be conducted varying only one factor at a time. Although this is not realistic in the business world, it will indicate how sensitive the NPV and the ROR are to the factor under investigation.

Using the simulation technique with the DCFROR method of analysis the risk of starting a mining project can be more fully evaluated. This technique uses repeated applications of a mathematical model where each application changes certain variables over a specified range to obtain a

series of results which are representative of possible situations. Each of the simulations can be considered a sensitivity analysis because the economic factors are changed within a certain range. If many simulations are completed, the most occurring NPV's can be established, and the risk of an unknown solution occurring that has not been assessed is reduced.

After the factor values, net present values, and rates of return are computed, the negotiator or company analysts can isolate those simulations which resulted in negative NPV's. For each of these NPV's, the values of the factors can be examined to determine if individually or in combinations they are realistic. Probabilities could be added or the values changed and new simulations completed for a more complete evaluation.

MODEL ANALYSIS USAGE IN NEGOTIATING AGREEMENTS

The first step in this financial analysis of the surface coal mine model will be the establishment of values for the economic factors. Using these factors in a DCFROR analysis will establish a base case. The factors involved are then varied individually for a sensitivity analysis. The last part of the analysis will include a simulation analysis where more than one factor is varied and many cash flows are generated. This procedure first establishes the base case, then determines the factors having the most influence on the NPV and ROR, and assesses the risk in undertaking a possible uneconomical venture.

Base Case

Using the computer program given in Appendix D, the NPV and the ROR were determined for the base case. These values were determined in both escalated and constant dollar values. (10) Escalated dollar values refer to actual dollars of revenue or cost that will be realized or incurred at specified future points in time. Constant dollar values refer to hypothetical constant purchasing power dollars obtained by calculating the present worth of escalated dollar values at the inflation rate to some arbitrary point in time. This time is normally the beginning of the project.

Constant dollar analysis requires more calculations than escalated dollar analysis and has one potential intangible advantage. During inflationary times a given constant dollar minimum ROR is always less than the equivalent escalated dollar minimum ROR. Therefore, it may be easier to convince a buyer to accept paying the price needed to get a certain constant dollar ROR rather than a higher but equivalent escalated dollar ROR for a given rate of inflation. Since both analyses result in the same present value and economic conclusion, the advantage of the constant dollar analysis can be considered as a negotiable advantage to be used when an agreement is being developed. In this computer program the NPV from the escalated analysis does not exactly equal the value from the constant dollar analysis. The reason for this small difference is the way in which the computer converts escalated dollar ROR to constant dollar ROR. If i=Escalated Dollar ROR the factor is $(1/(1+i))^n$. But in the Constant Dollar ROR i'=(1+i)/(1+f)-1 where f is the inflation rate and two calculations to obtain the factors are required; $(1/(1+f))^n(1/(1+i'))^n$. These two calculations do not give the exact same value as the one calculation.

The values used in this base case analysis were taken as those most likely to occur based on many sources as covered in the analytical procedures section. The base case values are given in Table 7. The operating costs for an actual coal mine will vary from year to year. For this thesis the operating cost will be considered as an average value obtained over the life of a typical coal mine.

TABLE 7

VALUES FOR BASE CASE FACTORS

Price = $16.00

Operating Cost = $29,061,000

Tax Rate = 50%

Royalty = 12%

Minimum Discount Rate = 10% (Escalated Dollars)
= 3% (Escalated Dollars)

Escalation Factors:

- Price Factor = 7%
- Cost Factor = 7%
- Replacement Factor = 7%
- Investment Factor = 7%

Inflation Rate = 7%

Depletion = 10%

Investment Cost Distribution

- Year 1 = 32%
- Year 2 = 48%
- Year 3 = 10%
- Year 4 = 5%
- Year 5 = 5%

Amount of Loan = 25% of Investment

Interest on Loan = 15%

Several assumptions were made in the base case DCFROR analysis. The first assumption is a company planning to build this mine would have to be a multimillion dollar corporation. A company of this size would have other mines to cover the preproduction exploration and development costs incurred by this coal mine; therefore, no losses are carried forward.

The size of the company allows the base case analysis to be completed two ways. One way with a loan and the other, without a loan. The values of the escalation factors used are average values based on past experience and used in industry when an exact starting date is unknown. The starting date given in this analysis was selected only because the program requires a date be used. These values are also used during preliminary analysis where exact values are not required.

With this assumption and values, two base case analyses were completed; one with a loan and one without. A complete analysis of each are given in Appendix E and the NPV's and ROR's are listed in Table 8. The printouts in Appendix E are typical of all analyses performed in this thesis. The first analysis in Appendix E is without a loan and the second one is with a loan.

Based only on these results (Table 8), the project or mine would be developed. The NPV is positive for both cases and the RORs for both cases are greater than the required minimum discount rate of 10 percent for escalated dollars and 3 percent for constant dollars. A positive NPV indicates the profit the company will make on the mine, while the ROR

TABLE 8

BASE CASE RESULTS

I. Without a Loan

A. Escalated (Minimum Discount Rate = 10%)

1. Net Present Value = $26,912,000
2. Rate of Return = 12%

B. Constant (Minimum Discount Rate = 3%)

1. Net Present Value = $25,265,000
2. Rate of Return = 4.7%

II. With a Loan

A. Escalated (Minimum Discount Rate = 10%)

1. Net Present Value = $51,791,000
2. Rate of Return = 15%

B. Constant (Minimum Discount Rate = 3%)

1. Net present Value = $52,098,000
2. Rate of Return = 7.5%

indicates the mine will return more profit to the company than if the money was invested at 10 percent interest.

The company under these circumstances could pay a bonus payment of up to the amount of the NPV and break even. This bonus payment may be the deciding factor as to whether or not the mining company can purchase the coal deposit on which to base the agreement for selling the mined coal. However, if the bonus payment needed is large and the sales agreement requires a low price, the mining project could be unprofitable.

The influence of a loan reduces the amount of money required immediately and the payments are spread out over time. The reduction in the initial investment through the use of borrowed money is leverage. Borrowing money is desirable but risks are attached. Changes in any factor that affect an economic analysis will cause a larger percent variation in a leveraged DCFROR than in a cash investment DCFROR. Therefore, leverage can reduce profits as fast as they were created. Using leverage is desirable as long as the after-tax cost of borrowed money is less than the cash investment DCFROR of the project. (10) A second reason for the influence of the loan factor is that interest payments are considered operating costs which help to reduce taxes.

In escalated dollars when this mining project is funded within the company, the project with a minimum discount rate of 10 percent has a NPV of $26,912,000 and a ROR of 12% (Table 8). If a loan is obtained for one quarter of the investment cost the NPV increases to $51,791,000 with a minimum discount rate of 10 percent, a 92% change in the value. The ROR

also increases to a new rate of 15 percent, a 25 percent change in the rate. This exercise shows how critical the time value of a large amount of money is to a DCFROR analysis.

At this point in the model analysis an additional assumption is made that although the company is large and has other mines to charge the preproduction costs to, the company will borrow money and take the risks in order to obtain the higher ROR and NPV. The base case for all other analyses will contain a loan value of 25 percent of the investment costs at 15 percent interest (Appendix E and Table 8).

In summary, the base case was made using the most likely to occur value for each factor. Anytime a financial analysis of this type is to be undertaken a base case analysis should be the first step. If the project appears to be profitable, the next step is to determine the sensitivity of the NPV and the ROR to the other factors which may vary.

Sensitivity Analysis

Sensitivity is determined by varying one factor at a time. The NPV and ROR are determined in escalated dollars as each factor is varied by the same percentage (Table 9). For this study all factors were varied by 10%. Table 10 is a listing of the factors ranked by percentage of change and direction of change in the NPV and Table 11 is a ranked list of factors relating to the ROR and the direction of change in the rate.

TABLE 9

NET PRESENT VALUE AND RATE OF RETURN RESULTS
FOR SENSITIVITY ANALYSIS

Value	Base %Change	Value		New Value	Net Present Value	Factor DCFROR(%)
Price	$16.00				$26,912,000	12.0
		10		$17.60	60,956,000	14.1
Royalty	12%				26,912,000	12.0
		10		13.2%	22,270,000	11.7
Tax Rate	50%				26,912,000	12.0
		10		55%	13,179,000	11.1
Minimum Discount Rate	10% (Escalated Dollars)	10		11%	26,912,000 12,183,000	12.0 12.0
Operating Costs	$29,061	10		$31,967	25,912,000 14,137,000	12.0 11.1
Escalations Price (PE) Investment (IE) Replacement (RE) Cost (CE)						
All	7%				26,912,000	12.0
IE, RE, CE	7%	10	PE	7.7%	46,765,000	13.1
PE, RE, CE	7%	10	IE	7.7%	25,652,000	11.9
PE, IE, CE	7%	10	RE	7.7%	23,807,000	11.8
PE, IE, RE	7%	10	CE	7.7%	19,462,000	11.5
Loan	$40,799,000	(1/4 Investment)				
Interest	15%				51,791,000	15.0
		10		16.5%	51,472,000	15.0
Interest	15%				51,791,000	15.0
Loan	$40,799,000	10		$44,879,000	54,279,000	15.4

TABLE 10

ECONOMIC FACTORS RANKED BY PERCENT OF CHANGE IN NET PRESENT VALUE AS THE FACTORS ARE CHANGED BY 10 PERCENT

Factor	Controllable	% Change in NPF	Direction Of Change
Price	Within Limits	126	Direct
Price Escalation	No	74	Direct
Minimum Discount Rate	Yes	55	Inverse
Tax Rate	No	51	Inverse
Operating Costs	Yes	47	Inverse
Cost Escallation	No	28	Inverse
Royalty	Yes	17	Inverse
Replacement Escalation	No	12	Inverse
Investment Escalation	No	5	Inverse
Loan Amount	Yes	5	Direct
Loan Interest	No	0.6	Inverse

TABLE 11

ECONOMIC FACTORS RANKED BY PERCENT OF CHANGE IN RATE OF RETURN AS THE FACTORS ARE CHANGED BY 10 PERCENT

Factor	Controllable	% Change in ROR	Direction Of Change
Price	Within Limits	17.5	Direct
Price Escalation	No	9.2	Direct
Tax Rate	No	7.5	Inverse
Operating Costs	Yes	7.5	Inverse
Cost Escalation	No	4.2	Inverse
Loan Amount	Yes	2.7	Direct
Royalty	Yes	2.5	Inverse
Replacement Escalation	No	1.7	Inverse
Investment Escalation	No	0.8	Inverse
Minimum Discount Rate	Yes	0	No Change
Loan Interest	No	0	No Change

Price and the price escalation factors affect the NPV more than the other factors. This result could have been anticipated since the price and its related escalation factor are the only influences on the yearly revenue in a cash flow analysis if the production remains constant. This factor puts money into the project every year in the form of revenue, and all expenses are subtracted from the revenue. By escalating the price at a higher rate than costs, the company is able to increase its profits while selling the same amount of coal. The company is really increasing profits at a faster rate than inflation is increasing costs.

These two factors (price and price escalation) also have the greatest influence on the ROR for the same reasons. If the company is earning more per ton of coal, the return of the investment will increase if the same tonnage is sold.

The amount of the loan is the only other factor studied directly affecting the NPV and the ROR. Loans spread the payments for investments into the future as stated in the previous section where money has a reduced value.

All of the other factors are inversely related to both the NPV and the ROR. The exception to this statement are the interest on the loan and the minimum discount rate which do not change the rate of return.

At this point in the analysis a negotiator can assume the mining project will make a profit for the company. This decision is based on the base case where the NPV is positive and the ROR is larger than the minimum discount rate selected by the company.

But the base case is only one combination of values for the various factors. In the business world these factors do not remain constant. This statement is what makes the sensitivity analyses just completed important. From this analysis, it can be shown how each factor affects the overall results when changed. By varying each factor the same amount, a ranking from the most influential to the least can also be developed (Table 10 and 11). An example would be the price which if increased causes the NPV and ROR to increase. Price also has the most influence on the NPV and the ROR of all the factors evaluated according to this sensitivity analysis.

With the breakdown of factors into controllable and uncontrollable (Table 5), the negotiator can determine which ones can be manipulated during the negotiations for an agreement (Tables 10 and 11) and which are more sensitive to any change.

From the factors studied, the negotiator will know that the price is the most important factor, that it directly affects the NPV and ROR, and that it is controllable within limits. Tax rates are also important, inversely affecting the NPV and ROR and are not controllable during negotiations. After being involved in many negotiations the company may want to change the tax rates, etc., but will have to accomplish this in the long term through legislation which is beyond the scope of this thesis.

However, before completing the agreement, the negotiator and the company will want to know if the base case is the exception or the normal

situation. Also, what if some of the uncontrollable factors are changed by external bodies (governments-federal, state, local; etc.), over the life of the contract could the effects of these changes make the mine unprofitable. These types of questions lead into a simulation analysis where more than one factor can be varied at one time which realistically resembles the business world. This type of analysis will help determine the risk of the mining project and is the subject of the next section.

Simulation and Risk Analysis

Risk in this investigation is the unforseen deviation of individual factors used in cash flow analysis from their expected values which could lead to the failure of a project. The remainder of this section will include a procedure for evaluating risk by simulation. This procedure is different than taking a random sampling of a population. Random sampling means that the population is defined. Then sampling proceeds by taking items from the population by some system that is in no way dependent upon the characteristics of the items chosen, so that the presence in the sample of any particular item is left entirely to chance. Simulation of a system is defined as the operation of a model which is a representation of the system. This model is amenable to manipulations which would be impossible, too expensive or impractical to perform. The operation of the model can be studied and properties concerning the behavior of the system can be inferred. (11) In simpler terms, simulation is a numerical

technique for conducting experiments on a computer, which involves certain types of models that describe the behavior of a system over extended periods of time.

Two variables in mining establish it as a high risk industry. The first is the capital intensity of the industry. Fortune magazine ranks mining companies high in assets per employee and last in annual sales per dollar of invested capital. According to economists this situation means the industry is capital intensive. Second is the long lead time from discovery to production. This lead time was discussed earlier but needs to be reemphasized. The longer the time lapse before production, the more opportunities there are for the factors involved to vary.

Although there is no better system than "good managerial judgment," management does need some method to reduce the uncertainties by evaluating the risks involved in developing a successful project.

One method of evaluation would be to use discrete values for the factors in a DCFROR analysis. Each factor's value would vary to cover all possible combinations of values that could be anticipated. This method would be feasible if there were only one or two factors that could vary and the variance consisted of only a few values. Unfortunately, this situation does not exist in the mining industry where a number of factors could all change at the same time. Also in today's economy the values can vary in many ways and some values might be omitted if only discrete values were used. Therefore, the method of using discrete values becomes impractical very quickly.

In order to avoid problems from discrete values, the factors will be considered to have continuous values. This means an infinite number of values can be assumed within specified ranges. A computer and a simulation program generating random numbers are required for this type of procedure to be allowed. The simulation program is given in Appendix D.

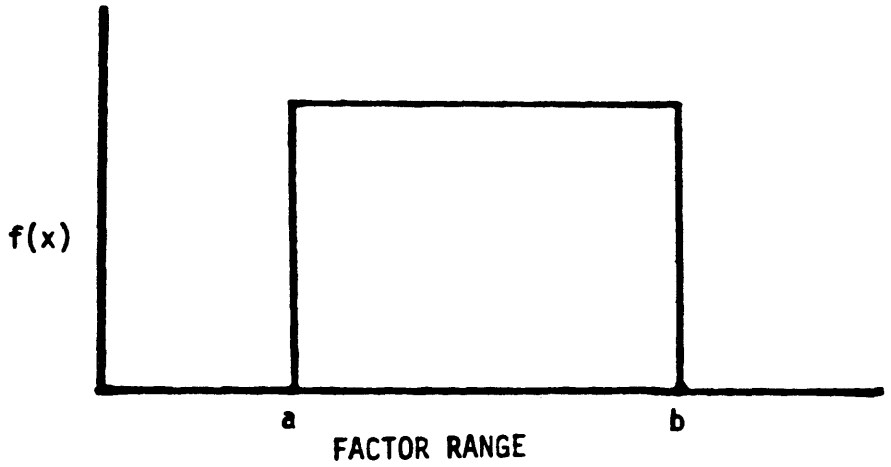
The ranges for the variable factors are given in Table 12, and were based on past fluctuations of the factors. The minimum discount rate was held constant at 10 percent escalated dollars for this simulation analysis. With the present economic situation in this country, any value within these ranges was no more likely to occur than any other value. Using this approach means that the original probabilities of obtaining a certain value are unknown to the company and the negotiators. Therefore, this could be considered a range approach with a large number of sensitivity analyses.

However, if the assumption is restated that all values have the same chance of occurring, then the probability for each factor equals one. The present evaluation could be considered a Monte Carlo simulation where all of the probabilities are equal. This decision means that each of the factors are uniformly distributed. The density and cumulative distribution functions are shown in Figure 1. The distribution function is based on the probability that $P(a \leq x \leq b) = \int_a^b f(x)dx = F(X)$. Since this is a uniform distribution $\int_a^b f(X)dx = 1$ and $f(X) = 1/(b-a)$, which is the basis for the values from the random number generator. (12)

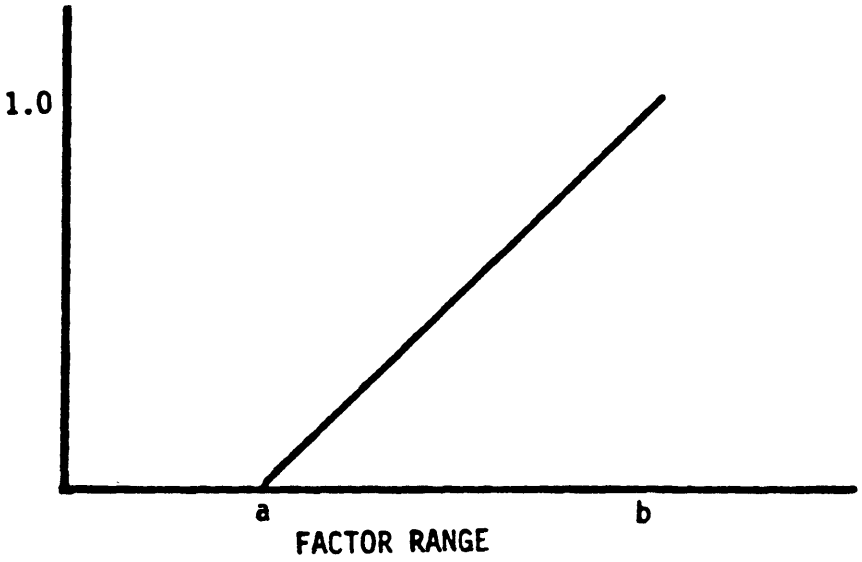
TABLE 12

RANGES OF VALUES FOR VARIABLE FACTORS

Factor	Range
Price	$ 8.00 - $24.00
Operating Cost	$17,437 - $40,685
Tax Rate	40% - 60%
Royalty	8% - 16%
Cost Escalation	5% - 9%
Investment Escalation	5% - 9%
Replacement Investment Escalation	5% - 9%
Price Escalation	5% - 9%
Loan Interest	12% - 18%



A. DENSITY CURVE



B. CUMMULATIVE DISTRIBUTION FUNCTION

FIGURE 1. DENSITY AND CUMMULATIVE DISTRIBUTION FUNCTION CURVES

For this simulation analysis, all factors and their ranges were considered to be independent. To consider interdependence causes complexity in the program and increases the time and expense of running the program that is not warranted by the additional reliability obtained.

Based on the above discussion 500 cash flow simulations were completed. The NPV's were grouped and are illustrated as a distribution curve in Figure 2 with the cumulative distribution curve given in Figure 3. To analyze these curves a method using grouped frequencies was used. (13) The data is grouped into cells and all calculations are based on the cell mid-mark. A small amount of error from the cell width selection and in the number of cells exists, but is small and does not affect the accuracy for use in this thesis. In order to obtain a meaningful curve the groupings or cell widths required a $30,000 width. Table 13 was developed for the grouped normally distributed data with an escalated dollar discount rate of 10 percent. A mean of -$9,500,000 and a standard deviation of ± $65,930,000 were computed. Therefore, based on the mean value of the NPV, the project would not make a profit.

At this point in the investigation, the negotiator might examine four approaches. One, would be to drop the project as unprofitable. Two would be to request the company recalculate all values after determining probability values, if possible, for use with the factors. Three is to rerun the 500 simulations using a different minimum discount rate. If the value is reduced the curve in Figure 2 will shift to the right and more of the simulations will indicate a profitable venture. A fourth

TABLE 13

GROUPED FREQUENCY CALCULATIONS FOR THE NET PRESENT VALUE

x	f	t	ft	ft^2
-165	2	-5	-10	50
-135	2	-4	-8	32
-105	6	-3	-18	54
-75	15	-2	-30	60
-45	13	-1	-13	13
-15	18	0	0	0
15	15	1	15	15
45	14	2	28	56
75	9	3	27	81
105	4	4	16	64
135	1	5	5	25
165	1	6	6	36
	100		18	486

x_o = assumed mean = -15

x = mid-mark

c = cell width = 30

f = frequency (%)

t = deviation from x_o

$\bar{x}$ = computed mean

s = standard deviation

$$\bar{x} = x_o + c(\Sigma ft/\Sigma f) = -15+(30\ (18/100)) = -15+30(.18) = -15+(5.52) = -9.5$$

$$s = c\sqrt{(\Sigma ft^2/\Sigma f)-(\Sigma ft/\Sigma f)^2} = 30\sqrt{(486/100)-(.18)^2} = 30\sqrt{4.86-.032} =$$

$$30\sqrt{4.83} = \pm 65.93$$

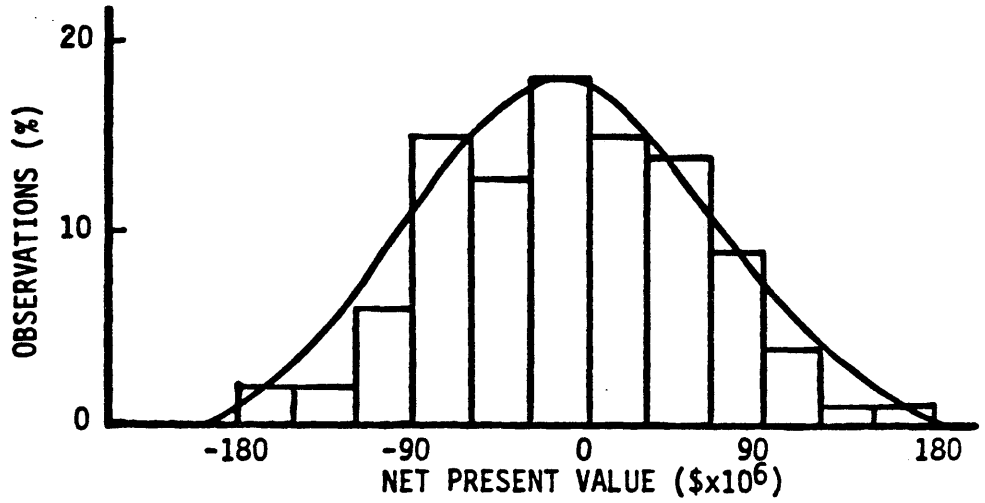


FIGURE 2. DISTRIBUTION CURVE FOR THE NET PRESENT VALUE (AT 10% MINIMUM DISCOUNT RATE)

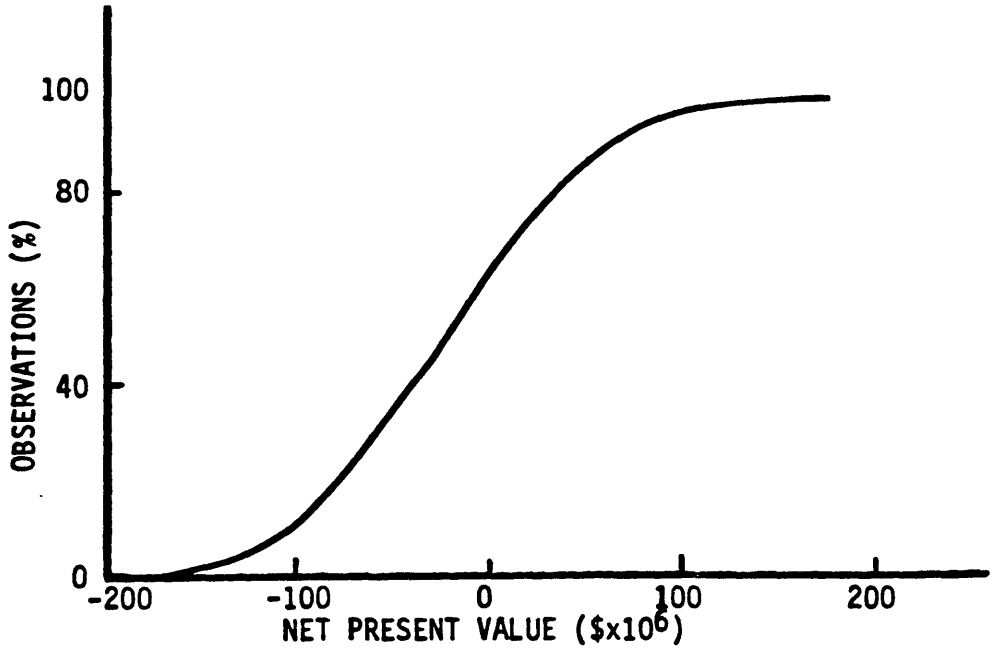


FIGURE 3. CUMULATIVE DISTRIBUTION CURVE FOR THE NET PRESENT VALUE (AT 10% MINIMUM DISCOUNT RATE)

approach is to examine each of the analyses that have a negative NPV or an ROR of less than 10 percent in escalated dollars.

During the examination a basis must be established to determine if the factors are adversely affecting the NPV and the ROR. For this investigation, the base case values were selected as the basis for comparison since the base case had a positive NPV. An example would be the operating costs. If they are higher than the base case, they lower the NPV and the ROR and can be considered one of the negative influencing factors. Of the 278 analyses with negative NPV's or ROR's less than 10 percent, a low price appears in 220 (Table 14). High operating costs are found in 154 of the analyses and high royalty rates in 159 analyses. These are the only three factors which are controllable by the company in the short term investigated in this thesis.

Each unprofitable analyses would have to be examined further by an experienced negotiator to eliminate those combinations of values that would be almost impossible to exist. Since price is the most influential factor, if the company decides after the initial investigation to limit the price to $13.00, 93 analyses would be eliminated from this study. This would be changing the lower limit of the range of expected prices.

By eliminating the analyses with prices lower than $13.00, all NPV's larger negatively than $120,000,000 are also eliminated. Also, all of the other groups of negative values in Table 14 are reduced. This one factor influences 220 of the 278 negative present values and by

TABLE 14

FACTOR ANALYSIS OF CASH FLOWS WITH NEGATIVE NET PRESENT VALUES

	Low Price	Low Price Escalation	High Operating Costs	High Operating Cost Escalation	High Tax Rate	High Royalty Rate	High Interest Rate	Total
-150 - -180	9	5	7	9	5	4	6	45
-120 - -150	9	5	6	6	3	4	5	38
-90 - -120	29	14	19	18	15	18	11	124
-60 - -90	73	42	41	51	39	46	39	331
-30 - -60	53	41	36	42	40	36	31	279
0 - -30	47	45	45	42	54	51	45	329
TOTAL	220	152	154	168	156	159	137	

increasing the lower limit by $5.00 eliminates almost half of the 220 analyses and about a third of the total negative analyses.

The same type of analyses as given for the price could be accomplished on the other factors involved even those that are uncontrollable. Analysis of the uncontrollable factors would require input from an economist or an experienced negotiator who could base the future trends on analysis and experience with possible assignment of probabilities. With the factors changed, 500 new analyses should be made and the procedures repeated. An investigation of this scope can become very costly for a property that would be marginal at best.

The overall decision for the conditions given would be to cancel the project. This investigation concerned a very marginal project which a company would not pursue. However, the computer program can be utilized by a negotiator for his own base case, factor value ranges, and sensitivity analysis since the program is general, has updated tax formulas and a simulation procedure. The cash flow program was also constructed so that factors can be added, deleted or changed easily. Using the program with the base case and sensitivity approach results in better economic decisions and helps negotiators with non-economic backgrounds to understand the influence of various factors on the DCFROR analysis.

CONCLUSIONS

The purpose of this investigation was to determine what major factors, methods, and procedures are required to perform an economic analysis on a proposed coal mine for the development of a long-term coal sales agreement. The analysis started with a base case where all factors have set values which were applied to a financial analysis method called "discounted cash flow rate of return (DCFROR)." Required factors are listed in Table 7. A positive net present value (NPV) without a loan in escalated dollars of $26,912,000 with a rate of return (ROR) of 12% was obtained from this analysis using 10 percent as the minimum discount rate. In constant dollars using an inflation rate of 7 percent the NPV was $25,265,000 with a return of 4.7%. With a loan, both NPV and ROR were greater due to the leverage influence. The ROR value was greater than the rate set by management as the lowest acceptable project return (minimum discount rate).

Since mining is a complex industry and the investigation is really predicting into the future, none of the factors used in the DCFROR analysis can be considered constant. To account for the possible value changes, a sensitivity analysis should be performed as the next step in the investigation. During this analysis certain factors are varied individually by a constant amount. Ten percent was selected as the amount and price, interest on loans, amount of the loan, minimum discount rate, tax rate, operating costs, royalty, and escalation factors (price,

investment, cost, and replacement) were selected to be varied. A negotiator knowing what factors can be manipulated in the short term and how they affect the NPV and ROR will definitely be better prepared to obtain the best agreement for the company. Major conclusions from the sensitivity analyses are as follows:

1. Controllable factors which change the payment of money from present to future had the most influence on the NPV and the ROR. Going from a no loan situation to a loan is an example of this conclusion.
2. Price which is semi-controllable affects the annual revenue directly and influenced the NPV and ROR the most when varied 10 percent.
3. Factors, including the tax rate, the operating costs, and the royalty which affect the cash flow on a yearly basis were next in order of influence. The tax rate is uncontrollable while the operating costs and royalty are controllable.
4. One factor, the minimum discount rate, affected the NPV but not the ROR. This factor changes the present value, which means varying a value in the present and not the future. This factor is only compared to the ROR causing no changes.

Changing only one factor at a time is unrealistic in the mineral industries. To change the value of more than one factor over a range of values reuqires some type of iterative process and is the third phase of the investigation. This procedure evaluates the risk of continuing with a project that is not economically sound. For this investigation a simulation technique using random numbers and the DCFROR analysis method

was used to produce 500 simulations. A normal distribution in escalated dollars at a minimum discount rate of 10 percent for the net present value with a mean value of -$9,500,000 and a standard deviation of ±$65,930,000 were the results of the simulations.

The overall conclusions from this investigation are as follows:

1. A computer program was developed for determining the NPV and the ROR in escalated and constant dollars. A simulation procedure was also included in the program allowing for wider usage.
2. The DCFROR financial analysis method with the proper manipulation of the involved factors can be used to determine the sensitivity of the NPV and the ROR to these factors.
3. When negative NPVs are obtained, the factors causing the negative values should be isolated and examined for probability of occurrence.
4. Risk can be evaluated by using simulation techniques with random numbers and a large number of iterations of the DCFROR method. These iterations varying certain factor values will not eliminate any uneconomical project but will give management or a negotiator an indication of the success potential of a project.

RECOMMENDATIONS

Investigations should be conducted on the following topics:

1. Several different base cases should be analyzed. These cases would have the factors changed to resemble different economic situations that could occur. A sensitivity analysis with probabilities would then be completed on each base case varying not only the factors from this investigation but also others as the situation warrants. Simulations using the procedures from this investigation for each base case would result in a complete financial analysis of different economic situations that could exist.
2. The computer program should be expanded to include American owned foreign mines and procedures given above followed on an international basis.

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APPENDIX A

AGREEMENT CLAUSES

TERM AND QUANTITY

Seller agrees to supply Buyer at the _____ Power Station, in strict accordance with the terms, conditions, and specifications set forth in this Agreement, _____ tons of coal to be delivered at the approximate rate of _____ tons per month during the period beginning _____ and ending _____.

QUALITY AND SPECIFICATIONS

1. The coal delivered shall not exceed three (3) inches in size and, on an "as-received" basis averaged over each sample period, shall conform to all of the following characteristics:

Moisture content	- not to exceed	___%
Ash content	- not to exceed	___%
Sulfur content	- not to exceed	___%
BTU content	- not less than	_____ BTU per pound
Grindability	- not less than	___ HGI

Whenever the coal delivered during any sample period, on an "as-received" basis averaged over such sample period, does not so conform, the amount payable for such coal by Buyer shall be adjusted as outlined under Article _____ (Price).

2. Buyer shall have the right in its sole discretion to reject coal which is oversize, contains rock or other impurities that would affect the operation of the equipment at the Station; and Seller at its expense,

shall remove such rejected coal from Buyer's premises within seven (7) days after rejection.

3. Notwithstanding the foregoing and in addition thereto, if the coal delivered or to be delivered fails to meet the average sample period specifications provided hereinabove for a period of two (2) consecutive sample periods, the Buyer may, at its option immediately suspend performance hereunder until such time as Seller can provide Buyer with assurances satisfactory to Buyer that Seller will perform fully its obligations hereunder at which time such suspension shall thereupon cease. After two (2) suspensions, Buyer may terminate the contract. If Seller does not provide Buyer with assurances satisfactory to Buyer that it will fully perform its obligations hereunder and does not so perform within two (2) months from date of suspension, Buyer may at its option, terminate the contract at the end of such period.

PRICE (SIMPLE CLAUSE)

1. (a) The Base Price for coal sold hereunder shall be _____ cents per million BTU "as received" based on Buyer's analysis of coal as sampled by Buyer at destination. This price is f.o.b. mine with Buyer paying the freight and is based on weights.

(b) Sulfur adjustment - When Buyer's analysis, averaged for any sample period, indicates that the sulfur content is .10 or more percentage points above ____% sulfur "as received," the price to be paid for such coal shall be adjusted to compensate for the increase above ____% of sulfur content according to the following schedule:

Sulfur Content	Penalty
____ - ____%	$1.00 per ton
____ - ____%	$3.00 per ton
____% and above	$5.00 per ton

(c) In addition to the above provisions, the Base Price of coal supplied which exceeds the limitations of moisture set forth in Article ___ hereof by ____% or more in any sample period shall be reduced by $1.00 per ton.

(d) In addition to the above provisions, the Base Price of coal supplied which exceeds the limitation of ash set forth in Article ___ hereof by ___% or more in any sample period, shall be adjusted to

compensate for the increase above ___% of ash according to the following schedule:

Ash Content	Penalty
___ - ___%	$1.00 per ton
___ - ___%	$3.00 per ton
___% and above	$5.00 per ton

(e) In addition to the above provisions, the Base Price of coal supplied which, if accepted, falls below the limitation of grindability of ____ HGI by more than one (1) index point to ____ HGI or lower in any sample period shall be reduced by $1.00 per ton.

(f) In addition to the above provisions, the Base Price of coal supplied shall be reduced by 10.0 cents per million BTU should the heating value fall below _____ BTU per pound and by an additional 10.0 cents per million BTU should the heating value fall below _____ BTU per pound.

PRICE (COMPLEX CLAUSE)

1. Components - The price of coal supplied pursuant to this Agreement, per net ton of coal at the Purchaser's generating facilities, without adjustment for quality and quantity and exclusive of transportation, shall consist of elements of production costs and profit specified in Annex ___ hereto.

2. Initial Determination of Costs - The initial price stated in Paragraph 1 shall be the price mutually agreed upon by Seller and Purchaser as stated in Annex ___ attached hereto.

(a) Purchaser shall have the option to periodically audit these costs and distributions determined by Seller at reasonable times and upon reasonable notice throughout the term of this Agreement. Seller shall make available to Purchaser's designated auditor its books and the books of mines supplying coal hereunder upon request in order to verify these costs and distributions.

3. Quarterly Cost Adjustment - Direct labor costs and the costs of the materials and supplies specified in Annex ___ shall be escalated or de-escalated quarterly according to the percent changes in the corresponding WPI Code indices given in Annex ___ since the last preceding quarterly adjustment. The remaining production costs shall be

escalated or de-escalated quarterly in the same percentage as the total combined adjustment to labor costs and costs of materials and supplies specified in Annex ___. Profit shall be escalated or de-escalated, as the case may be, at the rate of ___ of the percentage of the adjustment defined above for remaining production costs.

(a) Upon implementation of federal, state, or local regulations or labor contracts which are generally applied to similar mining operations in the area from which coal is supplied under this Agreement and which significantly impact upon the cost components or the distribution thereof, the affected party, after taking appropriate action to minimize the impact, may submit revised information concerning costs in the same format contained in Annex ___, and request approval of the other party of those revised costs and/or distributions, as the basis for immediate relief and/or as the basis for future quarterly price adjustments.

(b) These revised costs and/or distributions shall be subject to audit by petitioned party. If, as a result of petitioned party's audit such modification or portion thereof is determined to be justified, approval of said request or such part thereof as is justified will not be unreasonably withheld.

(c) If, during the term of this Agreement, adjustments according to Paragraph 3(a) should be requested by either Seller or Purchaser, it is

the intent of the parties hereto that after consideration pursuant to Paragraph 3(b) and through discussions between the parties, they shall reach a mutual agreement as to the requested adjustment. Neither party shall be entitled to resort to arbitration with respect to any such claim.

ADJUSTMENTS TO BASE PRICES FOR COAL (COMPLEX CLAUSE)

1. General Purpose

(a) In determining the original base price schedule the Seller has taken into consideration economic factors and conditions as of _____. It is anticipated that changes will take place in costs of labor, in prices of materials and equipment, in incidence and rate of taxes and in other economic factors and conditions which will affect Seller in fulfilling its obligation under this agreement. Accordingly, provisions are made, as hereinafter set forth, to adjust the base prices for coal from time to time, its being recognized, however, that at any given time the application of an adjustment may not necessarily result in a change in price exactly comparable to then current economic changes.

(b) The possibility is foreseen that, through the operation of forces which are not within the reasonable control of the parties to this agreement, there may occur extreme or radical temporary or long-term changes from the economic factors and conditions which existed in _____. Should such a change occur and should its effect be such as to seriously distort or render clearly inequitable, on either a temporary or a long-term basis, the application of the methods of adjustment, hereinafter provided, with the result that either party would

suffer material injury or loss by the continued application of such methods of adjustment, then revised methods of adjustment shall be adopted so as to produce, in the light of then-existing and prospective circumstances, reasonable and equitable adjustments, either temporary or long-term, to base prices. It is not the intent of the parties that such revision in methods of adjustment should result in depriving the Seller of savings or advantages arising from additional investments in facilities or from improvements effected in unit costs, efficiency or profitableness of its operation, where there is no attendant adverse effect upon the Buyer, except for the limitations imposed on Seller's profit, as set forth in Paragraph ____.

(c) It is agreed that the purpose of adjustment to base prices is to allow the Buyer to purchase coal at a reasonable price and the Seller a reasonable return at all times on the selling price of coal delivered under this agreement, as measured by net income as a percent of total sales revenue of Seller's ____ Mine.

(d) Should the parties be unable to agree as to the necessity for such revision or upon such revised methods of adjust, as set forth in Subparagraph 9(b), the matters at issue shall be submitted and determined by arbitration, as provided in Article ____.

(e) An example of the operation of this Article is included in Appendix ____ attached hereto.

2. Adjustment of Base Prices of Coal - The base prices of coal sold under this agreement shall be adjusted as hereinafter set forth. The adjustment to the base prices shall be the sum of (i) the sum of the then effective changes to all components except the interest component and the coal severance taxes and federal reclamation fees, taxes or charges component multiplied by the price component multiplier of _____ (pursuant to Paragraph ____) carried out to the fourth decimal, and (ii) the change in the interest component, and (iii) the change in the coal severance taxes and federal reclamation fees, taxes or charges component. Such adjustment in the base prices to the nearest mill shall be added to or subtracted from the initial base prices set forth in Article ____ revisions of the base prices.

Components subject to periodic adjustment are:

(a) Labor

(b) Fringe Benefits

(c) Materials and Supplies

(d) Royalty

(e) Electric Power

(f) Pension

(g) Business, Plant and Equipment Tax, Permit, Bond and Insurance

(h) Coal Severance Taxes and Federal Reclamation Fees, Taxes or Charges

(i) Special Studies

(j) Investment

(k) Interest

APPENDIX B

DEFINITIONS OF ECONOMIC FACTORS

DEFINITIONS

1. Annual Price Agreement - An agreement to sell and buy coal that is based on a base price valued for only one year. This agreement must be renegotiated every year.

2. Ash - The inorganic residue remaining after the ignition of a combustible substance such as coal. Ash may not be identical in composition or in quantity, with the inorganic substances present in the material before ignition.

3. Base Price Plus Escalation Agreement - An agreement to sell and buy coal that is based on a base price with changes anticipated in various mining costs. As these changes reach certain limits the base price is adjusted.

4. Bonus Payment - An extra payment for work done or to be done. It is an incentive to a speedy advance of the development work in a mine.

5. British Thermal Unit (BTU) - The heat needed to raise 1 pound of water 1° Fahrenheit (equal to 252 calories).

6. Capitalized Costs - Investment costs that are not expensed for tax purposes in the year in which they are incurred but that are written off for tax purposes over a period of time greater than one year. Methods used for this write off are depreciation, depletion, and amortization.

7. Cash Flow - The reported net income of a corporation plus amounts charged off for extraordinary charges to reserves and other bookkeeping deductions (depreciation, depletion, amortization, etc.) and not paid out in actual dollars.

8. Cost-Plus Agreement - An agreement to sell and buy coal that is based on a base price established through the costs incurred by the mine. If the costs are higher than established in the agreement they are still covered.

9. Depletion - Recovery of an owner's economic interest in mineral reserves through federal tax deductions related to the removal of the mineral over the economic life of the property.

10. Depreciation - The periodic loss in value which tangible assets sustain through age.

11. Development Costs - The cost of the work performed for the purpose of opening up a mineral deposit and making the actual ore extraction possible.

12. Discounted Cash Flow Rate of Return - The rate of return that makes the present worth of the cash flow for an investment equal to the present worth of all after-tax investments. Discounting equations are used in this analysis.

13. Escalation - A persistent rise in the price of specific commodities, goods or services due to a combination of inflation, supply, demand, environmental changes, engineering changes, etc.

14. Expensed Costs - Costs which are written off for tax deduction purposes in the year in which they are incurred.

15. Exploration Costs - The cost of the work involved in searching for the ore.

16. Force Majeure - A major force which can affect a mine but which the mine has no control over, examples are: acts of God, fire, flood, civil disorders, etc.

17. Investment Tax Credit - A credit against the tax liability and not a deduction from taxable income. It is based on the amount of the investment qualifying.

18. Market Price Agreement - An agreement to sell and buy coal where the base price is a function of costs plus a reasonable profit and the results are compared to other prices in the coal market.

19. Minimum Discount Rate (Rate of Return) - The rate of return that a company feels it has opportunities in which to invest available investment capital with reasonable risk.

20. Moisture - A liquid diffused or condensed in relatively small quantities and dispersed in or on a solid body (coal) in insinsible form.

21. Net Present Value - The present value of future returns on an after-tax basis which is equal to the present worth of a cash flow minus the present worth of after-tax investments calculated at the minimum rate of return.

22. Rate of Return - The expected growth rate for capital invested in a project and is sometimes termed "opportunity cost of capital."

23. Risk - The probability that actual future values will vary from the values determined in an analysis. Of particular importance is the probability that the actual values will be less than the values determined through the analysis.

24. Royalty - The share of the product or profit reserved by the owner for permitting another to use the property.

25. Sensitivity Analysis - An analysis in which key variables are changed and the resulting change in the net present value and the rate of return are observed.

26. Simulation - A technique whereby probable future events are generated on a computer.

27. Sulfur - A brittle, odorless, nonmetallic element found as an impurity in coal.

APPENDIX C

LIST OF MINE EQUIPMENT, PERSONNEL & COSTS

TABLE C1

EQUIPMENT AND COST SUMMARY (1979 DOLLARS)

Item	Unit Cost	Quantity	Total Cost	Life Years
Dragline (Erected)	$12,720,400	1	$ 12,720,400	15
Drill, Overburden	938,400	2	1,876,800	10
Drill, Coal	56,000	2	112,000	10
Coal Shovel	2,304,000	1	2,304,000	10
Front-end Loader	583,520	2	1,164,040	5
Dozer (Dragline)	241,920	1	241,920	10
Truck, Coal	474,880	8	3,799,040	5
Scrapers, Overburden	431,040	2	862,080	5
Cable Holder and Reel	84,500	2	270,400	15
Road Grader	153,120	1	153,120	10
Scraper,Road&Reclamation	431,040	3	1,293,120	5
Dozer, Road&Reclamation	241,920	3	725,760	10
Truck, Water	70,400	1	70,400	10
Truck, Mechanic	18,720	1	18,720	5
Truck, Welding	17,600	1	17,600	5
Truck, Electrician	13,760	1	13,760	5
Truck, Supply	14,400	1	14,400	5
Truck, Explosive	51,480	1	51,480	10
Truck, Lubrication	66,000	1	66,000	10
Truck, Pickup	9,600	6	57,600	5
Forklift	13,760	1	13,760	5
Truck, Crane	184,320	1	184,320	10
Pumps, Sump	11,000	3	33,000	10
Towers and Floodlights	3,960	10	39,600	15
Substation, Power	65,880	4	263,520	15
Communications System			25,920	10
Disconnect Skid	19,440	4	77,760	15
Breaker Skid	41,040	4	164,160	15
Connection Box	2,592	7	18,144	15
Cable/Power Line			1,569,440	5
Company Car	8,360	1	8,360	5
Carryall	9,900	1	9,900	5
Rippers for Dozers	12,870	2	25,740	5
Pump, Casing and Well			33,000	15
Explosive Storage	80,000	1	80,000	15
Oil and Fuel Storage	48,000	1	48,000	15
Office and Washhouse	520,000	1	520,000	15
Shops and Warehouses			1,760,000	15
Shop Equipment			550,000	10
Office Equipment			110,000	10
Road Construction			495,000	15

TABLE C1 (Cont.)

Item	Unit Cost	Quantity	Total Cost	Life Years
Site Preparation			160,000	15
Exploration, Detailed			240,000	15
Cleaning Plant and Loadout Facility			17,369,400	15
TOTAL DIRECT COSTS			$ 49,634,664	
Field - Indirect 20% of Direct Costs			9,926,933	
TOTAL CONSTRUCTION COSTS			59,561,597	
Engineering - 25% of Total Construction Costs			14,890,400	
Overhead and Admin.-20% of Total Const. Costs			11,912,320	
Subtotal 1			86,364,317	
Contingency - 20% of Subtotal 1			17,272,864	
Fees, licenses, permits			15,545,578	
Subtotal 2			119,182,759	
Interest - 20% of Subtotal 2			23,836,552	
TOTAL COST			$143,019,311	

TABLE C2

WORKING CAPITAL AND TOTAL CAPITAL COSTS

Estimated Working capital:		Cost
Direct labor	- 3 months	$ 657,400
Operating supplies	- 3 months	1,035,000
Payroll overhead	- 3 months	263,000
Indirect cost	- 4 months	338,500
Fixed cost - 0.5 percent of insurance base		186,900
Spare Parts		226,700
Miscellaneous		99,000
Total working capital		2,806,500
Total investment cost from Table 1		143,019,311
TOTAL CAPITAL COST		$145,825,811
TOTAL EXPLORATION COSTS		2,000,000
TOTAL DEVELOPMENT COSTS		4,000,000
TOTAL INITIAL INVESTMENT COSTS		$151,825,811

TABLE C3

REQUIRED PERSONNEL AND WAGES PER YEAR

Personnel	Wages Per Year
Production	
Dragline operators (overburden)	$ 140,400
Dragline Oilers (overburden)	129,400
Bulldozer operators (overburden)	165,800
Drillers (overburden)	42,900
Driller helpers (overburden)	40,700
Shooters (overburden)	21,200
Wheel tractor scraper operators (with overburden drill)	85,500
Drillers (coal)	42,900
Driller helpers (coal)	40,700
Shovel operators (coal	48,900
Shovel Oilers (coal	45,100
Front-end loader operators (with coal shovel)	42,900
Shooters (coal)	42,900
Pitmen (coal)	40,700
Truckdriver (explosive truck)	21,200
Truckdrivers (coal)	300,200
	$1,251,400
Maintenance	
Road grader operators	42,900
Water truck drivers	20,400
Lubrication truck drivers	61,500
Supply truck drivers	61,500
Mechanics	204,100
Electricians	102,000
Machinists	102,000
Welders	102,000
	$ 696,400
Reclamation and road building	
Wheel tractor scraper operators	85,500
Bulldozer operators	85,500
	$ 171,000
Utility	
Utilitymen	122,100

TABLE C3 (Cont.)

Salary	
Superintendent	29,000
General pit foremen	40,000
Pit foremen	99,000
Maintenance superintendent	22,000
Maintenance foremen	50,000
Mining engineers	22,000
Safety inspector	43,500
Office Manager	15,500
Purchasing agent	15,500
Timekeeper	11,000
Bookkeeper	11,000
Warehouseman	30,000
	$ 388,500
TOTAL LABOR AND SUPERVISION	$2,629,400

TABLE C4

ANNUAL OPERATING COSTS

	Annual Cost
Direct Cost	
Production	
Labor	$ 1,544,500
Supervision	316,500
	$ 1,861,000
Maintenance	
Labor	696,400
Supervision	72,000
	768,400
Operating Supplies	
Spare parts	460,000
Fuel, oil, and lubrication	1,196,000
Dril bits	276,000
Tires	552,000
Explosives	1,196,000
Miscellaneous	460,000
	4,140,000
Power	1,104,000
Reclamation (Contracted for Mulching, liming, fertilizing, and seeding)	9,034,265
Payroll overhead (40 percent of payroll)	1,051,800
Union welfare	7,123,600
Rent	2,216,000
Indirect Cost	
15 percent of labor, maintenance, and supplies	1,015,400
Fixed Cost	
Taxes and insurance, 2 percent of mine cost	747,500
TOTAL	$29,061,765

TABLE C5

DEPRECIATION, INVESTMENT TAX CREDIT AND REPLACEMENT INVENTORY PERCENTAGES

1. Percent ot Total Capital Costs that can be depreciated
   $49,634,664/$145,825,811=.34(100)=34%.

2. Percent of 5 year depreciation
   $8,870,560/$49,634,664=.18(100)=18%

3. Percent of 10 year depreciation
   $6,504,720/$49,634,664=.13(100)=13%

4. Percent of 15 year depreciation
   $34,259,384/$49,634,664=.69(100)=69%

5. Percent of Investment Tax Credit
   $44,594,724/$145,825,811=.31(100)=31%

6. Percent of replacement inventory at beginning of each phase
   $15,375,280/$49,634,664=.31(100)=31%

APPENDIX D

DISCOUNTED CASH FLOW RATE OF RETURN

COMPUTER PROGRAM

TABLE D1

DEFINITIONS OF SYMBOLS USED FOR INPUT INTO THE PROGRAM

1. AR - Royalty rate
2. CE - Rate of cost escalation
3. D% - Percent of investment borrowed
4. DP - Depletion rate
5. DT - Indicates if a loan is considered
6. I% - Percent of investment used each year
7. IE - Rate of escalation for investment expenditures
8. IN(1) - Total estimated investment
9. K()- First year of operating net cash flow
10. KR - First year of replacement
11. M - First year of investment
12. MS - Capital cost index
13. N - Last year of investment
14. N()- Last year of operating net cash flow
15. NF - General inflation rate
16. NR - Last year of replacement
17. OP - Annual operating costs
18. OR - Mineable reserve
19. PA - Price at beginning of phases
20. PE - Price escalation
21. PO - Production
22. R - Minimum acceptable discount rate
23. RE - Rate replacement inventory escalation
24. S - Interest on loan
25. TX - Tax rate
26. WP - Price index (applies to operating cost)
27. X - Number of phases of production
28. Y - Analysis reference number

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1.01 T "               THIS IS COLRI.FCL                          ",! !!
1.53 Q
1.57 L T #1,! "COALRICH ANALYSIS REFERENCE NUMBER     ",%8,Y,!!!
1.60 L T #1,! "FIRST YEAR OF INVESTMENT CASH FLOWS                                    ",%8,M
1.61 L T #1,! "LAST YEAR OF INVESTMENT CASH FLOWS                                     ",%8,N
1.66 L T #1,! "PRICE INDEX THAT APPLIES TO OPERATING COSTS                             ",%8.01,WP(0)
1.72 L T #1,! "TOTAL ESTIMATED INVESTMENT (1979 $000)                  ",%21,IN(1)
1.73 L T #1,! "LESS LOANS (1979 $000) (",%4.01,D%*100," DEBT) AT ",%3.01,S*100," % INTEREST          ",%10,D%*IN(1)
1.74 S IT=.10*.31*IN(1);S TE=.48*.79*.04*IN(1)
1.75 L T #1,! "LESS TAX DEDUCTIONS: "
1.76 L T #1,! "FROM INVESTMENT TAX CREDIT (1979 $000)                 ",%21,IT
1.77 L T #1,! "FROM EXPENSING OF DEVELOPMENT COSTS (1979 $000)         ",%20,TE
1.78 S IN(2)=(1-D%)*IN(1)-IT-TE
1.79 L T #1,! "EQUALS NET EQUITY INVESTMENT ($000)     ",%36,IN(2)
1.80 L T #1,! "MINIMUM ACCEPTABLE DISCOUNT RATE                                       ",%8.01,R(1)*100
1.85 L T #1,! "PROJECTED RATE OF ESCALATION FOR INVESTMENT EXPENDITURES (% )          ",%8.01,IE*100
1.86 F I=1979,1983;S B(1)=I%(I)*IN(2)
1.87 F I=1979,1983;S C(I)=I%(I)*IN(1)
1.88 S T=0;F I=M,N;S D(I)=(1+IE)^T*C(I);S T=T+1
1.90 S T=0;F I=M,N;S A(I)=(1+IE)^T*B(1);S T=T+1
1.95 S T=0;F I=M,N;S MS(I)=(1+IE)^T*MS(M);S T=T+1

2.02 S I=M
2.04 S B(0)=B(I)
2.06 S I=I+1
2.08 IF (B(0)-B(I)) 2.04,2.09,2.09
2.09 IF (I-N) 2.06,2.1,2.1
2.10 L T #1,! ! "SUMMARY OF CAPITAL COST   INDEXES AND  INVESTMENT CASH FLOWS ($000)  THROUGH YEAR   ",%4,N,! !
2.15 L T #1,! " YR.        COST INDEX    CASH FLOW(1979 $)          CASH FLOW (ESC. $)",!
2.17 L T #1, "                          TOTAL     NET EQUITY      TOTAL     NET EQUITY",!
2.20 FOR I=M,N;L T #1,%4,I,   %11.01,  MS(I),     %10,C(I),    B(I),   %12,D(I),     A(I),!
2.30 S IN(4)=0;F I=M,N;S IN(4)=IN(4)+D(I)
2.35 S DT(2)=D%*IN(4)
2.40 S IN(3)=0;F I=M,N;S IN(3)=IN(3)+A(I)
2.50 L T #1,! "NET INVESTMENT     ";L T #1,%10,IN(1),IN(2),%12,IN(4),IN(3)
2.51 S DI=.34*IN(4);S RI(K(1)+5)=.10*IN(4);F J=K(1)+6,N(X);S RI(J)=(1+RE)*RI(J-1)
2.53 L T #1,! "DEPRECIABLE INVESTMENT ($000)          ",%8,DI
2.54 L T #1,! "MINEABLE RESERVE (000 M.T.)          ",%10,OR
2.57 S ML=OR/PC(X)
2.59 L T #1,! "MINE LIFE (YEARS)                          ",%4,ML
2.60 S Q=0;S VP=0
2.70 F I=M,N;S Q=Q+1;S VP=VP+(1/(1+R(1))^Q)*A(I)
2.71 S D5=.18*DI;S D8=.13*DI;S D9=.69*DI
2.72 S DL(1984)=D5*.15;S DL(1985)=D5*.22;S DL(1986)=D5*.21;S DL(1987)=DL(1986);S DL(1988)=DL(1986)
2.73 S DL(1989)=DL(1984);S DL(1990)=DL(1985);S DL(1991)= DL(1986);S DL(1992)=DL(1986);S DL(1993)=DL(1986)
2.74 S DL(1994)=DL(1984);S DL(1995)=DL(1985);S DL(1996)=DL(1986);S DL(1997)=DL(1986);S DL(1998)=DL(1986)
2.75 S DL(1999)=DL(1984);S DL(2000)=DL(1985);S DL(2001)=DL(1986);S DL(2002)=DL(1986);S DL(2003)=DL(1986)
2.76 S DM(1984)=D8*.08;S DM(1985)=D8*.14;S DM(1986)=D8*.12;S DM(1987)=D8*.10;S DM(1990)=D8*.09
2.77 S DM(1988)=DM(1987);S DM(1989)=DM(1987);S DM(1991)=DM(1990);S DM(1992)=DM(1990);S DM(1993)=DM(1990)
2.78 S DM(1994)=DM(1984);S DM(1995)=DM(1985);S DM(1996)=DM(1986);S DM(1997)=DM(1987);S DM(1998)=DM(1988)
2.79 S DM(2000)=DM(1990);S DM(2001)=DM(1991);S DM(2002)=DM(1992);S DM(2003)=DM(1993);S DM(1999)=DM(1989)
2.80 S DH(1984)=D9*.05;S DH(1985)=D9*.10;S DH(1986)=D9*.09;S DH(1987)=D9*.08;S DH(1988)=D9*.07;S DH(1989)=DH(1988)
2.81 S DH(1990)=D9*.06;S DH(1991)=DH(1990);S DH(1992)=DH(1990);S DH(1993)=DH(1990);S DH(1994)=DH(1990)
2.82 S DH(1995)=DH(1990);S DH(1996)=DH(1990);S DH(1997)=DH(1990);S DH(1998)=DH(1990)
2.83 S DH(1999)=0;S DH(2000)=0;S DH(2001)=0;S DH(2002)=0;S DH(2003)=0
2.87 F J=1984,2003;S AD(J)=DL(J)+DM(J)+DH(J)
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3.20 L T #1,! ! " NUMBER OF  PHASES OF PRODUCTION              ",%3,X,!
3.35 L T #1,! ! ;F T=1,95;L T #1,"-"
3.40 L T #1,! "FOR THE CASH FLOWS IN PHASES                                          ";F W=1,X;L T #1,%8,W
3.50 L T #1,! ! ! ! "FIRST YEAR OF OPERATING NET CASH FLOW                                 "  ;F W=1,X;L T #1,%8, K(W)
3.60 L T #1,! "LAST YEAR OF OPERATING NET CASH FLOW                                  ";F W=1,X;L T #1, N(W)
3.62 IF (DT(1)) ,4.05,3.65
3.65 S P=N(2)-K(2)+1;S A1=S*(1+S)^P;S A2=(1+S)^P-1;S AL(2)=DT(2)*(A1/A2)
3.70 L T #1,! "THE LOAN IS  ",%10,DT(2);L T #1,!  "THE PERIOD OF THE LOAN IS      ",%2,P
3.75 L T #1,! "LOAN REPAYMENT IS SCHEDULED DURING PHASE 2 (FULL PRODUCTION) OVER  ",%3,N(2)-K(2)+1, "   YEARS"
3.80 L T #1,! "THE ANNUAL PAYMENT IS  ",%10,AL(2)
3.85 S DT(K(2)-1)=DT(2)
3.87 S J=K(2)-1
3.90 S J=J+1
3.92 S IT(J)=S*DT(J-1);S AM(J)=AL(2)-IT(J);S DT(J)=DT(J-1)-AM(J)
3.95 IF (J-N(2)) 3.9, ,

4.05 L T #1,! "PROJECTED RATE OF PRICE ESCALATION (% ANNUALLY)                  ";F W=1,X;L T #1,%8.01,PE(W)*100
4.10 F W=2,X;S PA(W)=(1+PE(W-1))^(N(W-1)-K(W-1)+1)*PA(W-1)
4.15 L T #1,! "PRICE AT BEGINNING OF EACH PHASE ($/MT.)                         ";F W=1,X;L T #1,%8.02,PA(W)
4.16 S W=1
4.17 S T=0;F J=K(W),N(W);S PA(J)=(1+PE(W))^T*PA(W);S T=T+1
4.18 IF (W-X) 4.19,4.20,4.20
4.19 S W=W+1;GOTO 4.17
4.20 L T #1,! "ANNUAL PRODUCTION (METRIC TONS,M.T.)                              ";F W=1,X;L T #1,%8,PO(W)
4.50 S W=1
4.55 F J=K(W),N(W);S RV(J)=PO(W)*PA(J)
4.60 IF (W-X) 4.61,4.67,4.67
4.61 S W=W+1;GOTO 4.55
4.67 L T #1,! "PROJECTED RATE REPLACEMENT INV. ESCALATION (% ANNUALLY)          ";F W=1,X;L T #1,%8.01,RE*100
4.78 L T #1,! "PROJECTED RATE OF COST ESCALATION (% ANNUALLY)                   ";F W=1,X;L T #1,%8.01,CE(W)*100
4.79 F W=2,X;S OP(W)=(1+CE(W-1))^(N(W-1)-K(W-1)+1)*OP(W-1)
4.80 L T #1,! ,"ANNUAL OPERATING COSTS BEGINNING OF EACH PHASE  ($000)          ";F W=1,X;L T #1,%8,OP(W)
4.81 S W=1
4.82 S T=0;F J=K(W),N(W);S OP(J)=(1+CE(W))^T*OP(W);S T=T+1
4.83 IF (W-X) 4.84,4.90,4.90
4.84 S W=W+1;GOTO 4.82
4.90 L T #1,! "ANNUAL ROYALTY RATE  (% OF GROSS REV.)                           ";F W=1,X;L T #1,%8.01,AR(W)*100
4.92 S W=0
4.93 S W=W+1
4.95 F J=K(W),N(W);S R$(J)=RV(J)*AR(W)
4.96 IF (W-X) 4.93,4.97,4.97
4.97 L T #1,! "DEPLETION RATE (PERCENT,LIMITED TO 50% OF NET)                   ";F W=1,X;L T #1,%8,DP(W)*100
4.98 L T #1,! "COMBINED EFFECTIVE TAX RATE                                      ";F W=1,X;L T #1,%8.01,TX(W)*100
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```
5.02 S W=0
5.03 S W=W+1
5.04 F J=K(W),N(W);S D1(J)=(RV(J)-R$(J)-OP(J)-AD(J))*.5;S D2(J)=(RV(J)-R$(J))*DP(W)
5.05 S J=K(W)-1
5.06 S J=J+1
5.07 IF (D1(J)) 5.08,5.1,5.1
5.08 S D1(J)=0;GOTO 5.35
5.10 IF (D1(J)-D2(J)) 5.25,5.25,5.35
5.25 S T$(J)=(RV(J)-R$(J)-OP(J)-AD(J)-IT(J)-D1(J))*TX(W)
5.30 S CF(J)=RV(J)-R$(J)-OP(J)-IT(J)-AM(J)-RI(J)-T$(J);S DN(J)=D1(J);GOTO 5.5
5.35 S T$(J)=(RV(J)-R$(J)-OP(J)-AD(J)-IT(J)-D2(J))*TX(W)
5.40 S CF(J)=RV(J)-R$(J)-OP(J)-IT(J)-AM(J)-T$(J)-RI(J);S DN(J)=D2(J)
5.50 IF (J-N(W)) 5.06
5.60 IF (W-X) 5.03

6.01 S W=0

6.05 S W=W+1
6.06 L T #1,! ! !
6.10 L T #1,! ! ;L T #1,"              CASH FLOW CALCULATION FOR PHASE    ",%2,W,! ! ;L T #1,%10
6.12 L T #1,"YEAR   ",!;F J=K(W),N(W);L T #1,%8,J
6.13 L T #1,! !
6.15 L T #1,! "PRICE,COAL  ($/MT)  ",!;F J=K(W),N(W);L T #1,%8.02,PA(J)
6.16 L T #1,!,"ANNUAL COAL PRODUCTION PROD. (000 METRIC TONS .)   ",!;F J=K(W),N(W);L T #1,%8,PO(W)
6.19 L T #1,! "AVERAGE TOTAL COST ($/METRIC TON)   "!;F J=K(W),N(W);L T #1,%8.02,(OP(J)+R$(J)+I$(J)+IT(J)+AD(J)-DN(J))/(PO(W))
6.20 L T #1,! , "REVENUE ($000 U.S.)  ",!;F J=K(W),N(W);L T #1,%8.,RV(J)
6.25 L T #1,!,"LESS ANNUAL ROYALTY ($000)   ",!;F J=K(W),N(W);L T #1,%8,R$(J)
6.30 L T #1,!,  "LESS ANNUAL OPERATING COST ($000)  ",!;F J=K(W),N(W);L T #1,%8.,OP(J)
6.35 F J=K(W),N(W);S GI(J)=RV(J)-R$(J)-OP(J)
6.40 L T #1,! "EQUALS GROSS INCOME  ($000) ",!;F J=K(W),N(W);L T #1,%8,GI(J)
6.42 IF (DT(1)) 6.50,6.50,6.45
6.45 L T #1,! , "LESS INTEREST ON LOANS  ($000)          ",!;F J=K(W),N(W);L T #1,%8,IT(J)
6.50 L T #1,! , "LESS ANNUAL DEPRECIATION AND AMORTIZATION ($000)  ",!;F J=K(W),N(W);L T #1,%8,AD(J)
6.55 F J=K(W),N(W);S BA(J)=GI(J)-AD(J)-IT(J)
6.57 L T #1,! , "LESS DEPLETION ($000)  ",! ;F J=K(W),N(W);L T #1,%8,DN(J)
6.85 L T #1,! "TAXABLE INCOME  ($000)            ",! ;F J=K(W),N(W);L T #1,BA(J)
6.90 L T #1,! , "LESS TAX ($000)  ",!;F J=K(W),N(W);L T #1,%8,T$(J)
6.92 F J=K(W),N(W);S NI(J)=GI(J)-AD(J)-DN(J)-T$(J)-IT(J)
6.95 L T #1,!, "EQUALS NET INCOME AFTER TAX ($000)   ",! ;F J=K(W),N(W);L T #1,%8,NI(J)

7.02 IF (DT(1)) ,7.10,7.05
7.05 L T #1,! , "LESS AMORTIZATION OF LOAN ($000)  ",!;F J=K(W),N(W);L T #1,%8,AM(J)
7.10 L T #1,! , "PLUS NON CASH FLOWS ($000) ",!,"DEPRECIATION AND AMORTIZATION ",! ;F J=K(W),N(W);L T #1,%8,AD(J)
7.15 L T #1,! , "AND DEPLETION  ($000)  ",! ;F J=K(W),N(W);L T #1,%8,DN(J)
7.17 L T #1,!,"LESS REPLACEMENT INVESTMENT ($000)   ",!;F J=K(W),N(W);L T #1,%8,RI(J)
7.20 L T #1,! ,"EQUALS OPERATING CASH FLOW ($000)   ",! ;F J=K(W),N(W);L T #1,%8,CF(J)
7.25 S T=K(W)-W;F J=K(W),N(W);S CC(J)=(1/(1+NF)^T)*CF(J);S T=T+1
7.28 L T #1,! "CONSTANT (1979) DOLLAR CASH FLOW ($000)   ",!;F J=K(W),N(W);L T #1,%8,CC(J)
7.30 IF (W-X) 6.05,7.9,7.9
7.90 T ! ,"NOMINAL DOLLAR EVALUATION",!
7.95 L T #1,! "NOMINAL DOLLAR EVALUATION",!
```

```
8.10 S Q=0;S PV=0
8.20 F J=K(1),N(X);S Q=Q+1;S PV=PV+(1/(1+R(1))^Q)*CF(J)
8.30 S PV=PV/(1+R(1))^(K(1)-M)
8.40 S Q=0;S VP=0
8.50 F I=M,N;S Q=Q+1;S VP=VP+(1/(1+R(1))^Q)*A(I)
8.60 S NP(1)=PV-VP
8.70 L T #1,! ! ! "THE NET PRESENT VALUE AT   ",%3.01,R(1)*100,"   PERCENT DISCOUNT RATE IS  ($000)  ",%10,NP(1),!
8.80 T ! ! ! "THE NET PRESENT VALUE AT   ",%3.01,R(1)*100,"   PERCENT DISCOUNT RATE IS  ($000)  ",%10,NP(1),!

9.10 S PV=0;S VP=0;S  R=.0001;D 10
9.15 IF (PV-VP) 9.2,9.9,9.28
9.20 L T #1,"PRESENT VALUE IS NEGATIVE AT ZERO DISCOUNT RATE   ,($000)      ",PV-VP,!
9.22 T "PRESENT VALUE IS NEGATIVE AT ZERO DISCOUNT RATE   ,($000)      ",PV-VP,! ;GOTO 9.96
9.25 Q
9.28 S R=R+.25;DO  10;IF (PV-VP) 9.29,9.9,9.28
9.29 S R=R-.25
9.30 S R=R+.05;DO 10;IF (PV-VP) 9.4,9.9,9.3
9.40 S R=R-.05
9.42 S R=R+.01;DO 10;IF (PV-VP) 9.44,9.9,9.42
9.44 S R=R-.01
9.46 S R=R+.001;DO 10;IF (PV-VP) 9.48,9.9,9.46
9.48 S R=R-.001
9.50 S R=R+.0005;DO 10;IF (PV-VP) 9.9,9.9,9.5
9.90 L T #1,"THE DISCOUNTED CASH FLOW RATE OF RETURN IS        ",%4.01,R*100, "     PERCENT",! ! !
9.95 T  "THE DISCOUNTED CASH FLOW RATE OF RETURN IS        ",%4.01,R*100, "     PERCENT",! ! !
9.96 IF (G) ,13.1,
9.97 IF (SM) , ,28.1
9.98 T "OUTPUT TO FILE IS COMPLETE.",! ! !
9.99 L C #1;Q

10.10 S Q=0;S VP=0
10.20 F I=M,N;S Q=Q+1;S VP=VP+(1/(1+R)^Q)*A(I)
10.30 S Q=0;S PV=0
10.40 F J=K(1),N(X);S Q=Q+1;S PV=PV+(1/(1+R)^Q)*CF(J)
10.50 S PV=PV/(1+R)^(K(1)-M)

13.10 S T=0;F I=M,N;S A(I)=(1/(1+NF)^T)*A(I);S T=T+1
13.20 S T=K(1)-M;F J=K(1),N(X);S CF(J)=(1/(1+NF)^T)*CF(J);S T=T+1
13.30 L T #1,! "ASSUMED GENERAL INFLATION RATE IS ",%3.01,NF*100,"PERCENT",! ;S R(1)=R(1)-NF
13.40 L T #1,! "CONSTANT DOLLAR EVALUATION",!
13.45 T ! ,"CONSTANT DOLLAR EVALUATION",!
13.90 S G=1;G 8.1
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27.10 E ;A "IS THIS A SIMULATION ? TYPE 1 FOR YES, 0 FOR NO.",! ,SM
27.12 S Y=100;S M=1979;S N=1983;S WP(0)=182.9;S R(1)=.10;S IN(1)=151826;S D%=0.0
27.13 S DT(1)=0;S OR=100000;S S=0.0
27.16 S I%(1979)=.32;S I%(1980)=.48;S I%(1981)=.10;S I%(1982)=.05;S I%(1983)=.05
27.30 S MS(1979)=273.2;S NF=.07
27.50 S K(1)=1984;S K(2)=1994;S N(1)=1993;S N(2)=2003;S PA(1)=16.00
27.60 S OP(1)=29061;S X=2
27.70 F W=1,X;S AR(W)=.12;S DP(W)=.10;S TX(W)=.50
27.80 S CE(1)=.07;S PE(1)=.07;S PO(1)=5000;S RE=.07;S CE(2)=.07;S PE(2)=.07;S PO(2)=5000;S IE=.07
27.85 S KR(1)=1989;S NR(1)=1993;S KR(2)=1994;S NR(2)=2003
27.90 IF (SM) , ,28.05
27.91 T "THE BASE CASE VARIABLES (1979-2003)  ARE ENTERED   ",!
27.98 S Y=100;L O #1=CR100;GOTO 1.57

28.05 E ;D 50.1,50.12;S SM=1;L O #1=COLSIM;S NN=501
28.10

30.05 S R(1)=.10
30.10 S XM=16.00;S XL=8.00;S XH=24.00
30.20 S RN=FRAN(0)
30.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
30.22 L T #1,! "RANDOM NO. IS  ",%8.04,RN
30.23 S XX=(XM-XL)/(XH-XL)
30.30 IF (RN-XX) 30.60,30.60
30.40 S PA(1)=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
30.41 S PA(2)=PA(1)
30.50 GOTO 30.90
30.60 S PA(1)=XL+FSQT((XM-XL)*(XH-XL)*RN)
30.61 S PA(2)=PA(1)
30.90 T "PRICE AT BEGINNING OF EACH PHASE ($/MT)  ",%8.02,PA(1),!
30.91 L T #1,! "PRICE AT BEGINNING OF EACH PHASE ($/MT)  ",%8.02,PA(1)

31.10 S XM=29061;S XL=17437;S XH=40685
31.20 S RN=FRAN(0)
31.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
31.22 L T #1,! "RANDOM NO. IS  ",%8.04,RN
31.23 S XX=(XM-XL)/(XH-XL)
31.30 IF (RN-XX) 31.60,31.60
31.40 S OP(1)=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
31.41 S OP(2)=OP(1)
31.50 GOTO 31.90
31.60 S OP(1)=XL+FSQT((XM-XL)*(XH-XL)*RN)
31.61 S OP(2)=OP(1)
31.90 T "ANNUAL OPERATING COSTS BEGINNING OF EACH PHASE ($000)  ",%8,OP(1),!
31.91 L T #1,! "ANNUAL OPERATING COSTS BEGINNING OF EACH PHASE ($000)  ",%8,OP(1)
```

```
32.10 S XM=.50;S XL=.40;S XH=.60
32.20 S RN=FRAN(0)
32.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
32.22 L T #1,! "RANDOM NO. IS  ",%8.04,RN
32.23 S XX=(XM-XL)/(XH-XL)
32.30 IF (RN-XX) 32.60,32.60
32.40 S TX(1)=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
32.41 S TX(2)=TX(1)
32.50 GOTO 32.90
32.60 S TX(1)=XL+FSQT((XM-XL)*(XH-XL)*RN)
32.61 S TX(2)=TX(1)
32.90 T "COMBINED FFFECTIVE TAX RATE  ",%8.02,TX(1)*100,!
32.91 L T #1,! "COMBINED EFFECTIVE TAX RATE  ",%8.02,TX(1)*100

33.10 S XM=.12;S XL=.08;S XH=.16
33.20 S RN=FRAN(0)
33.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
33.22 L T #1,! "RANDOM NO. IS  ",%4.04,RN
33.23 S XX=(XM-XL)/(XH-XL)
33.30 IF (RN-XX) 33.60,33.60
33.40 S AR(1)=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
33.41 S AR(2)=AR(1)
33.50 GOTO 33.90
33.60 S AR(1)=XL+FSQT((XM-XL)*(XH-XL)*RN)
33.61 S AR(2)=AR(1)
33.90 T "ANNUAL ROYALTY RATE (% OF GROSS REV.)  ",%8.02,AR(1)*100,!
33.91 L T #1,! "ANNAUL ROYALTY RATE (% OF GROSS REV.)  ",%8.02,AR(1)*100

35.10 S XM=.07;S XL=.05;S XH=.09
35.20 S RN=FRAN(0)
35.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
35.22 L T #1,! "RANDOM NO. IS  ",%4.04,RN
35.23 S XX=(XM-XL)/(XH-XL)
35.30 IF (RN-XX) 35.6,35.6
35.40 S PE(1)=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
35.41 S PE(2)=PE(1)
35.50 GOTO 35.90
35.60 S PE(1)=XL+FSQT((XM-XL)*(XH-XL)*RN)
35.61 S PE(2)=PE(1)
35.90 T "PROJECTFD RATE OF PRICE ESCALATION (% ANNUALLY)  ",%8.02,PE(1)*100,!
35.91 L T #1,! "PROJECTED RATE OF PRICE ESCALATION (% ANNUALLY)  ",%8.02,PE(1)*100

36.10 S XM=.07;S XL=.05;S XH=.09
36.20 S RN=FRAN(0)
36.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
36.22 L T #1,! "RANDOM NO. IS  ",%4.04,RN
36.23 S XX=(XM-XL)/(XH-XL)
36.30 IF (RN-XX) 36.60,36.60
36.40 S CE(1)=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
36.41 S CE(2)=CE(1)
36.50 GOTO 36.90
36.60 S CE(1)=XL-FSQT((XM-XL)*(XH-XL)*RN)
36.61 S CE(2)=CE(1)
36.90 T "PROJECTFD RATE OF COST ESCALATION (% ANNUALLY)  ",%8.02,CE(1)*100,!
36.91 L T #1,! "PROJECTED RATE OF COST ESCALATION (% ANNUALLY)  ",%8.02,CE(1)*100
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37.10 S XM=.07;S XL=.05;S XH=.09
37.20 S RN=FRAN(^)
37.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
37.22 L T #1,! "RANDOM NO. IS  ",%4.04,RN
37.23 S XX=(XM-XL)/(XH-XL)
37.30 IF (RN-XX) 37.60,37.60
37.40 S RE=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
37.50 GOTO 37.90
37.60 S RE=XL+FSQT((XM-XL)*(XH-XL)*RN)
37.90 T "PROJECTED RATE REPLACEMENT INV. ESCALATION (% ANNUALLY)  ",%8.02,RE*100,!
37.91 L T #1,! "PROJECTED RATE REPLACEMENT INV. ESCALATION (%ANNUALLY)  ",%8.02,RE*100

38.10 S XM=.07;S XL=.05;S XH=.09
38.20 S RN=FRAN(0)
38.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
38.22 L T #1,! "RANDOM NO. IS  ",%4.04,RN
38.23 S XX=(XM-XL)/(XH-XL)
38.30 IF (RN-XX) 38.60,38.60
38.40 S IE=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
38.50 GOTO 38.90
38.60 S IE=XL+FSQT((XM-XL)*(XH-XL)*RN)
38.90 T "PROJECTED RATE OF INV. EXPENDITURES (% ANNUALLY)  ",%8.02,IE*100,!
38.91 L T #1,! "PROJECTED RATE OF INV. EXPENDITURES (% ANNUALLY)  ",%8.02,IE*100

39.10 S XM=.15;S XL=.12;S XH=.18
39.20 S RN=FRAN(0)
39.21 S RN=FRAN();T "RANDOM NO. IS  ",%4.04,RN,!
39.22 L T #1,! "RANDOM NO. IS  ",%4.04,RN
39.23 S XX=(XM-XL)/(XH-XL)
39.30 IF (RN-XX) 39.60,39.60
39.40 S S=XH-FSQT((XH-XM)*(XH-XL)*(1-RN))
39.50 GOTO 39.90
39.60 S S=XL+FSQT((XM-XL)*(XH-XL)*RN)
39.90 T "INTEREST ON LOAN  ",%8.02,S*100,!
39.91 L T #1,! "INTEREST ON LOAN  ",%8.02,S*100

40.09 S G=0
40.10 D 1.74,1.78,1.86,1.87,1.88,1.90,1.95,2.30,2.35,2.40,2.51
40.11 D 2.60,2.70,2.71,2.72,2.73,2.74,2.75,2.76,2.77,2.78,2.79
40.12 D 2.80,2.81,2.82,2.83,2.87
40.13 D 3.65,3.85
40.14 S J=K(2)-1
40.15 S J=J+1
40.16 D 3.92
40.17 IF (J-N(2)) 40.15,40.20,40.20
40.20 S W=0
40.25 S W=W+1
40.30 D 4.17,4.55
40.40 IF (W-X) 40.25
40.90 D 4.79
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41.10 S W=0
41.20 S W=W+1
41.30 D 4.82
41.40 IF (W-X) 41.2
41.41 S W=0
41.60 S W=W+1
41.70 D 4.95
41.80 IF (W-X) 41.6

42.02 S W=0
42.03 S W=W+1
42.04 F J=K(W),N(W);S D1(J)=(RV(J)-R$(J)-OP(J)-AD(J))*.5;S D2(J)=(RV(J)-R$(J))*DP(W)
42.05 S J=K(W)-1
42.06 S J=J+1
42.07 IF (D1(J)) 42.08,42.10,42.10
42.08 S D1(J)=0;GOTO 42.35
42.10 IF (D1(J)-D2(J)) 42.25,42.25,42.35
42.25 S T$(J)=(RV(J)-R$(J)-OP(J)-AD(J)-IT(J)-D1(J))*TX(W)
42.30 S CF(J)=RV(J)-R$(J)-OP(J)-IT(J)-AM(J)-RI(J)-T$(J);S DN(J)=D1(J);GOTO 42.50
42.35 S T$(J)=(RV(J)-R$(J)-OP(J)-AD(J)-IT(J)-D2(J))*TX(W)
42.40 S CF(J)=RV(J)-R$(J)-OP(J)-IT(J)-AM(J)-RI(J)-T$(J);S DN(J)=D2(J)
42.50 IF (J-N(W)) 42.06
42.60 IF (W-X) 42.03

43.10 S W=0
43.20 S W=W+1
43.30 D 6.35,6.55
43.32 D 6.92,7.25
43.40 IF (W-X) 43.2
43.43 S NN=NN-1
43.50 L T #1,! "SIMULATION NUMBER  ",%4,NN,!
43.80 IF (NN) , ,8.1
43.85 L C #1
43.91 T "OUTPUT TO SIMULATION FILE COLSIM.FCL IS COMPLETE",!

50.10 E ;D 27.12,27.13,27.30,27.50,27.60,27.70
50.12 D 27.80,27.85,27.16
50.90 S Y=200;T "AN. #200",! ;L O #1=CR200;GOTO 1.57
```

APPENDIX E

BASE CASE RESULTS

COALRICH ANALYSIS REFERENCE NUMBER 100.

FIRST YEAR OF INVESTMENT CASH FLOWS	1979.
LAST YEAR OF INVESTMENT CASH FLOWS	1983.
PRICE INDEX THAT APPLIES TO OPERATING COSTS	182.9
TOTAL ESTIMATED INVESTMENT (1979 $000)	151826.
LESS LOANS (1979 $000) (0.0 DEBT) AT 0.0 % INTEREST	0.
LESS TAX DEDUCTIONS:	
FROM INVESTMENT TAX CREDIT (1979 $000)	4707.
FROM EXPENSING OF DEVELOPMENT COSTS (1979 $000)	2303.
EQUALS NET EQUITY INVESTMENT ($000)	144816.
MINIMUM ACCEPTABLE DISCOUNT RATE	10.0
PROJECTED RATE OF ESCALATION FOR INVESTMENT EXPENDITURES (%)	7.0

SUMMARY OF CAPITAL COST INDEXES AND INVESTMENT CASH FLOWS ($000) THROUGH YEAR 1983.

YR.	COST INDEX	CASH FLOW(1979 $) TOTAL	CASH FLOW(1979 $) NET EQUITY	CASH FLOW (ESC. $) TOTAL	CASH FLOW (ESC. $) NET EQUITY
1979.	273.2	48584.	46341.	48584.	46341.
1980.	292.3	72876.	69512.	77978.	74378.
1981.	312.8	15183.	14482.	17383.	16580.
1982.	334.7	7591.	7241.	9300.	8870.
1983.	358.1	7591.	7241.	9951.	9491.
NET INVESTMENT		151826.	144816.	163195.	155661.

DEPRECIABLE INVESTMENT ($000)	55486.
MINEABLE RESERVE (000 M.T.)	100000.
MINE LIFE (YEARS)	20.
NUMBER OF PHASES OF PRODUCTION	2.

FOR THE CASH FLOWS IN PHASES	1.	2.
FIRST YEAR OF OPERATING NET CASH FLOW	1984.	1994.
LAST YEAR OF OPERATING NET CASH FLOW	1993.	2003.
PROJECTED RATE OF PRICE ESCALATION (% ANNUALLY)	7.0	7.0
PRICE AT BEGINNING OF EACH PHASE ($/MT.)	16.00	31.47
ANNUAL PRODUCTION (METRIC TONS,M.T.)	5000.	5000.
PROJECTED RATE REPLACEMENT INV. ESCALATION (% ANNUALLY)	7.0	7.0
PROJECTED RATE OF COST ESCALATION (% ANNUALLY)	7.0	7.0
ANNUAL OPERATING COSTS BEGINNING OF EACH PHASE ($000)	29061.	57167.
ANNUAL ROYALTY RATE (% OF GROSS REV.)	12.0	12.0
DEPLETION RATE (PERCENT,LIMITED TO 50% OF NET)	10.	10.
COMBINED EFFECTIVE TAX RATE	50.0	50.0

CASH FLOW CALCULATION FOR PHASE 1.

YEAR	1984.	1985.	1986.	1987.	1988.	1989.	1990.	1991.	1992.	1993.
PRICE,COAL ($/MT)	16.00	17.12	18.32	19.60	20.97	22.44	24.01	25.69	27.49	29.42
ANNUAL COAL PRODUCTION PROD. (000 METRIC TONS .)	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.
AVERAGE TOTAL COST ($/METRIC TON)	10.15	11.14	11.81	12.54	13.34	14.17	15.15	16.17	17.26	18.44
REVENUE ($000 U.S.)	80000.	85600.	91592.	98003.	104864.	112204.	120058.	128463.	137455.	147077.
LESS ANNUAL ROYALTY ($000)	9600.	10272.	10991.	11760.	12584.	13464.	14407.	15416.	16495.	17649.
LESS ANNUAL OPERATING COST ($000)	29061.	31095.	33272.	35601.	38093.	40760.	43613.	46666.	49932.	53427.
EQUALS GROSS INCOME ($000)	41339.	44233.	47329.	50642.	54187.	57980.	62039.	66381.	71028.	76000.
LESS ANNUAL DEPRECIATION AND AMORTIZATION ($000)	3989.	7036.	6409.	5882.	5499.	4899.	5144.	5044.	5044.	5044.
LESS DEPLETION ($000)	7040.	7533.	8060.	8624.	9228.	9874.	10565.	11305.	12096.	12943.
TAXABLE INCOME ($000)	37350.	37197.	40920.	44761.	48688.	53081.	56895.	61338.	65984.	70956.
LESS TAX ($000)	15155.	14832.	16430.	18068.	19730.	21603.	23165.	25016.	26944.	29007.
EQUALS NET INCOME AFTER TAX ($000)	15155.	14832.	16430.	18068.	19730.	21603.	23165.	25016.	26944.	29007.
PLUS NON CASH FLOWS ($000)										
DEPRECIATION AND AMORTIZATION	3989.	7036.	6409.	5882.	5499.	4899.	5144.	5044.	5044.	5044.
AND DEPLETION ($000)	7040.	7533.	8060.	8624.	9228.	9874.	10565.	11305.	12096.	12943.
LESS REPLACEMENT INVESTMENT ($000)	0.	0.	0.	0.	0.	16320.	17462.	18684.	19992.	21392.
EQUALS OPERATING CASH FLOW ($000)	26184.	29401.	30899.	32574.	34457.	20057.	21412.	22681.	24092.	25602.
CONSTANT (1979) DOLLAR CASH FLOW ($000)	18669.	19591.	19242.	18958.	18742.	10196.	10173.	10071.	9997.	9929.

CASH FLOW CALCULATION FOR PHASE 2.

YEAR	1994.	1995.	1996.	1997.	1998.	1999.	2000.	2001.	2002.	2003.
PRICE,COAL ($/MT)	31.47	33.68	36.04	38.56	41.26	44.14	47.23	50.54	54.08	57.86
ANNUAL COAL PRODUCTION PROD. (000 METRIC TONS .)	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.
AVERAGE TOTAL COST ($/METRIC TON)	19.63	21.08	22.49	24.02	25.66	27.13	29.08	31.09	33.24	35.55
REVENUE ($000 U.S.)	157372.	168388.	180175.	192788.	206283.	220723.	236173.	252705.	270395.	289322.
LESS ANNUAL ROYALTY ($000)	18885.	20207.	21621.	23135.	24754.	26487.	28341.	30325.	32447.	34719.
LESS ANNUAL OPERATING COST ($000)	57167.	61169.	65451.	70033.	74935.	80180.	85793.	91798.	98224.	105100.
EQUALS GROSS INCOME ($000)	81320.	87012.	93103.	99621.	106594.	114056.	122040.	130582.	139723.	149504.
LESS ANNUAL DEPRECIATION AND AMORTIZATION ($000)	4372.	5504.	5260.	5116.	5116.	2219.	2846.	2747.	2747.	2747.
LESS DEPLETION ($000)	13849.	14818.	15855.	16965.	18153.	19424.	20783.	22238.	23795.	25460.
TAXABLE INCOME ($000)	76948.	81508.	87843.	94505.	101478.	111836.	119193.	127836.	136976.	146757.
LESS TAX ($000)	31550.	33345.	35994.	38770.	41663.	46206.	49205.	52799.	56591.	60648.
EQUALS NET INCOME AFTER TAX ($000)	31550.	33345.	35994.	38770.	41663.	46206.	49205.	52799.	56591.	60648.
PLUS NON CASH FLOWS ($000)										
DEPRECIATION AND AMORTIZATION	4372.	5504.	5260.	5116.	5116.	2219.	2846.	2747.	2747.	2747.
AND DEPLETION ($000)	13849.	14818.	15855.	16965.	18153.	19424.	20783.	22238.	23795.	25460.
LESS REPLACEMENT INVESTMENT ($000)	22889.	24491.	26206.	28040.	30003.	32103.	34350.	36755.	39327.	42080.
EQUALS OPERATING CASH FLOW ($000)	26882.	29176.	30904.	32811.	34929.	35746.	38484.	41029.	43805.	46775.
CONSTANT (1979) DOLLAR CASH FLOW ($000)	9743.	9883.	9783.	9708.	9658.	9238.	9294.	9261.	9240.	9222.
NOMINAL DOLLAR EVALUATION										

THE NET PRESENT VALUE AT 10.0 PERCENT DISCOUNT RATE IS ($000) 26912.
THE DISCOUNTED CASH FLOW RATE OF RETURN IS 12.0 PERCENT

ASSUMED GENERAL INFLATION RATE IS 7.0PERCENT

CONSTANT DOLLAR EVALUATION

THE NET PRESENT VALUE AT 3.0 PERCENT DISCOUNT RATE IS ($000) 25265.
THE DISCOUNTED CASH FLOW RATE OF RETURN IS 4.7 PERCENT

COALRICH ANALYSIS REFERENCE NUMBER 200.

FIRST YEAR OF INVESTMENT CASH FLOWS	1979.
LAST YEAR OF INVESTMENT CASH FLOWS	1983.
PRICE INDEX THAT APPLIES TO OPERATING COSTS	182.9
TOTAL ESTIMATED INVESTMENT (1979 $000)	151826.
LESS LOANS (1979 $000) (25.0 DEBT) AT 15.0 % INTEREST	37957.
LESS TAX DEDUCTIONS:	
FROM INVESTMENT TAX CREDIT (1979 $000)	4707.
FROM EXPENSING OF DEVELOPMENT COSTS (1979 $000)	2303.
EQUALS NET EQUITY INVESTMENT ($000)	106860.
MINIMUM ACCEPTABLE DISCOUNT RATE	10.0
PROJECTED RATE OF ESCALATION FOR INVESTMENT EXPENDITURES (%)	7.0

SUMMARY OF CAPITAL COST INDEXES AND INVESTMENT CASH FLOWS ($000) THROUGH YEAR 1983.

YR.	COST INDEX	CASH FLOW(1979 $) TOTAL	NET EQUITY	CASH FLOW (ESC. $) TOTAL	NET EQUITY
1979.	273.2	48584.	34195.	48584.	34195.
1980.	292.3	72876.	51293.	77978.	54883.
1981.	312.8	15183.	10686.	17383.	12234.
1982.	334.7	7591.	5343.	9300.	6545.
1983.	358.1	7591.	5343.	9951.	7004.
NET INVESTMENT		151826.	106860.	163195.	114862.

DEPRECIABLE INVESTMENT ($000)	55486.
MINEABLE RESERVE (000 M.T.)	100000.
MINE LIFE (YEARS)	20.
NUMBER OF PHASES OF PRODUCTION	2.

FOR THE CASH FLOWS IN PHASES	1.	2.
FIRST YEAR OF OPERATING NET CASH FLOW	1984.	1994.
LAST YEAR OF OPERATING NET CASH FLOW	1993.	2003.
THE LOAN IS 40799.		
THE PERIOD OF THE LOAN IS 10.		
LOAN REPAYMENT IS SCHEDULED DURING PHASE 2 (FULL PRODUCTION) OVER 10. YEARS		
THE ANNUAL PAYMENT IS 8129.		
PROJECTED RATE OF PRICE ESCALATION (% ANNUALLY)	7.0	7.0
PRICE AT BEGINNING OF EACH PHASE ($/MT.)	16.00	31.47
ANNUAL PRODUCTION (METRIC TONS,M.T.)	5000.	5000.
PROJECTED RATE REPLACEMENT INV. ESCALATION (% ANNUALLY)	7.0	7.0
PROJECTED RATE OF COST ESCALATION (% ANNUALLY)	7.0	7.0
ANNUAL OPERATING COSTS BEGINNING OF EACH PHASE ($000)	29061.	57167.
ANNUAL ROYALTY RATE (% OF GROSS REV.)	12.0	12.0
DEPLETION RATE (PERCENT,LIMITED TO 50% OF NET)	10.	10.
COMBINED EFFECTIVE TAX RATE	50.0	50.0

CASH FLOW CALCULATION FOR PHASE 1.

YEAR	1984.	1985.	1986.	1987.	1988.	1989.	1990.	1991.	1992.	1993.
PRICE,COAL ($/MT)	16.00	17.12	18.32	19.60	20.97	22.44	24.01	25.69	27.49	29.42
ANNUAL COAL PRODUCTION PROD. (000 METRIC TONS .)	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.
AVERAGE TOTAL COST ($/METRIC TON)	10.15	11.14	11.81	12.54	13.34	14.17	15.15	16.17	17.26	18.44
REVENUE ($000 U.S.)	80000.	85600.	91592.	98003.	104864.	112204.	120058.	128463.	137455.	147077.
LESS ANNUAL ROYALTY ($000)	9600.	10272.	10991.	11760.	12584.	13464.	14407.	15416.	16495.	17649.
LESS ANNUAL OPERATING COST ($000)	29061.	31095.	33272.	35601.	38093.	40760.	43613.	46666.	49932.	53427.
EQUALS GROSS INCOME ($000)	41339.	44233.	47329.	50642.	54187.	57980.	62039.	66381.	71028.	76000.
LESS INTEREST ON LOANS ($000)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LESS ANNUAL DEPRECIATION AND AMORTIZATION ($000)	3989.	7036.	6409.	5882.	5499.	4899.	5144.	5044.	5044.	5044.
LESS DEPLETION ($000)	7040.	7533.	8060.	8624.	9228.	9874.	10565.	11305.	12096.	12943.
TAXABLE INCOME ($000)	37350.	37197.	40920.	44761.	48688.	53081.	56895.	61338.	65984.	70956.
LESS TAX ($000)	15155.	14832.	16430.	18068.	19730.	21603.	23165.	25016.	26944.	29007.
EQUALS NET INCOME AFTER TAX ($000)	15155.	14832.	16430.	18068.	19730.	21603.	23165.	25016.	26944.	29007.
LESS AMORTIZATION OF LOAN ($000)	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
PLUS NON CASH FLOWS ($000) DEPRECIATION AND AMORTIZATION	3989.	7036.	6409.	5882.	5499.	4899.	5144.	5044.	5044.	5044.
AND DEPLETION ($000)	7040.	7533.	8060.	8624.	9228.	9874.	10565.	11305.	12096.	12943.
LESS REPLACEMENT INVESTMENT ($000)	0.	0.	0.	0.	0.	16320.	17462.	18684.	19992.	21392.
EQUALS OPERATING CASH FLOW ($000)	26184.	29401.	30899.	32574.	34457.	20057.	21412.	22681.	24092.	25602.
CONSTANT (1979) DOLLAR CASH FLOW ($000)	18669.	19591.	19242.	18958.	18742.	10196.	10173.	10071.	9997.	9929.

CASH FLOW CALCULATION FOR PHASE 2.

YEAR	1994.	1995.	1996.	1997.	1998.	1999.	2000.	2001.	2002.	2003.
PRICE,COAL ($/MT)	31.47	33.68	36.04	38.56	41.26	44.14	47.23	50.54	54.08	57.86
ANNUAL COAL PRODUCTION PROD. (000 METRIC TONS .)	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.	5000.
AVERAGE TOTAL COST ($/METRIC TON)	20.24	21.66	23.04	24.52	26.12	27.54	29.43	31.36	33.44	35.66
REVENUE ($000 U.S.)	157372.	168388.	180175.	192768.	206283.	220723.	236173.	252705.	270395.	289322.
LESS ANNUAL ROYALTY ($000)	18885.	20207.	21621.	23135.	24754.	26487.	28341.	30325.	32447.	34719.
LESS ANNUAL OPERATING COST ($000)	57167.	61169.	65451.	70033.	74935.	80180.	85793.	91798.	98224.	105100.
EQUALS GROSS INCOME ($000)	81320.	87012.	93103.	99621.	106594.	114056.	122040.	130582.	139723.	149504.
LESS INTEREST ON LOANS ($000)	6120.	5818.	5472.	5073.	4615.	4088.	3481.	2784.	1982.	1060.
LESS ANNUAL DEPRECIATION AND AMORTIZATION ($000)	4372.	5504.	5260.	5116.	5116.	2219.	2846.	2747.	2747.	2747.
LESS DEPLETION ($000)	13849.	14818.	15855.	16965.	18153.	19424.	20783.	22238.	23795.	25460.
TAXABLE INCOME ($000)	70828.	75690.	82371.	89432.	96863.	107749.	115712.	125052.	134994.	145697.
LESS TAX ($000)	28490.	30436.	33258.	36233.	39355.	44163.	47464.	51407.	55600.	60118.
EQUALS NET INCOME AFTER TAX ($000)	28490.	30436.	33258.	36233.	39355.	44163.	47464.	51407.	55600.	60118.
LESS AMORTIZATION OF LOAN ($000)	2009.	2311.	2657.	3056.	3514.	4042.	4648.	5345.	6147.	7069.
PLUS NON CASH FLOWS ($000) DEPRECIATION AND AMORTIZATION	4372.	5504.	5260.	5116.	5116.	2219.	2846.	2747.	2747.	2747.
AND DEPLETION ($000)	13849.	14818.	15855.	16965.	18153.	19424.	20783.	22238.	23795.	25460.
LESS REPLACEMENT INVESTMENT ($000)	22889.	24491.	26206.	28040.	30003.	32103.	34350.	36755.	39327.	42080.
EQUALS OPERATING CASH FLOW ($000)	21812.	23956.	25511.	27218.	29107.	29661.	32096.	34292.	36667.	39176.
CONSTANT (1979) DOLLAR CASH FLOW ($000)	7906.	8115.	8076.	8053.	8048.	7665.	7752.	7740.	7735.	7723.
NOMINAL DOLLAR EVALUATION										

THE NET PRESENT VALUE AT 10.0 PERCENT DISCOUNT RATE IS ($000) 51791.
THE DISCOUNTED CASH FLOW RATE OF RETURN IS 15.0 PERCENT

ASSUMED GENERAL INFLATION RATE IS 7.0PERCENT

CONSTANT DOLLAR EVALUATION

THE NET PRESENT VALUE AT 3.0 PERCENT DISCOUNT RATE IS ($000) 52098.
THE DISCOUNTED CASH FLOW RATE OF RETURN IS 7.5 PERCENT