

7 THE FINANCIAL VIABILITY OF THE KANTIENPAN DEPOSIT

7.1 INTRODUCTION

Mining projects that are financially evaluated, always use three major input factors: mine life (a factor of the resource and the production rate), total investment (as based on fixed production rates) and returns on the investment (based on the profit). These factors are, however, each estimates with a certain degree of accuracy and a single value, such as net present value, that is calculate, should be accompanied by a statement of the reliability of the estimate. This reliability can be reported in two general ways: a sensitivity analysis and a risk analysis. Both analyses were used in the evaluation of the Kantienpan deposit.

A discounted cash flow (DCF) model was first used in the financial evaluation of the deposit and the values from the DCF were then used in the sensitivity analysis and risk analysis.

Benchmarking, with worldwide Zn-Cu deposits, were done to determine mining and processing costs, which were then used in the DCF to get a realistic and accurate estimate. The way that the mining and processing costs, as well as the methods, were determined, are described in the following paragraphs.

7.1.1 Metallurgy

Metallurgy will not be discussed in great detail, owing to the fact that flotation, the suggested beneficiation procedure, has been tested and proven to produce, in the Kantienpan case, a Zn and possibly a Cu concentrate. It is suggested that a bulk sample should be taken and sent to Kumba's Rosh Pinah mine for pilot floatation test work, should the project enter a pre-feasibility study phase.

The cost for the processing was estimated at US\$10.63/t, which was benchmarked against mines such as Rosh Pinah, Maranda, Black Mountain and the Clementine software from, AME Mineral Economics. Capital cost to

process the ore, for a concentrate, was calculated on a process factor of 3.5 times the operational expenditure (US\$17 600 000). This operational cost was again benchmarked against mines like Rosh Pinah, Maranda, and Black Mountain and found to be comparable. A plant recovery for Zn was also benchmarked against mines such as Rosh Pinah, Maranda, and Black Mountain and found to be an average of 90%, which was used in the discount cash flow (DCF) model.

7.1.1.1 Risks

Risks, as discussed in paragraph 5.2, are the flotation problems owing to possible high iron values substituting the Zn in the sphalerite and possible problems that might arise from the floatation test work. The capital cost assumption can be a factor of risk and detailed cost should be calculated for the project in the prefeasibility stage.

7.1.2 Mining

7.1.2.1 Mining Method

The mining method proposed is underhand benching, which is derived from the orebody width and the competency and strength of the surrounding wall rock. The operation can be mechanised as far as possible, using proven techniques employed at Maranda mine, where techniques such as conveyor hoisting and load-haul-dumper (“LHD”) equipment have proved successful (Terblanche, 1997).

It is proposed to develop the orebody by means of a main conveyor decline, which will also act as the main intake airway. Secondary access will be provided via the main ventilation exhaust raise. The main decline will be driven parallel to the ore zone and approximately 20m from it to 260E where the orepass system will be located (Terblanche, 1997).

The main haulage will be established on 200 Level, having drawpoints at approximately 12m centres. The orebody has been divided into on-strike stopes, each 65m long, separated by 8m rib pillars with a stoping height of 120m. Sub-levels will be established at 30m centres on 160, 130, 100 and 70m levels being connected by access raises mined in the centre of the rib pillar in the ore zone. Slot raises will be driven in ore in the centre of each stope block and the underhand bench stopes will commence from these raises on 200 Level.

Provision has been made on the main haulage (200 Level) for a orepass grizzly for both ore and waste handling and for workshop facilities.

There is a small ore extension in depth to the west below 200 Level, and provision has been made for ongoing development to exploit this by means of a scooptram decline hauling ore back up to the orepass on 200 Level.

Pre-production development is estimated at two years by the end of which 3632m will have been completed, generating approximately 19 000 tons of ore, and four stope blocks will be available for mining. Ongoing development is assessed at a rate of 72m per month and ore production has been set at 6 000 tons per month.

All development and stope drilling will be carried out by jackhammers. Development cleaning and stope production will be effected by a fleet of three two-yard scooptrams (inclusive of spares for maintenance and downtime), discharging into the main orepass on 200 Level, with ore transported to surface via a 24-inch conveyor system.

The cost of mining was estimated at US\$18.72/t, which was again benchmarked against mines like Rosh Pinah, Maranda, Black Mountain and the Clementine software from, AME Mineral Economics. The capital mining cost was calculated on a mining factor of 2 times the operational expenditure (US\$17 700 000). This mining operational cost was again benchmarked against

mines like Rosh Pinah, Maranda, and Black Mountain and found to be comparable. A mining recovery of 90%, a mining dilution of 5% and a transport cost of US\$0.005/km ton were used in the DCF model. These assumptions were again benchmarked and found to be comparable against mines such as Rosh Pinah, Maranda, and Black Mountain and found to be an average of 90%, which was used in the discount cash flow model.

7.2 DISCOUNTED CASH FLOW MODEL

The DCF was based on a geostatistical derived Zn equivalent value of 5%, a tonnage of 5 Mt derived from the geological block model and a Zn flat rate price of US\$950/ton. The DCF as a whole is calculated in US\$ although the NPV is also given in rand. A real discount rate of 8% was used, because this is currently the hurdle rate Kumba Resources Ltd. applies for projects in the “blue skies” phase.

The tax rate of 30% was used in the calculations, which is the company tax percentage for 2002, but no tax was paid, because the project has a negative NPV. Only royalties were paid and the amount can be seen in Table 9. The transport cost factor was obtained from benchmarks with other deposits like Black Mountain and Rosh Pinah.

It is, however, important to note that the project is probably in the “blue skies” phase and the model is therefore kept very simple. The assumptions used are mostly generalised, although the values correlate with other mines that were benchmarked. The achieved results, from the model, are however more than adequate for evaluating the project at this level.

The detailed costs and assumptions of the model can be seen in Appendix G. Table 9 gives a summary of cash flow of the project and it indicates that the project will probably not be positive as a stand-alone project.

Table 9. Total Cash Flow to Equity.

Cash Flow	Amount (US\$)
Discount Rate	8%
Revenue	101 841 416
Operational Expenditure	-147 789 650
Royalties	-509 207
Capital Expenditure	-39 889 000
Total	-86 346 441

A negative NPV of US\$66 818 693 was calculated.

7.3 KANTIENPAN BENCHMARKED AGAINST WORLD ZN PRODUCERS

7.3.1 Introduction

Most of the current world Zn producers were plotted in Figure 14 against their annual production and cash cost and a trend line was then fitted to the data.

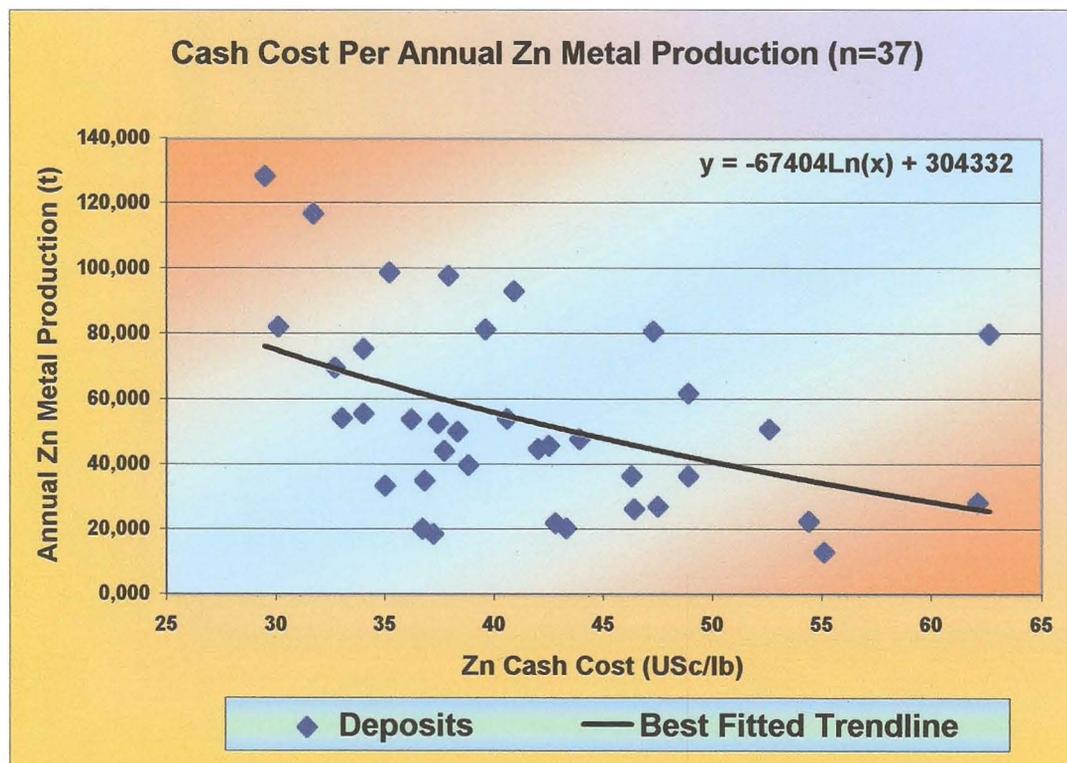


Figure 14. Cash cost per annual Zn metal production.

The life of mine (LOM) for each deposit was calculated by using the empirical formula for base metal deposits: $LOM = 0.2 (\text{Reserve})^{0.25}$ (Noakes and Lanz, 1993). With the known LOM values, the total annual metal ton production could be calculated. The formula for the trend line was then used to calculate the cash cost for each deposit. This cash cost per pound of metal could be contoured by the solid lines in Figure 15.

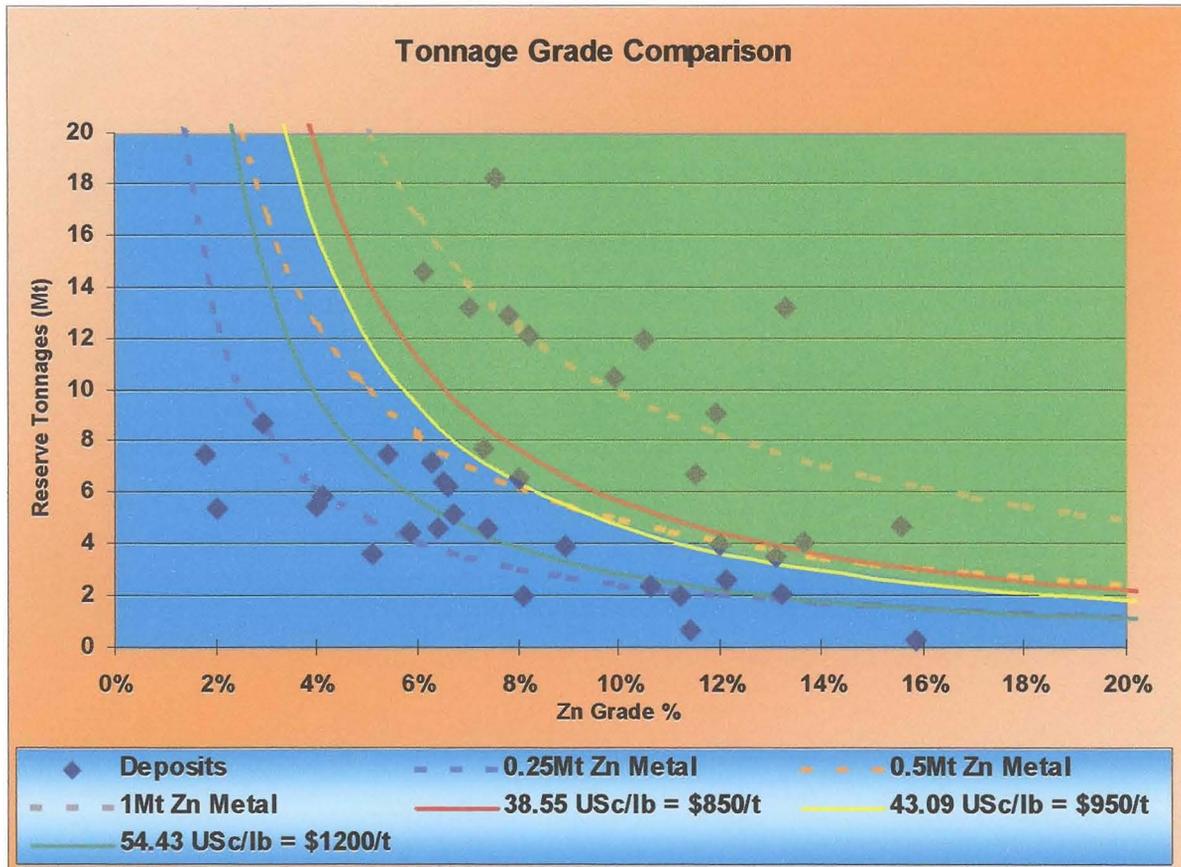


Figure 15. Tonnage and grade comparison at a Zn price of US\$950/t.

All the deposits in the green area are economical when based on the Zn value, taking the Zn price to be US\$950/t (Figure 15). Since all the deposits on the graph are current in production, this means that those deposits under the line must be making their money from other metals in the ore, given for instance a higher Cu price than the price for Zn. For those deposit in the green area the working cost is lower than the revenue at a Zn price of US\$950/t and where the deposit plot in the blue the working cost exceed the revenue. Price selected

brake even lines at are also provide for other Zn prices and comparison million ton contained Zn Metal lines were also plotted to compare different deposits.

By using Monte Carlo simulations (Appendix H), the present value contours for the Kantienpan deposit, specifically, could also be plotted (dotted lines in Figure 16).

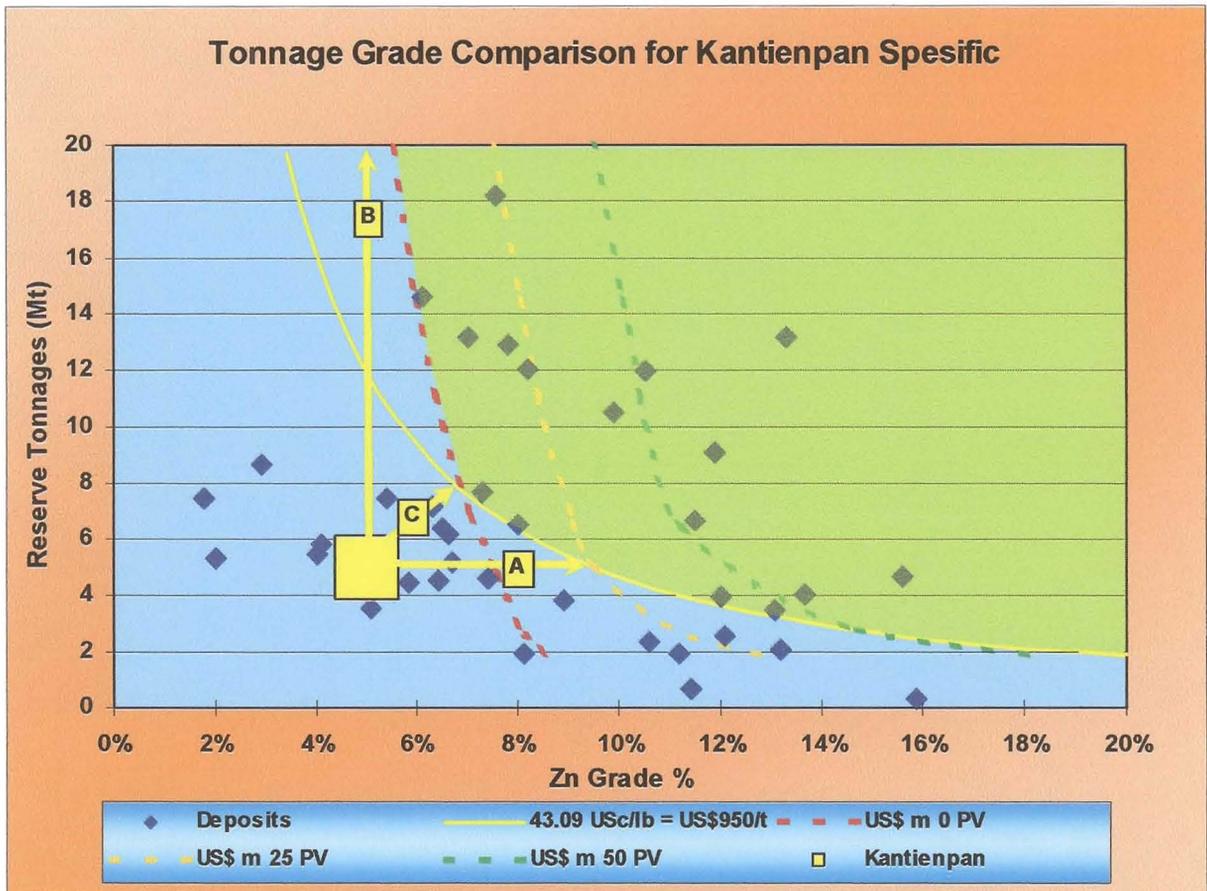


Figure 16. Tonnage and grade comparison for the Kantienpan deposit at a US\$0 NPV and a Zn price of US\$950/t.

The green area in Figure 16 shows the area of economic viability for the Kantienpan deposit. The yellow box is the current status of the Kantienpan deposit and the arrows, A, B and C, indicate the grades and tonnages, which will make the deposit economically feasible. It is however clear that the grade needs to increase dramatically before the deposit will be economical. Arrow C gives an indication of 7 % Zn and 8 Mt reserves to get to a breakeven situation. Another scenario is to increase the Cu grade, which will reach a positive NPV more easily than an increase in the Zn grade, due to a higher Cu price. Further

exploration drilling near Cu rich areas could lead to the discovery of the fumarolic vent with higher Cu grades and a detailed drilling programme is suggested for a prefeasibility stage.

7.4 SENSITIVITY ANALYSIS

A sensitivity analysis is one way of assessing reliability, by which one variable's value is changed systematically and the corresponding value of the financial criteria is reported. These corresponding values are plotted and the steeper the gradient of the line, the more sensitive the financial criteria to the variable's value.

Sources of risk, which are the variables used in a sensitivity analysis, are costs, prices, fluctuations in exchange rates, ore reserves, mineral processing, completion time of the project, pollution abatement costs, political, etc. The sensitivities that were used in this study can be seen in Figures 17 and 18, with grade being the most sensitive variable and price the second most sensitive variable to the NPV. Ore resources are very insensitive for this specific deposit. Costs, especially operating cost, are also sensitive, but were not plotted due to the fact that costs were calculated on a mining and processing factor (see Appendix G).

The sensitivity in terms of tonnage was evaluated using realistic increments at a grade of approximately 5% Zn (increments of 5Mt, up 30Mt were considered). It was found that a relatively small increment in tonnage would not provide any significant economic benefit. Economy of scale benefits would only be notable with very large increases in the tonnage.

The prices that were used were only for Zn and not for Cu. Cu prices are higher than Zn prices, which means that the NPV will be more sensitive towards Cu prices than Zn prices.

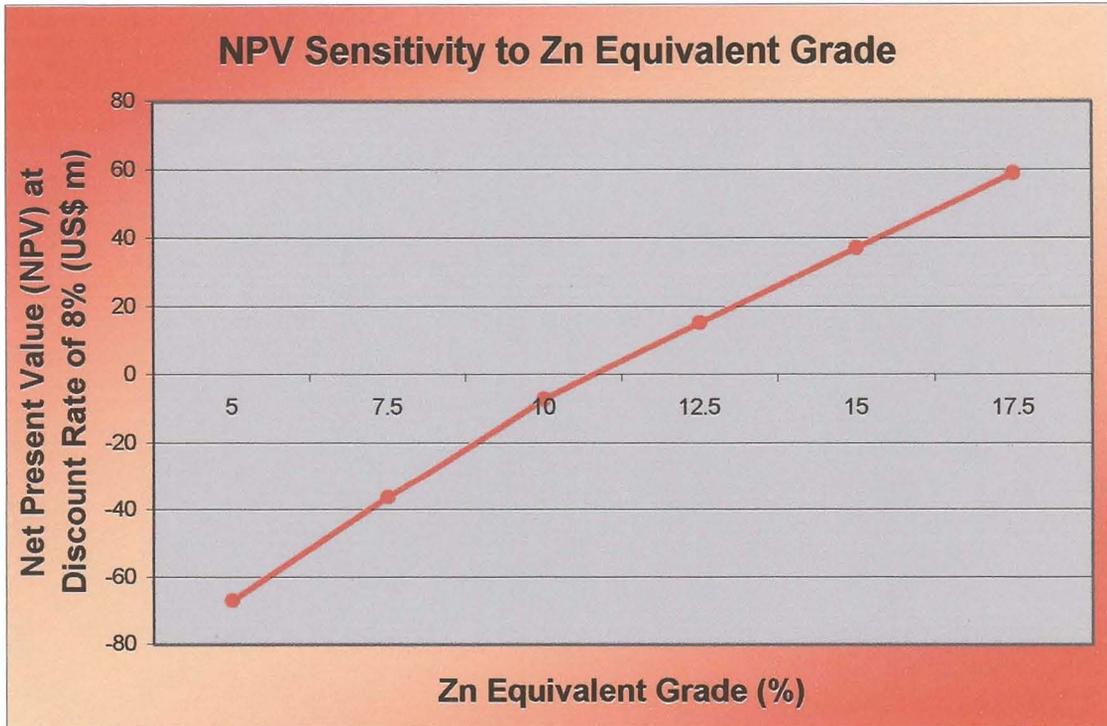


Figure 17. Zn Equivalent grade sensitivity plot.

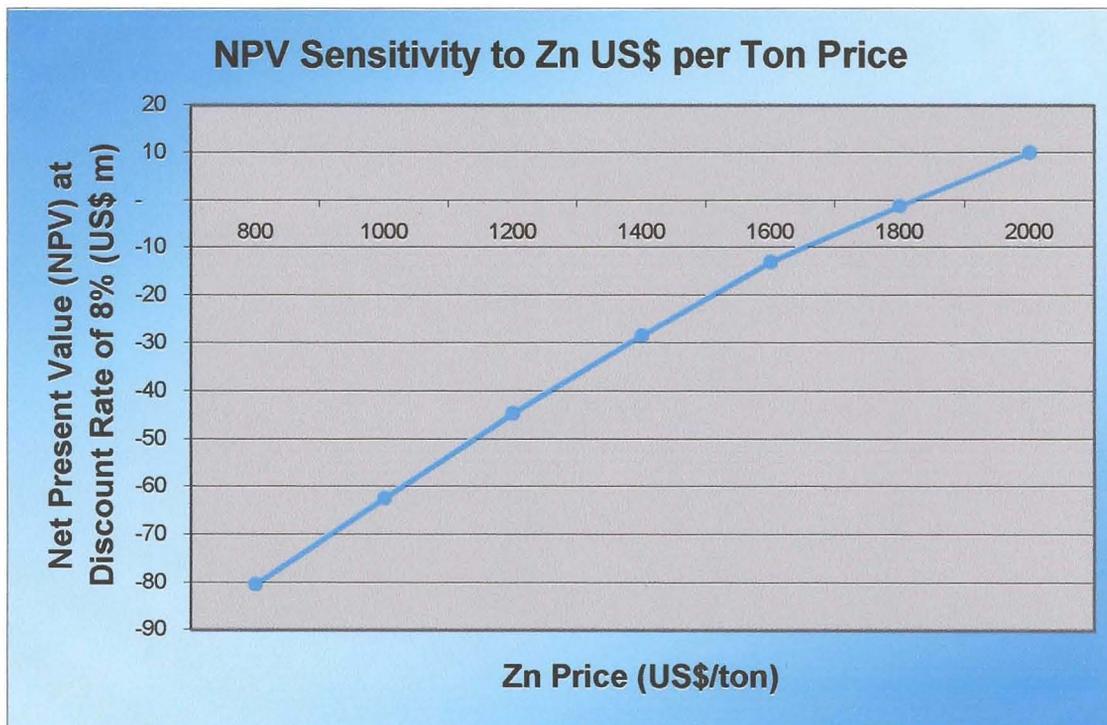


Figure 18. Zn US\$/t price sensitivity plot.

7.5 RISK ANALYSIS

Risk analysis is another way of assessing the confidence in the reliability of the final recommendation. One of several mathematical techniques for performing probabilistic risk assessments is Monte-Carlo analysis. Monte-Carlo analysis allows all variables to change their values simultaneously with each variable selected at random from a histogram that summarises historical values or future values of the variable based on a preferred prediction model.

According to Vose's, the cardinal rule of risk analysis modelling is: "Every iteration of a risk analysis model must represent a scenario that could physically occur." Following of this rule will result in a risk model that is both accurate and realistic (Vose, 1996).

A Monte-Carlo analysis was used to perform a probabilistic risk assessment of the Kantienpan deposit (Appendix H). A spreadsheet was set up with the same information that was used in the DCF. A standard deviation (STD) column was added on the right-hand side of the DCF information and populated with deviations for each aspect that would simulate the model as accurate and reliable as possible. A hundred permutations were added in columns to the right of the STD column to simulate 100 scenarios. The results were summarized in a cumulative frequency and variable value range table and plotted as a probability plot (shown in Figure 19).

Two analyses were done and plotted as probability plots of the NPV value at a discount rate of 8%. The first analysis was done with the current scenario with a 5 Mt reserve and an equivalent Zn grade of 5% (Figure 19). It is clear from the results that the project only has a 2.4% change on success. These results correlate with the negative NPV value from the discounted cash flow model that the project will not be economical at present.

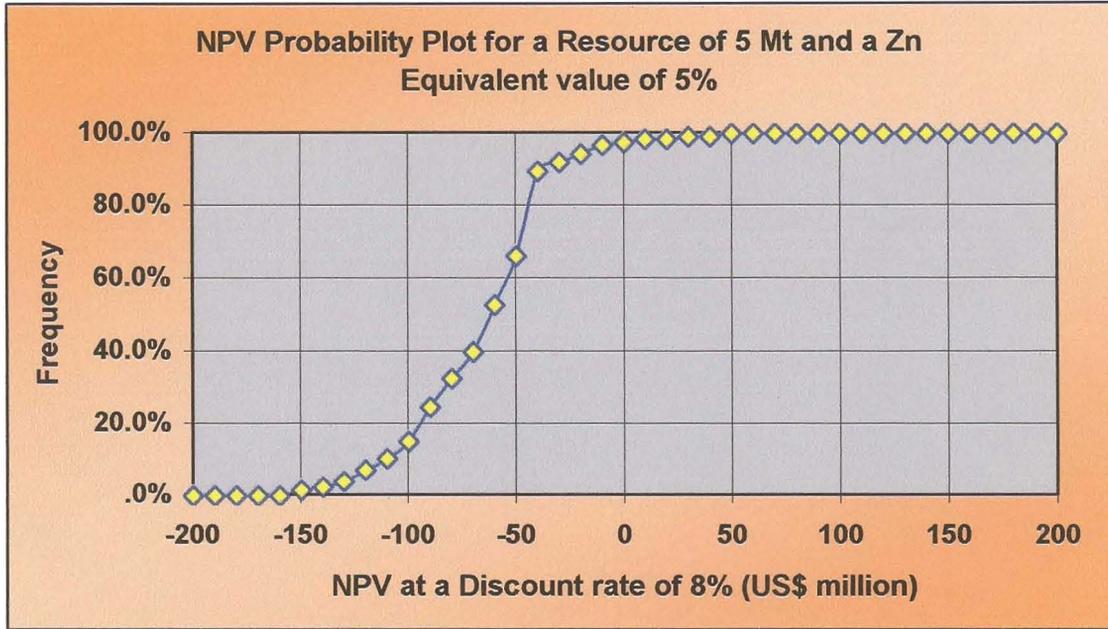


Figure 19. NPV probability plot for a reserve of 5 Mt at 5% Zn Eq.

Looking at an example of 5 Mt reserves at 12% Zn grade (Figure 20), the project will be economically viable 40% of the time. It is still less than what is needed for a project in a final feasibility stage, but most companies will jump at such a project in the “blue skies” phase.

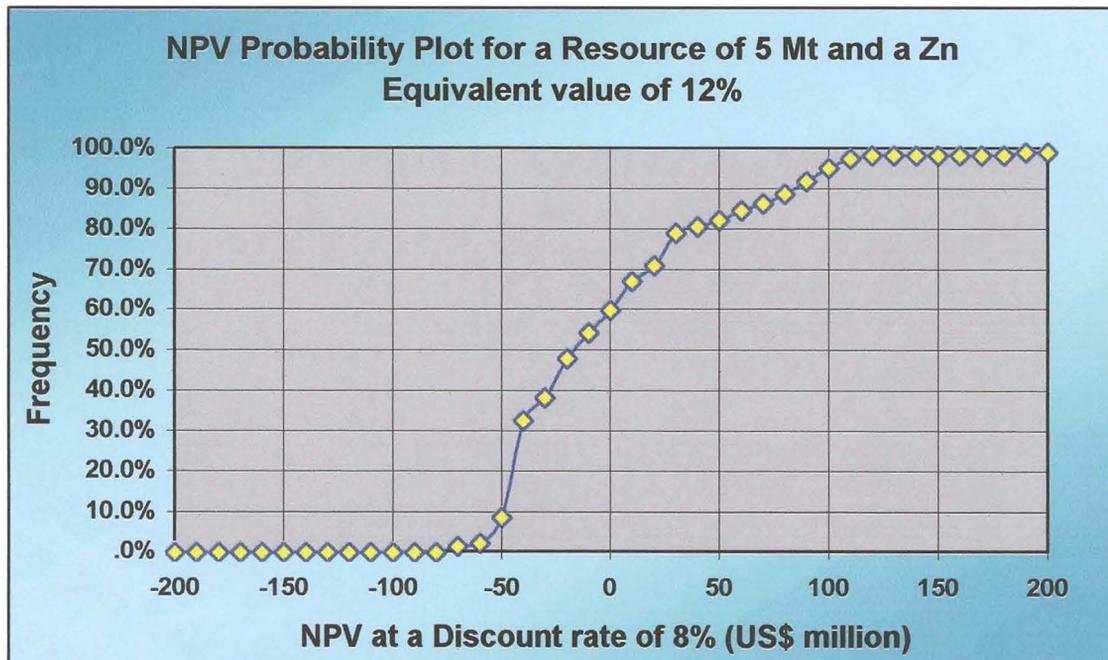


Figure 20. NPV probability plot for a reserve of 5Mt at 12% Zn Eq.

7.6 ALTERNATIVE SCENARIO

An alternative option that must also be considered is the cost of importing Zn concentrate, should Zincor run out of nearby suppliers. With the closure of Pering, imminente closure of Maranda and the decreasing life of mine of Rosh Pinah, demand for Zn concentrate, to supply the smelter, is steadily increasing.

The cost to import 1 ton of Zn concentrate cannot be reviled, but is taken at US\$X/t more than for domestic concentrate (information supplied by Kumba's commodity annalist, Mr E.T. Fourie, pers. comm., 2002). The discounted cash flow model shows an operating income per ton milled of -US\$9.7 (Appendix H). With a concentrate Zn grade of 55%, a Zn grade of 5% and a recovery of 90%, 12.2 run of mine tons are needed to produce one ton of concentrate (Concentrate grade / (Zn grade x Recovery)). The imported concentrate amounts to an operating cost of US\$4.9/ton milled. Adding the cost to import Zn concentrate (-US\$9.7 + US\$4.9) gives an operation income of -US\$4.8/t.

This means that a loss of US\$4.8/t is still made to produce a ton even if one can save the US\$X/t to import Zn concentrate. Should the Zn price increase to US\$1200/t, the operating income per ton milled is -US\$3.7 (Appendix H). Adding again the cost to import Zn concentrate (-US\$3.7 + US\$4.9) gives an operation income of US\$1.2/t, which means that the project is positive. It must be stated that the Cu and Ag has not been taken into account; additional revenue from these elements would definitely affect the project positively.