MAXIMINE Project Evaluation

DR ROBERT FAGAN

MAXIMINE is a compiled, comprehensive spreadsheet-based, macro driven software package written to aid in the rapid and early assessment and design of virtually any small, medium, and large mining or quarrying project. The system has been **designed to be used by exploration geologists, mine geologists**, or **mining engineers** and has particular application in **prospect evaluation, mine modelling** and in various forms of **feasibility analysis**. Metallurgists, process engineers, financial analysts, prospectors and miners are all additional potential users.

The program calculates the simplest, regular shaped deposit of uniform thickness and grade defined from minimal dimensions and other input entered by the user. The user enters a limited range of generally readily available data defining the **deposit geology, geometry, mining method** (surface or underground mining), selects **mining and processing options**, and enters appropriate **capital and running cost data**. No provision has been made for handling geometrically complex ores or for significant grade variations. Up to 60 separate data inputs for any project may be entered in as little as five minutes.

SUMMARY OF PRINCIPAL INPUT DATA

Ore Character and Deposit Geometry
nominate up to three precious and four non-precious commodities
strike length of ore
ore thickness
ore grade (g/tonne or weight percent)
dip of ore
depth of overburden (depth to the top of the orebody)
depth to deepest ore (depth to the base of the orebody)
S.G. of ore and waste

Mining Details:
mining method (surface or underground)
mining rate (tonnes/shift, shifts/day, etc)
pit wall slope (batter angle for open pit mining)
ore dilution factor
mining cost ($/tonne, waste and ore costed separately)
waste handling cost ($/tonne)
cartage cost ($/tonne)
stockpile costs ($/tonne)
backfill handling costs ($/tonne)
rehabilitation cost ($/tonne)

Processing details:
cartage distance to plant
cartage costs to plant ($/tonne/km)
costings for up to three user-defined process streams. Eg.
    size reduction ($/tonne)
    roasting ($/tonne)
    CIP ($/tonne)
any nominated throughput
any nominated recovery
choice of fully refined product or concentrates of any grade
automatic dilution adjustments in mill tonnages & grades

Capital Costs
acquisition & development costs
exploration expenditure
any four user-nominated major depreciable assets
non-depreciable assets
costings for drives, shafts, declines, ramps etc, ($/metre)
loans, (principle, term, and rate)
annual rates of depreciation and maintenance,
write down periods
royalties on production

Additional Running Costs
drilling (metres & $/metre)
contractors (hours & hourly rate)
equipment hire (up to four user-nominated major items)
up to eight other user-nominated total price items

Financial
metal or other commodity price ($US/oz or $US/tonne), currency exchange rate (default is Australian currency), interest rates for NPV & IRR data, and a range of sensitivity table parameters

A SUMMARY OF PRINCIPAL OUTPUT DATA

The printed output consists of some twelve pages of geological, mining, process, and economic data and five additional pages consisting of five one-way and six two-way sensitivity tables. These tables can be modified in a few key strokes to examine the impact of **any** systematic variation in **any** of the data inputs on **any** individual or grouping of output data. In addition twenty multi-variable graphs linked to the sensitivity tables and automatically updated may be viewed and printed.

The result is a detailed interactive spreadsheet model of the deposit which may be interrogated, analysed, varied and manipulated at will. Each cost item is evaluated in terms of $/tonne of ore, grade equivalence, and is displayed in terms of a detailed breakdown of the annual and mine life cost. The extensive calculated output includes: **waste:ore ratios,;cut-off grades; optimum pit depth, annual and mine-life profitabilities; NPV, IRR and payback periods; ore, tailings, processable waste, stockpile and materials inventories**.

A detailed breakdown of the selected mining option **(underground or open pit)** is provided. The user nominates a mining interval (bench height or level interval), and a large selection of mining, production, and economic data for the entire mine for the selected configuration is presented. The data is presented in table and graphical form indicating both the individual and cumulative changes on a level-by-level, or bench-by-bench basis as mining progresses. **Annual summaries covering the first eight years of production including detailed mining and financial data are provided and can be varied to cover any time interval**.

A range of sophisticated computational features include comprehensive "Solver", "Back solver", mine design optimisation functions, and facilities for ranking the sensitivity of any user-selected input against any user-selected output variable.

SYSTEM OPERATION

The program runs as an Excel spreadsheet. All the main features of the program including spreadsheet navigation, printing, data re-calculation, sensitivity analysis, file management, graphing, and an extensive range of utility and programming function are automatically controlled by invisible macros activated by buttons and icons visible on screen and function as they would in Excel.

Cautionary comments

The program is quite involved with many complex input variables and complex hidden subroutines controlled by macros. No guarantees are made as to the accuracy or reliability of the data and output in all circumstances. It is up to the user to check the reasonableness of the output before completely relying on the data and basing major decisions on the output. As much care as possible has been taken, but the system is an over-simplified view of a complex set of relationships, based on incomplete information, some guestimates of input values, and more importantly an inability to handle variations in input values except as in one and two variable sensitivity tables. The inability to handle varying input values such as grade and density variations that may exist in the ground, may provide a fair degree of uncertainty in the output. The program provides a quick and easy guide only and should be followed up by more careful and rigorous analysis using more expert and flexible systems.

The program should be regarded as producing a detailed, sophisticated, digital, back-of-the-envelope calculation complete with optimisation and sensitivity analysis but with limited flexibility. A best guess approximation only within the inherent limitations of the data input.