Rerum Naturalium Fragmenta

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PEREC
Prospect Evaluation for Windows
User's Guide

Part 1

by

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Chapter 1
INTRODUCTION

PEREC is a computer software package for Prospect Evaluation. The core of the application system consists of functions to calculate the expected amount of hydrocarbons-in-place by Monte-Carlo simulation. You can also calculate prospect value and perform strategic inventory analysis of your exploration portfolio.

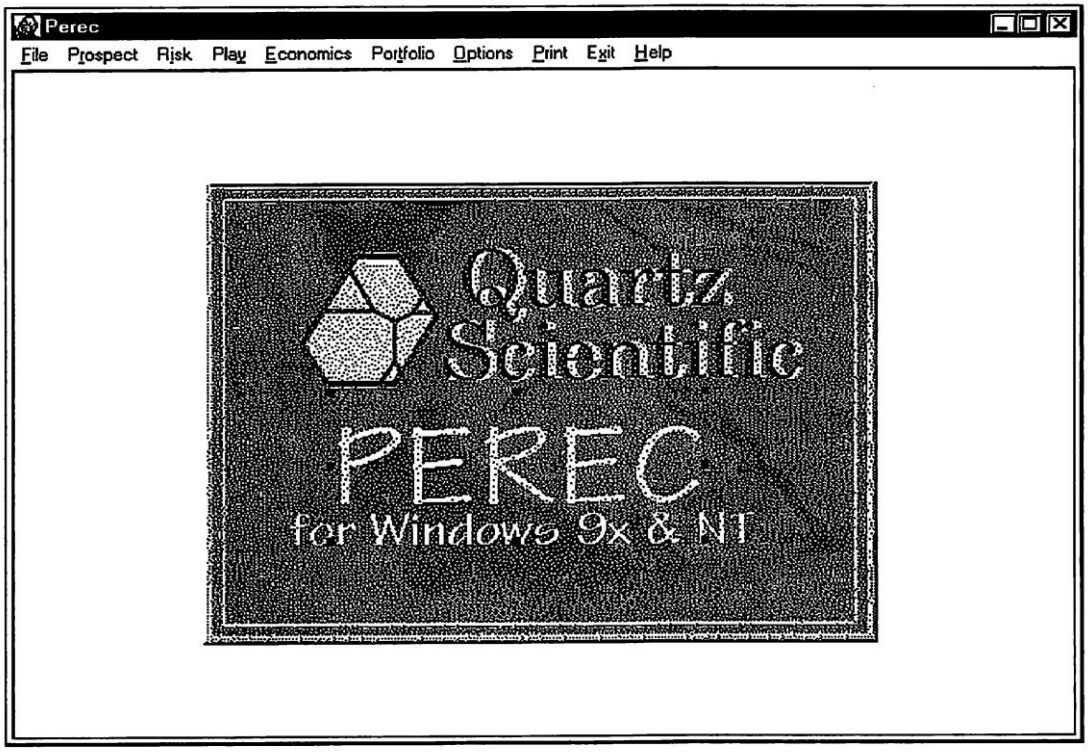

Figure 1.1: The main menu

Menu options include programs for the entry of geological models, the validation of model parameters, and the graphic display and printing of the results.

The package is set up to run on IBM PC compatible microcomputers under Windows 95, 98 or NT. While most graphics functions are resolution independent some will benefit from higher resolution: 600*800 or higher modes are recommended for the display of graphs.

Access to PEREC

Switch on the PC, wait until the Windows desktop appears.

You may find the PEREC icon on the desktop. If PEREC is not among the desktop icons, chose it from the program menu by selecting Start Menu/Programs/Perec.

The PEREC splash screen will appear while the application is loading, then the main window appears with the menu options listed on the top of the screen as drop down menu items.

The Perec menu

The main options shown are Prospect, Risk, Play, Economics, Portfolio, File, Print and Options.

Some of the options lead to a further selection of functions. When you select one of these a group of functions is displayed as a drop-down menu.

Menu functions can be selected by clicking on them or by **Alt**-key combinations. For example Help can be selected by pressing **Alt-H**, and **Alt-F** displays the drop down File menu of utility functions.

Chapter 2
EDITING

From the main menu select the Prospect option. The Prospect Modelling menu will be displayed.

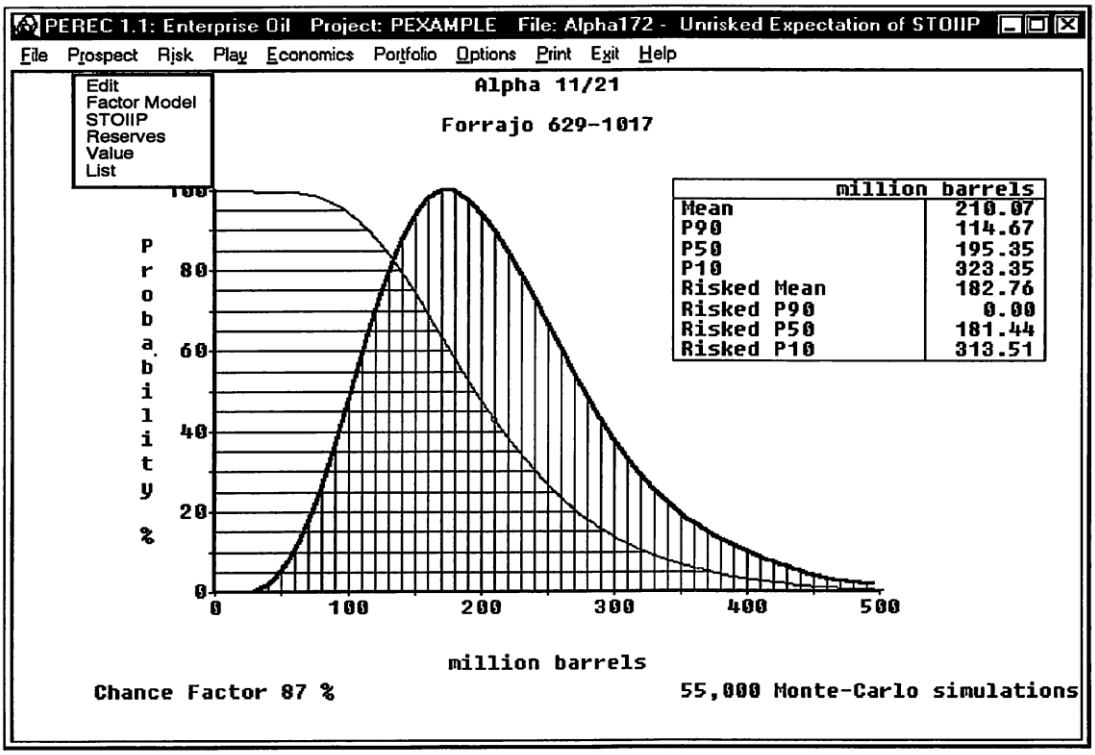

Figure 2.1: Prospect modelling menu

The Edit option on this menu can be used to enter or modify reservoir model data. When you select **Edit** the program will first ask for an input file. If you want to start from scratch specify BlankOil or BlankGas as the input file.

Choosing an input file sets the initial state of the work file. The BlankOil option starts editing by filling the work file with a default template containing the usual set of geological factors applicable to oil reservoirs. The BlankGas option uses a similar template for gas reservoirs.

Each of these options asks for a name for the file to save the edited model to. When you start editing from scratch, the list of existing files presented on the left of the menu serves as a reminder of names already used.

If you are editing the contents of an existing model file, the edited data will be used to update the same file unless saved under a different name.

Entering a new reservoir

When you are entering a new reservoir data set, you can select BlankOil or BlankGas as input to serve as a template. They differ only in the initial contents of the work file. The choice reflects the units in which the results will be reported: barrels, cubic feet or cubic metres. Certain data fields are loaded initially with typical parameters for oil reservoirs or gas reservoirs. In any case the displayed entries can be modified by the user.

Names of model files

The editor program will prompt for a file name of up to 8 characters. The name may be the abbreviation of prospect and reservoir - this will be the name under which the data set is stored. Each reservoir needs a new file; and if a reservoir contains both oil and gas, these should be put in separate files, too.

The file name should consist only of letters, digits and the characters “&”, “-“, or “!”.

The Editor program

Model parameters are entered more or less in the same order as they appear in the printed PEREC summary listings.

The first screen presented by the editor shows general reservoir parameters.

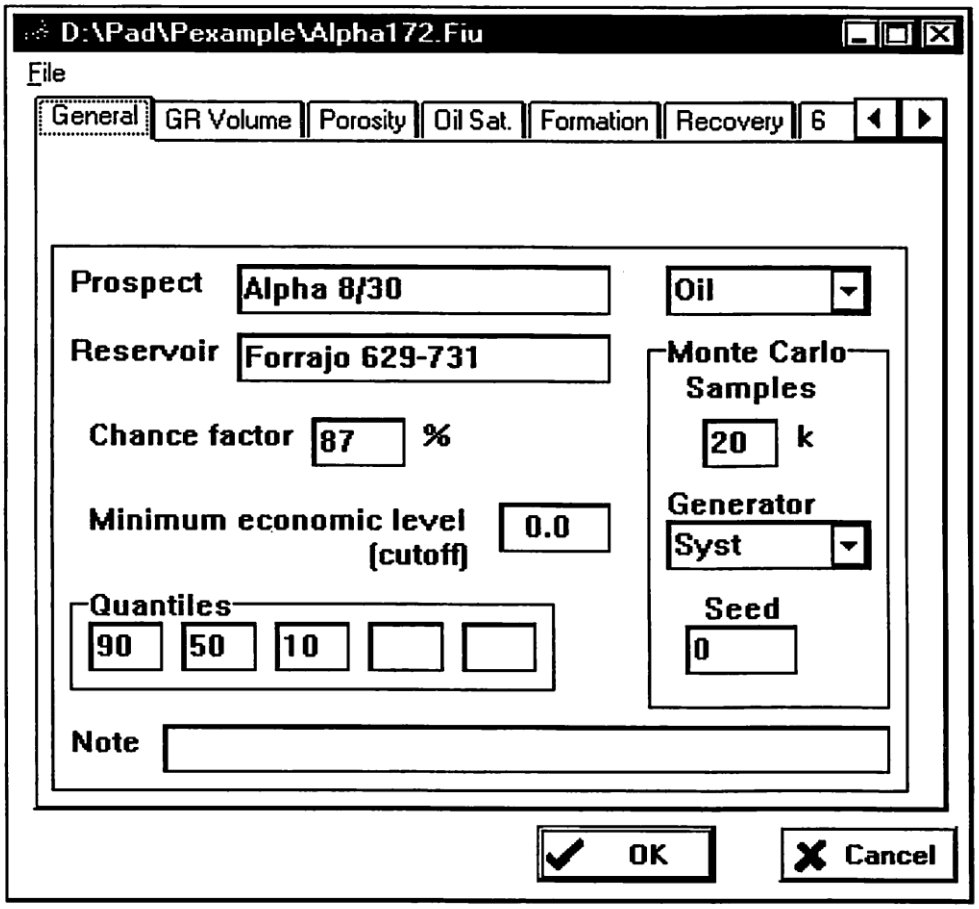

Figure 2.2: Editor screen: model parameters

Each of the following screens contain parameters of a single geological factor e.g. gross rock volume or porosity. You can move about the screen by using the arrow keys and so type the values into the boxes. Pressing Enter takes you to the next data field, pressing the Tab key moves back to the preceding field. You can move between screen pages by pressing the Page Down or the Page Up key.

When entering data in a box you can overwrite existing, displayed information.

Reservoir parameters

The first screen of the model data file is devoted to general Reservoir description. The first two items to type in are Prospect name and Reservoir name. Both can be up to 20 characters long and should be entered in the form which you wish to appear on the plots and listings. You can use upper or lower case letters or other printable characters, the restrictions on model file naming do not apply.

Oil or Gas : enter Oil, Gas or Metric. This determines the units in which the results will be reported. If you enter Metric in the box then the results are reported as million cubic metres, otherwise as million barrels or billion cubic feet.

Chance factor (risk): enter as a percentage.

In the 'Note' field you can enter a line of annotation which will then be displayed at the bottom of the plots.

Values to compute

Values to be computed and displayed as numerical results can be specified in the following fields of this screen.

To specify an economic cut-off, enter the value in the units of the computed results e.g. million barrels of oil. The program will compute the chance of finding a volume bigger than this and also the average of all values above the cut-off.

Up to 6 quantiles e.g. P90, P50,... can be requested. (The usual set is P90, P50, P10).

If these fields are left blank only the unrisked average and the expectation curve will be computed.

Simulations

You can specify the number of simulations as a number between 1000 and 999,000 (entered as 999k). It should be a multiple of 1000. The default value set by the Quick Editing option is typically 5000, but this can be changed by a customising option. Computing more simulations increases precision but requires more time. (This is discussed in more detail in chapter 4.)

You can choose between various methods of generating random numbers for the simulation runs and you can also specify an initial seed or randomisation. To use the default seed, leave the box empty or enter a zero. To specify a different seed, enter a suitable odd number as seed. If you want randomisation enter 2 in the 'seed' box. Quick Edit uses the default random number generator ('System') with the default seed and no randomisation.

Factor parameters

A factor is any geological parameter you wish to include in the reservoir model (see Chapter 3). While the number of factors used and their names can be entered at the user's discretion, there is a template of suggested factors when entering a new oil or gas data set.

For oil reservoirs the template consists of gross rock volume, net/gross ratio, porosity, oil saturation, formation volume factor and recovery (See Example).

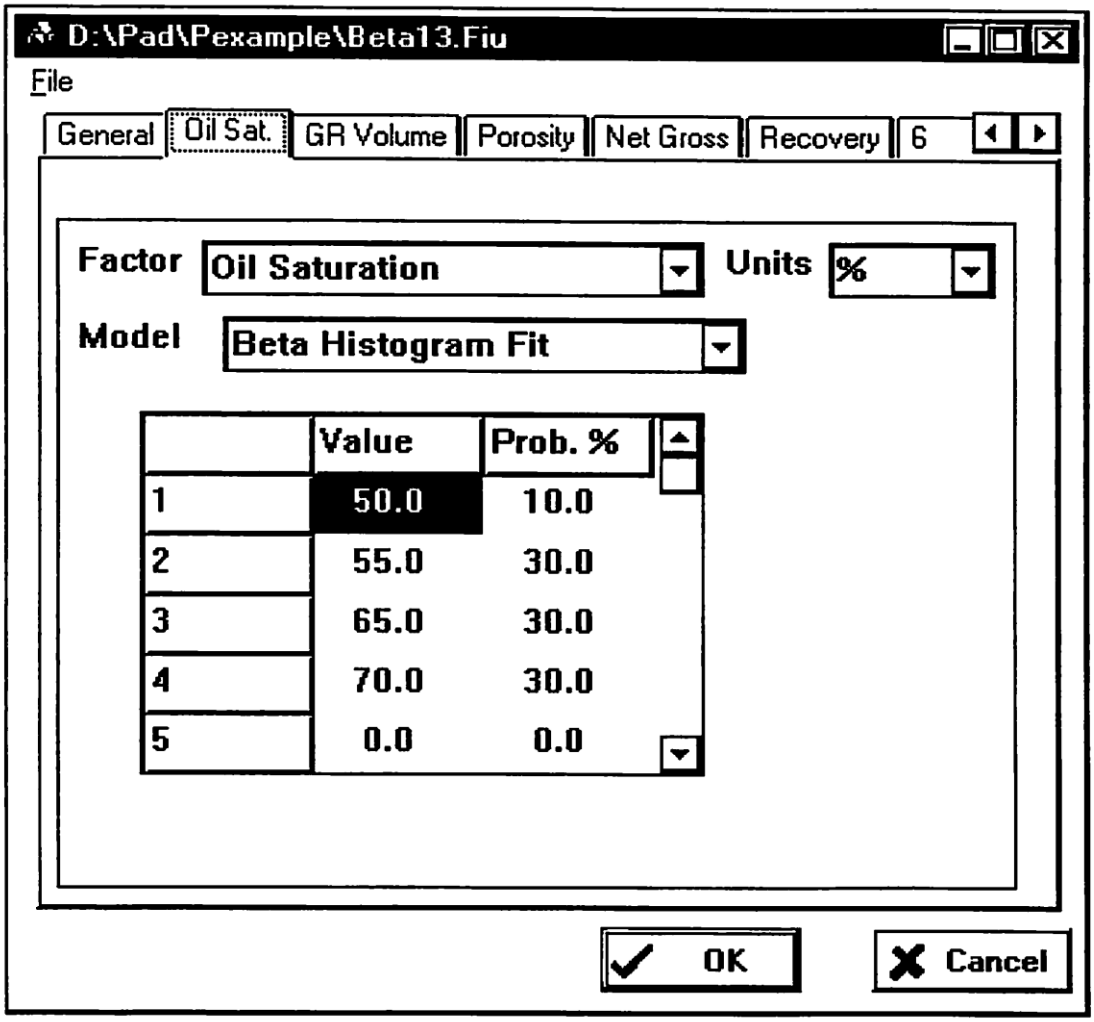

Figure 2.3: Editor screen for a geological factor

For gas reservoirs the factors in the template are gross rock volume, net/gross ratio, porosity, gas saturation, gas expansion, and recovery. If needed, factors can be added to or deleted from the set.

Up to 12 factors can be entered, one by one. Each new factor is entered on a new screen page.

For each factor enter its name, units, probability model, dependencies and parameter values.

The name of the factor can be up to 20 characters long. Spelling is generally not important as the name is only used for identification - longer names can be abbreviated. The two exceptions are the Formation Volume factor (this can be entered in full or abbreviated to FVF) and Recovery (enter in full). These are treated specially and have to be recognised by the Monte-Carlo program.

Units and conversions

Select the unit of measurement for factor values from the abbreviated choices. The specification of unit is important for defining rock volume and percentage values.

If gross volume is given in thousands of acre feet, select Tacf. If volume data are in million cubic metres, select mCum. Gross rock volume can also be entered in (billion) cubic feet. Or, enter the area (thousands of acres or square km) and pay thickness (in feet or metres) as two separate factors.

If the unit of a factor is % (percent sign) values will be divided by 100.

If a unit is not specified then the factor's values will be used as entered without any unit conversion.

Internally, all computations are done in millions of cubic metres until the end when they are multiplied by a conversion

factor to give results in the desired output units e.g. million barrels (oil) or in billion scf (gas) if required.

Probability distribution model

Select a distribution model from the following:

Beta (minimum, maximum)
Beta (minimum, most likely, maximum)
Cumulative
Discrete
Expanded beta (minimum, maximum)
Expanded beta (minimum, most likely, maximum)
Frequency
Guided beta fit
Fitted cumulative
Johnson's Su curve
Johnson's Sb curve
Log-normal histogram fit
Log-normal cumulative fit
Normal histogram fit
Normal cumulative fit
Pearson's fitted beta
Smoothed frequency
Triangle
Uniform
Weibull
Explicit normal
Explicit log-normal
Explicit beta

These are discussed in detail in Chapter 3.

Parameter values

You can enter up to 12 pairs of representative values with associated probabilities. These are the numbers describing the probability distribution model and are to be entered according to the requirements of the particular model chosen.

Dependencies

Known dependencies between factors can be specified by filling these fields of the screen. For example, if Oil Saturation depends on Porosity then enter Porosity in the Dependency box of the factor screen of Oil Saturation. Each dependency relationship is entered only once. It should be entered under the factor that comes later in the list.

In the next box enter the strength of dependency as a number between -10 and +10. Here +10 corresponds to total positive dependency, -10 to total negative dependency. 0 means no dependency (i.e. the factors are independent) - same as leaving the entry blank. Example: If the dependency between Porosity and Gross volume is weakly positive, it can be entered as +3.

Saving the model

Press **OK** when the editing is done and the program will save the file and return to the editing menu.

The newly entered or modified data are kept in a work file till the (successful) completion of editing and only then are written

to the 'new' file. If the program is aborted by pressing Cancel then the file will be left unchanged.

Modifying an existing file

Proceed as for entering 'new' data but as an input file specify a file created previously. Next, enter the name of the 'new' (output) file if different.

Entering the same file name again will cause the old file to be overwritten with the updated contents. The modify/update option is often used to change perhaps a single entry in a model.

Changing the model parameters in the file will obviously invalidate the results previously computed so the program recalculates the computed values when it saves the updated file. If the modified file has a different name then the original file will still hold the original results.

On saving the edited file the program will validate the factors for consistency, if necessary, it will fit probability distributions to the factors and then compute STOIIP and reserves.

Saving the file

At the end of editing press **OK** to save the data and return to the menu. To abandon the changes press **Cancel** at any time while editing to return to the menu and leave the file unchanged.
(Perec for Windows User Guide, Quartz Scientific, Watford, 2002)