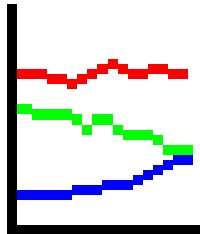


RESys
Reservoir Evaluation System

REProduction
Well Production Data Analysis

Users Manual



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Introduction

RESys is an integrated software system for performing oil and gas reservoir evaluations. Based on an integrated database and using object oriented software design techniques, RESys is a modular and extensible software system consisting of various specialized modules for the analysis and evaluation of well logs, core data, production data and more. The modular integrated design allows the system to be extensible, so that additional modules can be added without requiring a rewrite or redesign of the rest of the system. In addition, due to the modularity and integrated database, individual modules can be optimized.

RESys is designed as a standalone, yet integrated system. Each module can be used by itself; however the full power of integrated software is unleashed when the various modules are combined.

REProduction comprises the module for viewing and analyzing production data. As a standalone program, it allows the visualization of production data and decline curve analysis, but REProduction is fully integrated into RESys.

At Comport Computing we value the comments and suggestions of our software users. If you find a bug, please let us know. We'll fix it as fast as possible and send you a free updated copy of the software. In addition, if you suggest an enhancement which we implement, you'll receive a free upgrade to the new version.

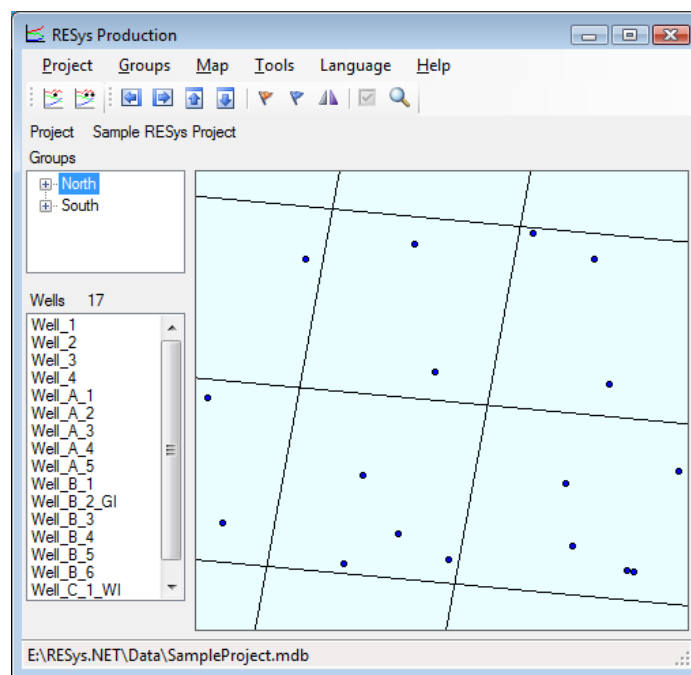
Corrections or comments on REProduction or on this manual should be sent by email to "software@comportco.com".

Overview

REProduction is a system for importing, exporting, viewing and performing decline curve evaluations of well production data. The system consists of a database along with tools to aid in the entry of data and interpretations. RESys is based on so-called “projects” which represent data that are somehow related. You can create as many projects as you want and organize them in whatever way makes sense for your purpose. For example, perhaps a project would consist of all of the wells in a given oil field. On the other hand, for a student, a project might be all of the work done during a class or in conjunction with a project. It really is up to you as to how you want to organize your projects and data.

It is important to understand that the project database contains all of the information needed to perform evaluations. If you need to make a backup of the project, simply copy the project database.

Once a project is created or opened, the leftmost side of the REProduction main window shows the list of wells and well groups included in the project. A map showing the location of the wells is displayed on the right side of the window. At the top of the window there are various menus and tool bar buttons as shown in the screen shot below.



Selecting any well in the list will highlight the well on the map and vice-versa.

The menu at the top of the window allows access to the functions available in REProduction and includes functions to create and open projects, display production data, decline curves, etc.

The Toolbar contains buttons for rapid access to common functions, such as viewing production graphs.

A well's production data can be displayed by selecting a well and clicking the display button



(Note that the single dot indicates a single well.) The production display is controlled by templates which can be configured as desired. Although a simple default template is built in, in many cases it may be preferable to redefine the templates to display the desired information. The ability to edit, save and load templates is provided interactively from the display window.

Note that there is no limit to number of templates that can be defined, nor is there a software limit to the amount of data, the size of the display or the number of graphs that may be displayed. Instead, the limitations will mainly be determined by the screen size.

The **Project** menu contains functions to create, open and close projects, and edit project information.

The **Groups** menu allows groups of wells to be defined.

The **Map** menu allows adjustment of the map display.

The **Tools** menu permits the display of the various graphs and decline curves, importing and editing data, and the option to automatically load the last project when REProduction is started.

The **Language** menu allows the use of either English or Spanish text on all of the windows in RELogAnalysis. To change the language, simply select the desired language from the menu.

The **Help** menu allows information concerning the version of RELogAnalysis to be displayed. To see the version information, select **Help | About**.

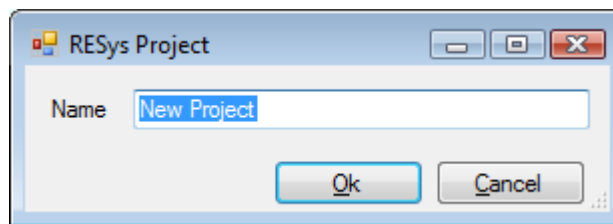
Getting Started

To start using REProduction, it is necessary to open or define a project. Defining a project creates a database which will contain all of the data needed to view and evaluate well logs as well as cores or outcrops. It should be noted that RESys uses a Microsoft Jet database by default. That means that there's nothing special to install or configure, since Jet drivers are normally included in Microsoft Windows. It's the same database format used by Microsoft Access. Once any RESys module, including REProduction, is installed, it is ready to use without any further hassles, unless you decide to use a different database format. The remainder of this manual assumes that the default Jet database is used.

Creating a Project

To create a new project, select **Project | New** from the menu. You will need to select a directory and a filename from the file selection dialog, and then will be asked if you want to create the project. Selecting **Yes** will automatically create the database, selecting **No** will abort with no database created. If the selected file already exists, you will be asked whether to replace the database. Selecting **Yes** will overwrite the existing file, erasing all of its contents. Selecting **No** will abort without doing anything.

Once the project database is created, you will be presented with a dialog to enter the project name as shown. Simply add your own project title. Click **Ok** to save the project data or **Cancel** to accept the default. Normally you will want to provide your own name for the project. If you need to change the project name later, simply select **Project | Edit** from the menu.



Opening an Existing Project

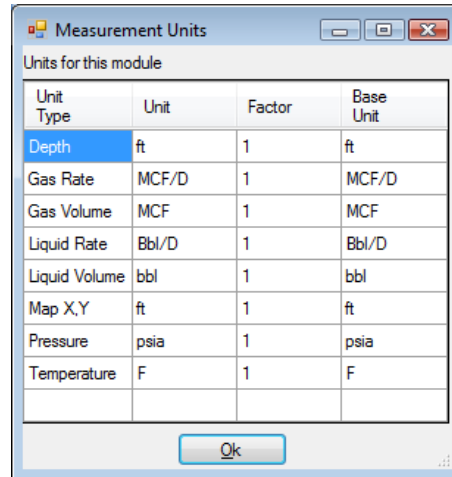
If you have an existing RESys project, you can open it for use by any module, including RELogAnalysis. Simply select **Project | Open** from the menu and then choose the project database file from the file selection dialog.

When a Project is Opened the First Time

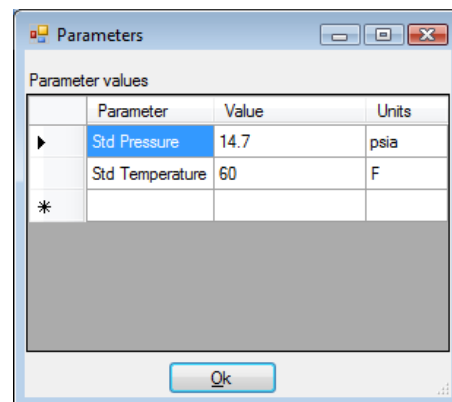
The first time a module is used with a particular project, the RESys system will check to make sure that all needed parameters and units are defined and you will be presented with a dialog allowing the units to be defined. Depending on what modules may have been used before, you may see some or all of the following unit definitions. To accept the defaults, simply press

Ok. To change the default units, select or type the desired unit name in the **Unit** column and a conversion factor in the **Factor** column. For example, to specify depth in meters, use **m** as the unit name and **3.28084** (the number of feet in a meter) as the factor.

Note that once set, these values and units definitions cannot be changed, since doing so would corrupt the database.



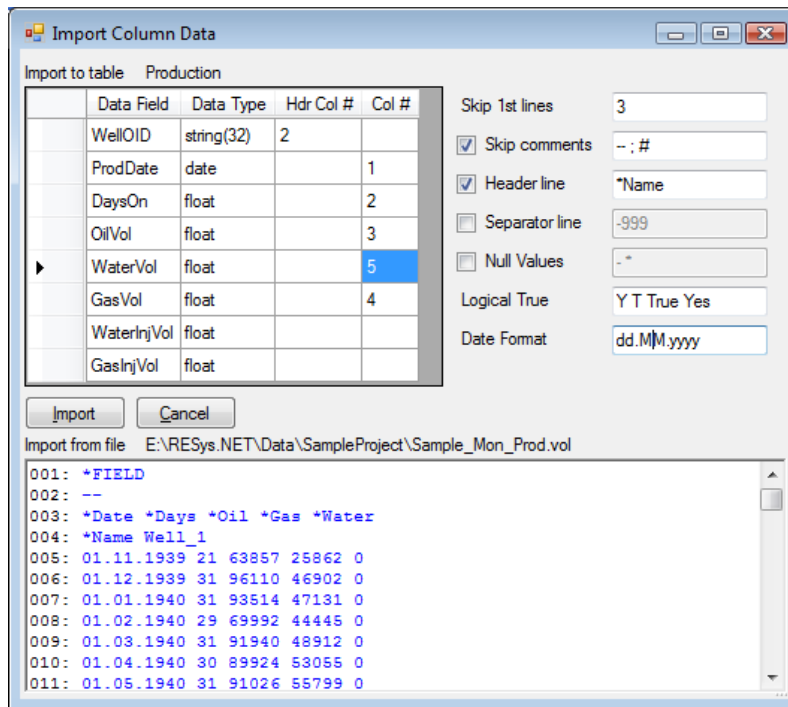
After the units have been set, REProduction uses two parameters that will need to be defined. As shown in the following dialog, the Standard Temperature and Pressure are required and might be used in some volume calculations.



Importing Data

Of course a project isn't of much use without data, so normally the next step will be to import well and production data. REProduction can easily import well, well trajectory, completion intervals, geological markers, well pressures and production data provided in ASCII columnar format. (Production data can also be imported from IHS 298 report files.) To import ASCII columnar data, select **Tools | Import** and the type of data to import from the menu, then select the text file that contains the columnar data. The following dialog will display the file

and allow the data columns and general format to be specified. To quit without importing any files, select the **Cancel** button. To import the files, select the **Import** button.



For example, in the above screen, production data is imported from a typical production format used by OFM™ and other production export formats, where each well is delineated by a header line with the well name followed by columnar data as described. In this case the data can be imported by specifying that the first 3 lines should be skipped, that each data section is delineated by a header line beginning with ***Name** and the date format is as shown.

Note that the data definition is shown in the upper left of the window while the parameters defining the data format are shown in the upper right. A preview of the data file is shown at the bottom of the window for reference while choosing the format parameters.

The table in the upper left displays the data that can be imported with a description of the data type (string, date, floating point, etc.) and a number indicating which column the data will be read from. If a header line is present to delineate sections, a column will be displayed allowing data to be imported from both the header line as well as the data sections.

The meaning of the import parameters is as follows:

Skip 1st lines indicates how many lines should be skipped at the start of the file in order to bypass any extraneous header information.

Skip comments indicates whether comment lines should be skipped or not. If selected, the list of space separates strings that indicate comments is used to determine which lines are comment lines.

Header line indicates whether the file is divided into sections separated by header lines. If selected, the string shown will be used to determine which lines are section headers.

Separator line indicates whether data sections are separated by separator lines with a

special format. If selected the text will be used to determine which lines separate data sections.

Null Values indicates whether the file contains data where the value is not specified. If selected, the list of space separated strings will be used to determine whether data values represent Null values.

Logical True contains a list of strings that will be interpreted as **true** for Boolean (true/false) data. Boolean variables with values not in the list will be considered **false**.

Date Format contains a format string that will be used to import dates. In general the string should contain the characters **d** to indicate day, **M** to indicate month and **y** to indicate year with any appropriate separators, such as **/**. Note that **d** or **M** represents a number without leading zeros while **dd** or **MM** indicates that the number will always have 2 digits with a leading zero if required. In general, **yy** should be used for 2 digit years and **yyyy** (preferred) for 4 digit years.

Except for basic well data, new wells will not be created while importing data, so any data associated with well names not defined in the project will be skipped. After importing data, a summary of the data imported and skipped will be shown and the data can be saved to a log file for reference if desired.

Compact Production Data

Many production data systems store or export zeros for times when wells are off production. For old wells, it is possible that production data is given every month for many years and may even comprise the majority of the production data. Clearly there is no logical reason to save these values, since there is in effect no value to save.

To remove the extraneous, nonexistent production data from the database, REProduction automatically performs a compaction procedure after data has been imported. Note that no real data is deleted, only production data entries that are all zero are removed to save space in the project database.

In case that manual editing of production data has been done, the data can be manually compacted by selecting **Tools | Compact Production** from the menu. Any consecutive zero production records will be removed from the database, but the first zero record following non-zero data will be retained. The data compacting process can take quite some time for large projects.

Defining Groups

For various purposes, it is often useful to define groups of wells for visualization and evaluation. Groups can represent anything whatsoever. For example a group can be defined for all well in the North of a field, or all wells drilled in a certain year, or all wells in a specific reservoir. Individual wells can be included in several groups, if desired, for example a well in the North that was drilled in a certain year might appear in 2 separate groups. REProduction does not place a limitation of how the groups are defined.

To create a Group, select **Groups | New** from the menu. A new group will be added to the

group tree in the Group box where you can change the name. Note that the new group will not yet contain any wells.

To change the name of a group, select the group, then select **Groups | Rename** from the menu.


To add wells to a group, select the group in the Group box and the wells to be added in the Well list, then select **Groups | Add Wells** from the menu.

To delete a Group, select the group in the Group box and then select **Groups | Delete** from the menu. Note that deleting the group only removes the group definition, it does not delete any wells from the project.

Once a group has been defined, selecting the group will highlight the wells in the group on the map. To see which wells are in a group, select the + to the left of the group name to expand the tree and display the names of all the wells in the group.

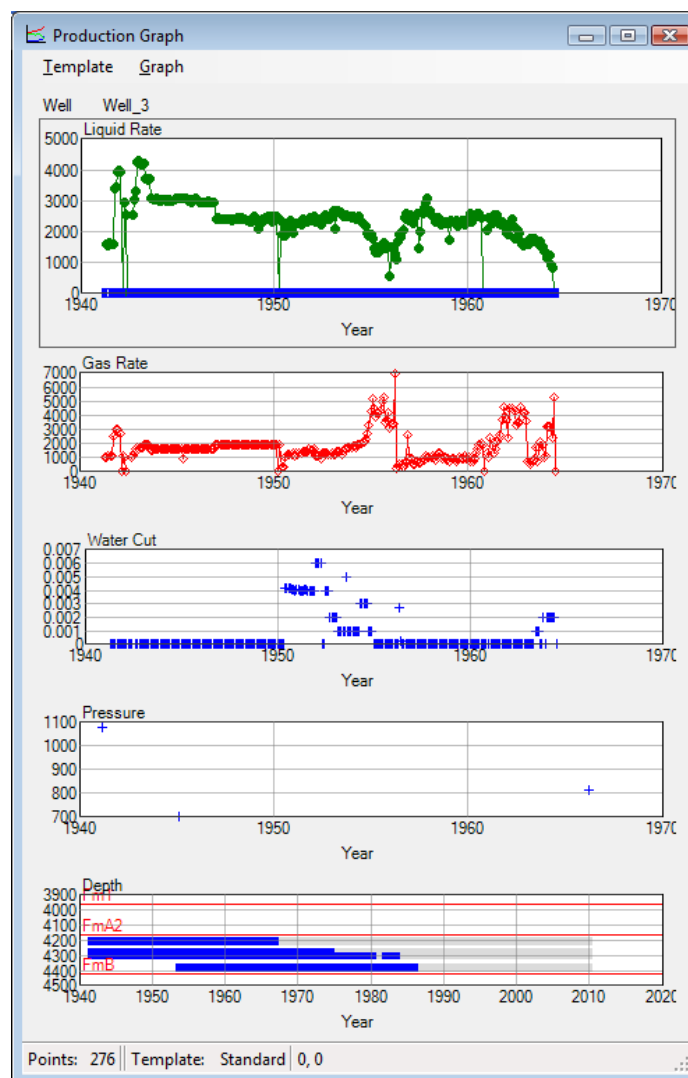
To remove a well from a group, expand the group well list, select the well, then press the **[Delete]** key. Note that removing wells from a group will not remove wells from the project.

Displaying Production Data

To display the production data for a well, simply double click the well name or select the well in the list and click the Well Display button  or select **Tools | Well Production** from the menu.

To display production data for a group of wells, select the group in the Group list, then click the Group Display button  or select **Tools | Group Production** from the menu.

The production data will be displayed using the current template, which can be modified and redefined as desired.



The first time you display production data, a standard template will be used, but much better displays are possible by modifying the template and saving it in a new template file. You may edit the display configuration interactively. The modified template can be saved to a file or alternate templates can be loaded from the **Template** menu in the Display window. A typical

customized display is shown above.

On the display, the number and order of graphs can be defined, along with the scale, colors and display options for each. As detailed later in this manual, REProduction supports 2 types of graphs for display purposes. On each graph, the horizontal and vertical scales can be modified by pressing the right mouse button and selecting from the popup menu.

Display Templates

The production displays in REProduction are controlled by templates, which the user configures interactively. Please note that the user never really needs to see the templates, since the results are always visible on the display. On the Display screen, each Graph is separated from the graphs above and below by an invisible separator that can be moved with the mouse. When the mouse cursor is over a Graph separator, the cursor will change to 2 parallel lines with arrows. To change the height of a Graph, simply the separator up or down as desired while pressing the left mouse button.

Each display template consists of a number of “Graphs” or vertical segments. A display template can contain any number of Graphs. To modify the display configuration a track can be selected with the mouse by pressing the left mouse button. When selected, a border will appear around the selected graph.

To add additional Graphs to the display, select **Graph | New | Insert** to insert a graph before the currently selected graph or **Graph | New | At End** to add a graph at the bottom of the display. To delete the currently selected graph, select **Graph | Delete**.

When you first run REProduction or any other time a user defined template is not available or not specified, REProduction automatically uses a default template. The means to load and save display templates are found in the **Template** menu on the Display screen. To load a previously saved template, select **Template | Open** from the menu and select the desired graph template file (*.gtf) from the file dialog. To update the template currently in use, select **Template | Save** from the menu. If you are using the standard template, you will be required to enter a filename. To save the current configuration to a new template file, select **Template | Save As** and enter a filename on the file dialog. You can create as many templates as needed or desired.

To revert to the default template, select **Template | Default** from the menu.

Display Graph Types

REProduction has 2 different types of graphs that can be displayed in any order. Once a graph has been added, you can change the type of graph and the options by selecting the graph and choosing the desired graph type from the **Graph | Type** menu. Each graph type has additional configuration options accessible from the menu.

Production. A Production graph displays curves or point data, including production rates and pressures.

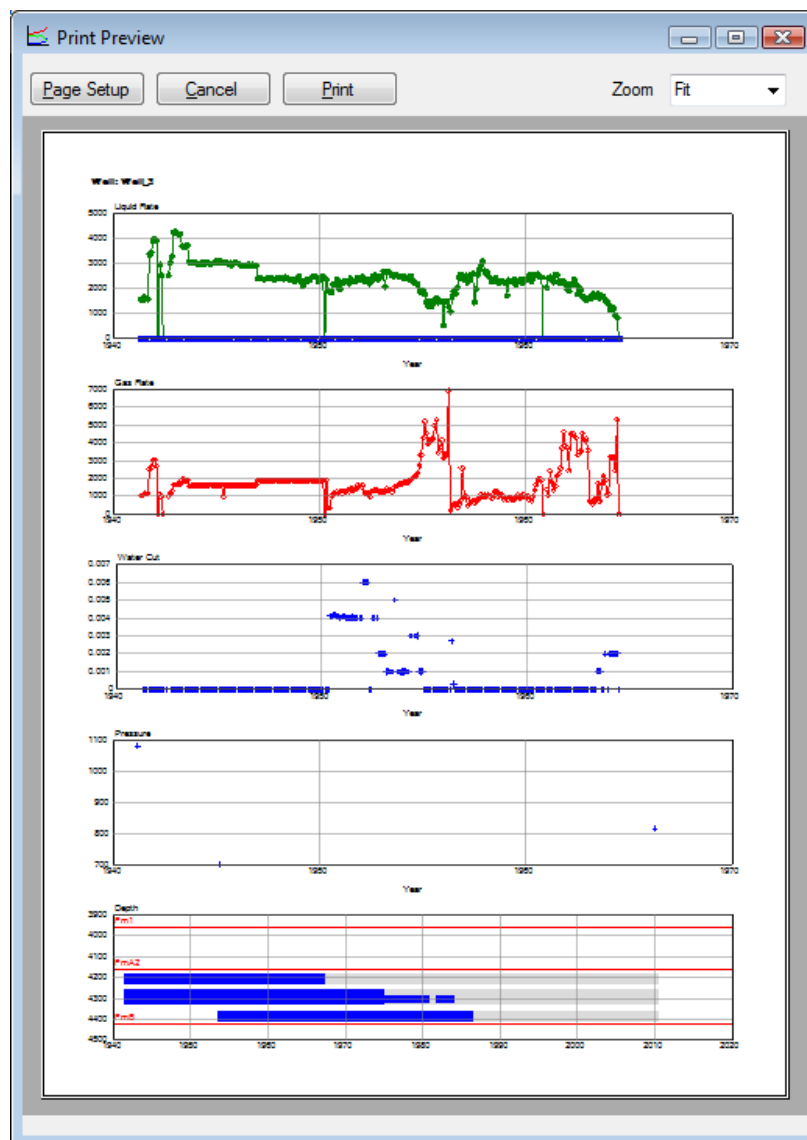
To add a curve to a Production graph, select **Graph | Curves | New**. To change the appearance of an existing curve, select **Graph | Curves | Edit <curve>**, where <curve> is an existing curve name. On the resulting dialog, you can change the curve to be displayed, set the color for the curve, determine whether to show the curve or the points or both and also define the curve scale to be used.

Intervals. This graph displays completion intervals and geological markers that are interpreted for the well. Select from the **Graph | Curves** submenu to determine what information should be displayed and adjust the colors as desired. The intervals graph is very useful in visualizing changes to the producing interval with time.

Printing

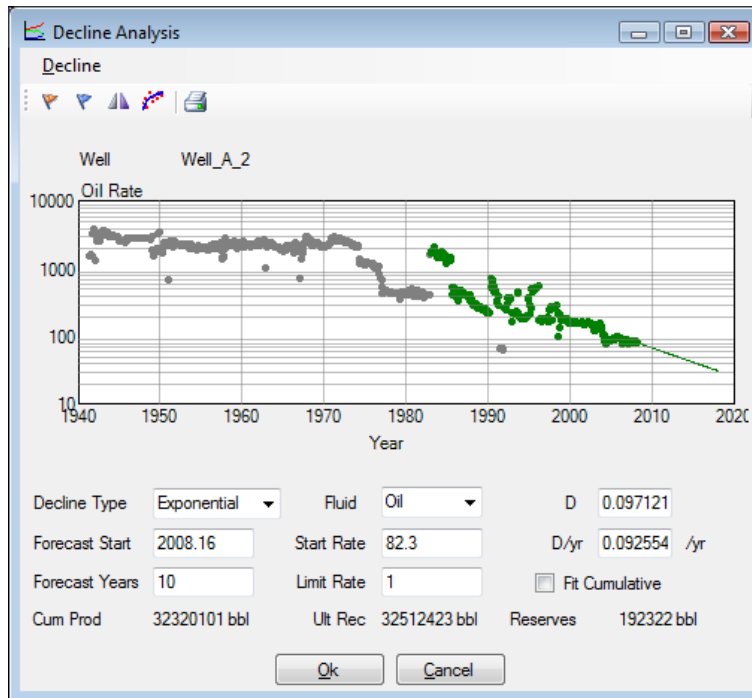
REProduction supports printing to standard Windows printers. To print a production display, select **Graph | Print** from the menu. A print preview screen will appear, showing a preview of the displayed graphs.

On the Print Preview screen, press the **Page Setup** button to adjust the printer and page settings, **Cancel** to quit and **Print** to send the graph to the selected printer or plotter.



Decline Analysis

Decline curve analysis is an empirical, but common technique used to evaluate the production performance of wells, leases and fields. To evaluate the decline performance of wells using REProduction, select a well from the well list, then select **Tools | Well Decline** from the menu. A window similar to the following will appear where data can be selected and decline parameters can be specified.



Technical Description

This section of the manual documents and explains the technical details of the calculations in REProduction.

Decline Parameters

REProduction implements various decline analysis methods.