

Production Plot & Decline Curve Analysis Java Applet

by John R. Victorine

Introduction

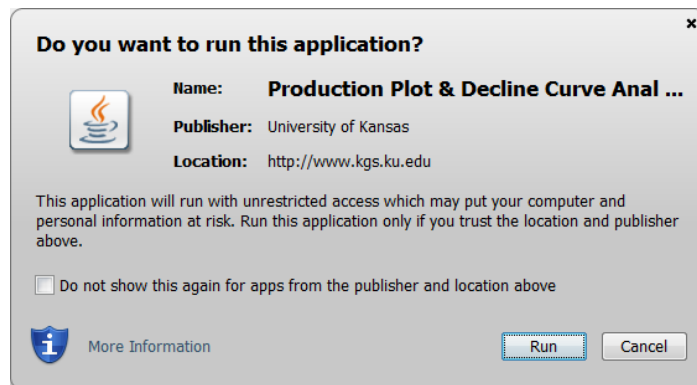
The Production Plot & Decline Curve Analysis web app has 2 sources for importing well data, 1) the user's PC or 2) the Kansas Geological Survey (KGS) ORACLE Database.

This is the production plot & decline curve analysis web application, which allows the user to access production data from the Kansas Geological Survey (KGS) Database for Leases, Fields, Operators and Counties. The web application was designed to read production from the user's PC as an ASCII Extensible Markup Language (XML) file or as a comma-separated values (CSV) file. A "spread sheet" like table was provided to display the data retrieved, but editable to allow the user to add data to the existing list, i.e., download production data from the KGS Database and insert missing months or previous years that may not be recorded.

The Program allows the user to save the raw production data as an ASCII Extensible Markup Language (XML) file or as a comma-separated values (CSV) file. The Program allows the user to save the Production Plot Java Image to their PC as a Portable Network Graphics (PNG) Image, the Program will then display a web page with the image file with a link at the top of the page that will allow the user to launch the PDF Web Applet to convert the PNG Image File to a Portable Document Format (PDF) File.

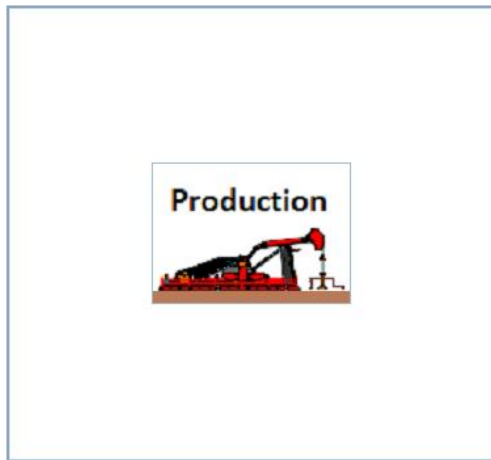
A decline curve analysis dialog was included to allow the user to predict the economic limit for a specific lease, field, operator and county. This analysis uses three methods for predicting the decline of a reservoir, exponential, harmonic and hyperbolic¹.

To access Profile go to <http://www.kgs.ku.edu/software/production/>. At the top of the web page there is a menu "Main Page|Description|Applet|Help|Copyright & Disclaimer". Select the "Applet" menu option a "Warning - Security" Dialog will appear. The program has to be able to read and write to the user's PC and access the Kansas Geological Survey (KGS) Database and File Server, ORACLE requires this dialog.



¹ SPE 83470: A Decline Curve Analysis Model Based on Fluid Flow Mechanisms by Kewen Li, SPE, and Roland N. Horne, SPE, Stanford University <http://pangea.stanford.edu/~kewenli/spe83470.pdf>

The program does not save your files to KGS, but allows you to access the KGS for well information that may be missing in your Kansas logs. The program does not use Cookies or any hidden software it only reads the XML (Extensible Markup Language) and CSV (Comma Separated Values) files for the Production Plot Session and writes a XML (Extensible Markup Language) or CSV (Comma Separated Values) File to your PC to save your Production Data imported into the web app. The blue shield on the warning dialog is a symbol that the Java web app is created by a trusted source, which is the University of Kansas. Select the "Run" Button, which will show the Production Plot "Enter" Panel illustrated below,



Enter

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Loading Well Data

Click the "Production Plot Enter" Icon Button, which will show the "Load Data" Dialog. The dialog below displays an example of the Arroyo Field production data loaded from the "Load KGS Data" icon button. The radio buttons & icon buttons in the Data Source Panel assists the user in loading well data into the Production Plot & Decline Curve Analysis Applet.

Data Source

KGS: Search KGS Production Data

☐ By Lease ☒ By Field ☐ By County ☐ By Operator

Load KGS Data

PC: Read Production ASCII Data Text File

☒ AS XML (Extensible Markup Language) ASCII File ☐ AS CSV (Comma Delimited) ASCII File

Load PC Data

Production Data Table (Editable)

☐ Lease ☒ Field ☐ County ☐ Operator

Field Name: Arroyo

KGS Primary KEY: 1000152060 DOR: 0

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL; GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1989	11	0	OIL	348	1
1989	12	0	OIL	1,364	1
1990	1	0	OIL	1,364	1
1990	2	0	OIL	957	1
1990	3	0	OIL	1,386	1
1990	4	0	OIL	968	1
1990	5	0	OIL	1,124	1
1990	6	0	OIL	728	1
1990	7	0	OIL	1,093	1
1990	8	0	OIL	908	1
1990	9	0	OIL	915	1
1990	10	0	OIL	917	1
1990	11	0	OIL	922	1
1990	12	0	OIL	729	1
1991	1	0	OIL	960	2
1991	2	0	OIL	728	2
1991	3	0	OIL	723	2
1991	4	0	OIL	735	2
1991	5	0	OIL	726	2
1991	6	0	OIL	725	2
1991	7	0	OIL	541	2
1991	8	0	OIL	1,084	2
1991	9	0	OIL	707	2
1991	10	0	GAS	41,553	3
1991	10	0	OIL	913	2

Add Row Remove Row Sort Data

Plot Data Clear Exit

KGS: Search KGS Production Data

Search the Kansas Geological Survey Database (KGS) production data by Lease, Field Operator or County.

PC: Read Production ASCII Data

This panel allows the user to read in production data by 2 file types,

1. Comma Separated Values (CSV) ASCII File
2. Extensible Markup Language (XML) ASCII File, which must be by a specific format defined by (DTD) Document Type Definition.

Production Data Table (Editable)

This panel holds the records that will be plotted.

- Header Information for production data, identifies the type, name and if the information comes from the KGS Database the Unique KEY and DOR Number if available.

Production Data Table (Editable) Buttons:

- **Add Row** – The user can add production record by clicking on the "Add Row" button, which will add a row to the Editable Production Data Table.
- **Remove Row** – The user can remove production record from the table
- **Sort Data** – The user can order the production history by date.

Load Data Dialog Buttons

- **Plot Data** – Transfers the contents of the Production Data Table to the Production Plot Control Dialog.
- **Clear** – clears the Production Data Loaded into this dialog.
- **Exit** – Exit Dialog

Data Source Panel

The Data Source Panel provides two methods of importing data into the Production Data & Decline Curve Analysis Web App. The Kansas Geological Survey (KGS) Database and the user's PC. The "Load KGS Data" icon button assists the user in locating a set of production data by Lease, Field, County and Operator in Kansas. The data shows the current status of the production history at the time the user accesses the data. The "Load PC Data" icon button along with the 2 radio buttons assists the user to load Brine data by 2 possible ASCII File methods,

1. Comma Separated Values (CSV).
2. Extensible Markup Language (XML) Files.

The CSV (Comma Separated Values) radio button under the “PC: Read Production ASCII Data Text File” panel are expecting a general type of data presentation. Although the order of the specific data columns is not important, the “Mnemonics” of the data column is. The CSV Search Dialog will use the first two lines of the CSV file to automatically match the file column data mnemonics with the web app curve mnemonics, but if the program does not recognize the file data mnemonic then it will leave it blank and expect the user to match the file data mnemonic to the web app curve mnemonics, this will be explained later.

The Extensible Markup Language (XML) radio button under the “PC: Read Production ASCII Data Text File” panel are expecting a specific Document Type Definition (DTD) to read the file. The DTD is used in retrieve both the data coming from the Kansas Geological Survey Database or as the output from the Production Plot & Decline Curve Analysis Java Web App. The DTD will be presented later.

KGS (Database) - Importing Production Data - By Lease

The Kansas Geological Survey (KGS) has a good collection of production data stored in the ORACLE Database. In this example the user will download the well data available from the KGS Lease Production Database Table. The ORACLE Database is accessed by making Stored Procedure PL/SQL calls to the ORACLE Database from which an Extensible Markup Language (XML) data stream is created containing the lease production data that is passed back to the web app making the request.

The 'Data Source' dialog box has two main sections. The top section, 'KGS: Search KGS Production Data', contains four radio buttons: 'By Lease' (selected), 'By Field', 'By County', and 'By Operator'. To the right of these buttons is a 'Load KGS Data' button with a circular icon containing a well symbol. The bottom section, 'PC: Read Production ASCII Data Text File', contains two radio buttons: 'AS XML (Extensible Markup Language) ASCII File' (selected) and 'AS CSV (Comma Delimited) ASCII File'. To the right of these buttons is a 'Load PC Data' button with a rectangular icon showing an oil pumpjack.

Select the “By Lease” radio button and left click on the “Load KGS Data” Icon Button in the Data Source Panel of the Load Data Dialog to display the “Search for Data on KGS Server” dialog.

The 'Search for Data on KGS Server' dialog box has a title bar and a search section. The search section includes a 'Search By:' label, two radio buttons ('Name (Partial Phrase)' selected and 'Township Range Section'), and an 'Enter Lease Name' text box containing 'Kendrick'. Below the text box is a 'Search' button. The main area of the dialog is a table titled 'List of Oil & Gas Wells:'. The table has columns: KID, DOR, Lease, Operator, Field, Town, Range, and Sec. The table contains 18 rows of data. The row with KID '1001141616' and Lease 'KENDRICK 23-1' is highlighted in yellow. At the bottom of the dialog are 'Select' and 'Close' buttons.

KID	DOR	Lease	Operator	Field	Town	Range	Sec
1001152066	218238	KENDRICK 14-2	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1001152590	219254	KENDRICK #23-2	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	23
1001151937	217764	KENDRICK 14-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1024006251	223452	KENDRICK 2-19	Priority Oil & Gas LLC	Cherry Creek Niobrara Ga...	4S	40W	19
1001141493	131446	KENDRICK 14-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1001142067	132489	Kendrick 15-2	Huber, J.M. Corporation	Arroyo	29S	41W	15
1001171714		KENDRICK		Ray West	5S	21W	27
1043937423	133213	KENDRICK 23-2	Huber, J.M. Corporation		29S	41W	23
1041035231	140109	KENDRICK 14-2	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1001152440	219002	Kendrick 15-2	Huber Oil Company, a Gen...	Arroyo	29S	41W	15
1024006252	223453	KENDRICK-SCHORZMAN	Priority Oil & Gas LLC	Cherry Creek Niobrara Ga...	4S	40W	20
1001148381	211673	KENDRICK-SCHORZMAN	Priority Oil & Gas LLC	Cherry Creek Niobrara Ga...	4S	40W	20
1001141616	131500	KENDRICK 23-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	23
1001143038	133977	KENDRICK 15-3	Huber, J.M. Corporation	Arroyo	29S	41W	15
1001141773	131859	KENDRICK 22-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	22
1001152103	218378	KENDRICK 22-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	22

Search for Data in KGS

- **Name (Partial Phrase)** – The user can search for production data by lease partial phrase, i.e. “Kendrick”, which will look for all leases with the phrase “Kendrick” in the lease name.
- **Section-Township-Range** – Search for a list of leases by a specific area.

List of Leases with Production History Data, note that each lease can have multiple wells assigned.

Dialog Buttons:

- Select** – Transfers the Production History back to the main dialog.
- Close** – Exit Dialog

This dialog allows the user to search the KGS database for lease production data. In this example, the lease of interest will be the Kendrick 23-1 this lease contains all the lease production history records that can be retrieved from the KGS Database.

As the Summary image suggests there are 2 methods for searching for the lease production data within this dialog,

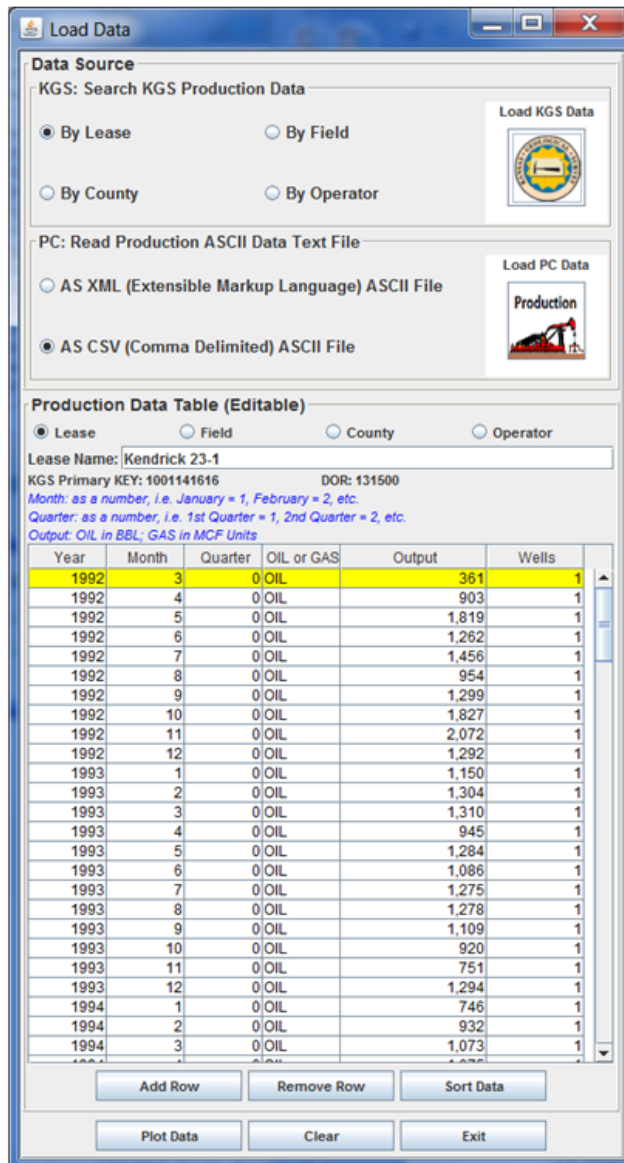
- Name (Partial Phrase) – The stored procedure used to retrieve the list of lease production data from the KGS Database allows the user to enter a partial phrase, in this example Kendrick. The program places a ‘%’ in front and back of the phrase and sends the request to the Database, i.e. “%Kendrick%”.

- By Township Range Section – This search is for brine samples in Kansas by, e.g. to look for the Kendrick 23-1 lease production history, enter Township as 29 set the S (South) Radio button and Range as 41 set the W (West) Radio button. This example left off the section, but you can include it to narrow the search.

The user only needs to enter the above data and select the “Search” Button to display the list of leases in the Kansas Database that match the search criteria. In the image below the Lease Name “Kendrick” was entered to search for all leases in Kansas with the Phrase Kendrick in it. The user searches through the list until they find the lease of interest.

KID	DOR	Lease	Operator	Field	Town	Range	Sec
1001152066	218238	KENDRICK 14-2	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1001152590	219254	KENDRICK #23-2	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	23
1001151937	217764	KENDRICK 14-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1024006251	223452	KENDRICK 2-19	Priority Oil & Gas LLC	Cherry Creek Niobrara Ga...	4S	40W	19
1001141493	131446	KENDRICK 14-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1001142067	132489	Kendrick 15-2	Huber, J.M. Corporation	Arroyo	29S	41W	15
1001171714		KENDRICK		Ray West	5S	21W	27
1043937423	133213	KENDRICK 23-2	Huber, J.M. Corporation		29S	41W	23
1041035231	140109	KENDRICK 14-2	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	14
1001152440	219002	Kendrick 15-2	Huber Oil Company, a Gen...	Arroyo	29S	41W	15
1024006252	223453	KENDRICK-SCHORZMAN	Priority Oil & Gas LLC	Cherry Creek Niobrara Ga...	4S	40W	20
1001148381	211673	KENDRICK-SCHORZMAN	Priority Oil & Gas LLC	Cherry Creek Niobrara Ga...	4S	40W	20
1001141616	131500	KENDRICK 23-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	23
1001143038	133977	KENDRICK 15-3	Huber, J.M. Corporation	Arroyo	29S	41W	15
1001141773	131859	KENDRICK 22-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	22
1001152103	218378	KENDRICK 22-1	Kerr-McGee Oil & Gas Ons...	Arroyo	29S	41W	22

To import the lease production history data click the “Select” button, which will transfer the data back to the “Load Data” Dialog.



Data Source

KGS: Search KGS Production Data

☒ By Lease ☐ By Field

☐ By County ☐ By Operator

Load KGS Data

PC: Read Production ASCII Data Text File

☐ AS XML (Extensible Markup Language) ASCII File

☒ AS CSV (Comma Delimited) ASCII File

Load PC Data

Production Data Table (Editable)

☒ Lease ☐ Field ☐ County ☐ Operator

Lease Name: Kendrick 23-1

KGS Primary KEY: 1001141616 DOR: 131500

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL, GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1992	3	0	OIL	361	1
1992	4	0	OIL	903	1
1992	5	0	OIL	1,819	1
1992	6	0	OIL	1,262	1
1992	7	0	OIL	1,456	1
1992	8	0	OIL	954	1
1992	9	0	OIL	1,299	1
1992	10	0	OIL	1,827	1
1992	11	0	OIL	2,072	1
1992	12	0	OIL	1,292	1
1993	1	0	OIL	1,150	1
1993	2	0	OIL	1,304	1
1993	3	0	OIL	1,310	1
1993	4	0	OIL	945	1
1993	5	0	OIL	1,284	1
1993	6	0	OIL	1,086	1
1993	7	0	OIL	1,275	1
1993	8	0	OIL	1,278	1
1993	9	0	OIL	1,109	1
1993	10	0	OIL	920	1
1993	11	0	OIL	751	1
1993	12	0	OIL	1,294	1
1994	1	0	OIL	746	1
1994	2	0	OIL	932	1
1994	3	0	OIL	1,073	1

Add Row Remove Row Sort Data

Plot Data Clear Exit

Production Data Table (Editable)

- Header Information for production data, sets the “Lease” radio button to identify the search, the Lease Name, i.e. Kendrick 23-1 and the KGS Primary Key 1001141616 and the DOR 131500.
- List of Raw Oil Production Records

Click on the “Plot Data” to display the Production Plot and Control Dialogs.

KGS (Database) - Importing Production Data - By Field

The Kansas Geological Survey (KGS) has a good collection of production data stored in the ORACLE Database. In this example the user will download the well data available from the KGS Field Production Database Table. The ORACLE Database is accessed by making Stored Procedure PL/SQL calls to the ORACLE Database from which an Extensible Markup Language (XML) data stream is created containing the field production data that is passed back to the web app making the request.

The 'Data Source' dialog box is divided into two sections. The top section, 'KGS: Search KGS Production Data', contains four radio buttons: 'By Lease', 'By Field' (which is selected), 'By County', and 'By Operator'. To the right of these buttons is a button labeled 'Load KGS Data' with a circular icon containing a gear and a document. The bottom section, 'PC: Read Production ASCII Data Text File', contains two radio buttons: 'AS XML (Extensible Markup Language) ASCII File' (which is selected) and 'AS CSV (Comma Delimited) ASCII File'. To the right of these buttons is a button labeled 'Load PC Data' with a rectangular icon showing an oil pumpjack and the word 'Production'.

Select the “By Field” radio button and left click on the “Load KGS Data” Icon Button in the Data Source Panel of the Load Data Dialog to display the “Search for Data on KGS Server” dialog.

The 'Search for Data on KGS Server' dialog box has a title bar with the same text. Below the title bar is a section 'Search for Data in Kansas Geological Survey Database:' with a 'Search By:' label and a radio button for 'Name (Partial Phrase)'. Below this is a text input field labeled 'Enter Field Name' containing the text 'Arroyo'. A 'Search' button is located below the input field. Below the search section is a table titled 'List of Oil & Gas Wells:'. The table has columns: KID, DOR, Lease, Operator, Field, Town, Range, and Sec. The table contains several rows of data, with the row for KID 1000152060 highlighted in yellow. At the bottom of the dialog are 'Select' and 'Close' buttons.

KID	DOR	Lease	Operator	Field	Town	Range	Sec
1022007191				ARROYO SOUTHEAST			
1022168690				SAND ARROYO CREEK W...			
1028646148				ARROYO NORTHWEST			
1000152060				Arroyo			
1000152061				ARROYO NORTHEAST			
1000152075				SAND ARROYO			
1000152076				SAND ARROYO CREEK			
1000152077				SAND ARROYO CREEK S...			

Search for Data in KGS

- **Name (Partial Phrase)** – The user can search for production data by field partial phrase, i.e. “Arroyo”, which will look for all fields with the phrase “Arroyo” in the field name.

List of Fields with Production History Data.

Dialog Buttons:

- Select** – Transfers the Production History back to the main dialog.

- Close** – Exit Dialog

As the Summary image suggests there is only 1 method for searching for the field production data within this dialog,

- Name (Partial Phrase) – The stored procedure used to retrieve the list of field production data from the KGS Database allows the user to enter a partial phrase, in this example Arroyo. The program places a ‘%’ in front and back of the phrase and sends the request to the Database, i.e. “%Arroyo%”.

Search for Data in Kansas Geological Survey Database:

Search By:

☒ Name (Partial Phrase)

Enter Field Name

Arroyo

Search

The user only needs to enter the above data and select the “Search” Button to display the list of fields in the Kansas Database that match the search criteria. In the image below the Field Name “Arroyo” was entered to search for all leases in Kansas with the Phrase Arroyo in it. The user searches through the list until they find the field of interest.

Search for Data on KGS Server

Search for Data in Kansas Geological Survey Database:

Search By:

☒ Name (Partial Phrase)

Enter Field Name

Arroyo

Search

List of Oil & Gas Wells:

KID	DOR	Lease	Operator	Field	Town	Range	Sec
1022007191				ARROYO SOUTHEAST			
1022168690				SAND ARROYO CREEK W...			
1028646148				ARROYO NORTHWEST			
1000152060				Arroyo			
1000152061				ARROYO NORTHEAST			
1000152075				SAND ARROYO			
1000152076				SAND ARROYO CREEK			
1000152077				SAND ARROYO CREEK S...			

Select Close

To import the field production history data click the “Select” button, which will transfer the data back to the “Load Data” Dialog.

Load Data

Data Source

KGS: Search KGS Production Data

☐ By Lease ☒ By Field

☐ By County ☐ By Operator

Load KGS Data

PC: Read Production ASCII Data Text File

☐ AS XML (Extensible Markup Language) ASCII File

☒ AS CSV (Comma Delimited) ASCII File

Load PC Data

Production Data Table (Editable)

☐ Lease ☒ Field ☐ County ☐ Operator

Field Name: Arroyo

KGS Primary KEY: 1000152060 DOR: 0

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL; GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1989	11	0	OIL	348	1
1989	12	0	OIL	1,364	1
1990	1	0	OIL	1,364	1
1990	2	0	OIL	957	1
1990	3	0	OIL	1,386	1
1990	4	0	OIL	968	1
1990	5	0	OIL	1,124	1
1990	6	0	OIL	728	1
1990	7	0	OIL	1,093	1
1990	8	0	OIL	908	1
1990	9	0	OIL	915	1
1990	10	0	OIL	917	1
1990	11	0	OIL	922	1
1990	12	0	OIL	729	1
1991	1	0	OIL	960	2
1991	2	0	OIL	728	2
1991	3	0	OIL	723	2
1991	4	0	OIL	735	2
1991	5	0	OIL	726	2
1991	6	0	OIL	725	2
1991	7	0	OIL	541	2
1991	8	0	OIL	1,084	2
1991	9	0	OIL	707	2
1991	10	0	GAS	41,553	3
1991	10	0	OIL	913	2

Add Row Remove Row Sort Data

Plot Data Clear Exit

Production Data Table (Editable)

- Header Information for production data, sets the “Field” radio button to identify the search, the Field Name, i.e. Arroyo and the KGS Primary Key 1000152060.
- List of Raw Oil & Gas Production Records

Click on the “Plot Data” to display the Production Plot and Control Dialogs.

KGS (Database) - Importing Production Data - By Operator

The Kansas Geological Survey (KGS) has a good collection of production data stored in the ORACLE Database. In this example the user will download the well data available from the KGS Operator Production Database Table. The ORACLE Database is accessed by making Stored Procedure PL/SQL calls to the ORACLE Database from which an Extensible Markup Language (XML) data stream is created containing the operator production data that is passed back to the web app making the request.

The 'Data Source' dialog box is divided into two sections. The top section, 'KGS: Search KGS Production Data', contains four radio buttons: 'By Lease', 'By Field', 'By County', and 'By Operator'. The 'By Operator' button is selected. To the right of these buttons is a 'Load KGS Data' button with a circular icon containing a well and the text 'KANSAS GEOLOGICAL SURVEY'. The bottom section, 'PC: Read Production ASCII Data Text File', contains two radio buttons: 'AS XML (Extensible Markup Language) ASCII File' and 'AS CSV (Comma Delimited) ASCII File'. The 'AS CSV' button is selected. To the right of these buttons is a 'Load PC Data' button with a square icon containing the word 'Production' and an image of an oil pumpjack.

Select the “By Operator” radio button and left click on the “Load KGS Data” Icon Button in the Data Source Panel of the Load Data Dialog to display the “Search for Data on KGS Server” dialog.

The 'Search for Data on KGS Server' dialog box has a title bar with the same text. Inside, there's a section 'Search for Data in Kansas Geological Survey Database:' with a 'Search By:' label and a radio button for 'Name (Partial Phrase)'. Below this is a text input field with 'Kerr-McGee' entered. A 'Search' button is at the bottom of this section. Below the search section is a table titled 'List of Oil & Gas Wells:'. The table has columns: KID, DOR, Lease, Operator, Field, Town, Range, and Sec. The first row is highlighted in yellow. Below the table are 'Select' and 'Close' buttons.

KID	DOR	Lease	Operator	Field	Town	Range	Sec
1000440221			KERR-MCGEE CORPO				
1027997546			Kerr-McGee Corporation				
1027998569			Kerr-McGee Corporation				
1028005088	33002		Kerr-McGee Oil & Gas Ons...				

Search for Data in KGS

- **Name (Partial Phrase)** – The user can search for production data by operator partial phrase, i.e. “Kerr-McGee”, which will look for all fields with the phrase “Kerr-McGee” in the operator name.

List of Operators with Production History Data.

Dialog Buttons:

Select – Transfers the Production History back to the main dialog.

Close – Exit Dialog

As the Summary image suggests there is only 1 method for searching for the operator production data within this dialog,

- Name (Partial Phrase) – The stored procedure used to retrieve the list of operator production data from the KGS Database allows the user to enter a partial phrase, in this example Kerr-McGee. The program places a ‘%’ in front and back of the phrase and sends the request to the Database, i.e. “%Kerr-McGee%”.

Search for Data in Kansas Geological Survey Database:

Search By:

☒ Name (Partial Phrase)

Enter Operator Name

Kerr-McGee

Search

The user only needs to enter the above data and select the “Search” Button to display the list of fields in the Kansas Database that match the search criteria. In the image below the Field Name “Arroyo” was entered to search for all leases in Kansas with the Phrase Arroyo in it. The user searches through the list until they find the field of interest.

Search for Data on KGS Server

Search for Data in Kansas Geological Survey Database:

Search By:

☒ Name (Partial Phrase)

Enter Operator Name

Kerr-McGee

Search

List of Oil & Gas Wells:

KID	DOR	Lease	Operator	Field	Town	Range	Sec
1000440221			KERR-MCGEE CORPO				
1027997546			Kerr-McGee Corporation				
1027998569			Kerr-McGee Corporation				
1028005088	33002		Kerr-McGee Oil & Gas Ons...				

Select Close

To import the operator production history data click the “Select” button, which will transfer the data back to the “Load Data” Dialog.

Load Data

Data Source

KGS: Search KGS Production Data

☐ By Lease
 ☐ By Field
 ☐ By County
 ☒ By Operator

Load KGS Data

PC: Read Production ASCII Data Text File

☐ AS XML (Extensible Markup Language) ASCII File
 ☒ AS CSV (Comma Delimited) ASCII File

Load PC Data

Production Data Table (Editable)

☐ Lease
 ☐ Field
 ☐ County
 ☒ Operator

Operator Name: Kerr-Mcgee Corporation

KGS Primary KEY: 1027998569 DOR: 0

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL; GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1996	1	0	GAS	28,414	8
1996	2	0	GAS	24,814	8
1996	3	0	GAS	30,231	8
1996	4	0	GAS	23,573	8
1996	5	0	GAS	20,284	8
1996	6	0	GAS	23,017	8
1996	7	0	GAS	25,325	8
1996	8	0	GAS	28,548	8
1996	9	0	GAS	25,541	8

Production Data Table (Editable)

- Header Information for production data, sets the “Operator” radio button to identify the search, the Operator Name, i.e. Kerr-Mcgee Corporation and the KGS Primary Key 1027998569.
- List of Raw Oil & Gas Production Records

Click on the “Plot Data” to display the Production Plot and Control Dialogs.

KGS (Database) - Importing Production Data - By County

The Kansas Geological Survey (KGS) has a good collection of production data stored in the ORACLE Database. In this example the user will download the well data available from the KGS County Production Database Table. The ORACLE Database is accessed by making Stored Procedure PL/SQL calls to the ORACLE Database from which an Extensible Markup Language (XML) data stream is created containing the lease & production data that is passed back to the web app making the request.

The 'Data Source' dialog box is divided into two sections. The top section, 'KGS: Search KGS Production Data', contains four radio buttons: 'By Lease', 'By Field', 'By County' (which is selected), and 'By Operator'. To the right of these buttons is a button labeled 'Load KGS Data' with a circular icon containing a well and the text 'KANSAS GEOLOGICAL SURVEY'. The bottom section, 'PC: Read Production ASCII Data Text File', contains two radio buttons: 'AS XML (Extensible Markup Language) ASCII File' and 'AS CSV (Comma Delimited) ASCII File' (which is selected). To the right of these buttons is a button labeled 'Load PC Data' with a square icon containing a well and the text 'Production'.

Select the “By County” radio button and left click on the “Load KGS Data” Icon Button in the Data Source Panel of the Load Data Dialog to display the “Search for Counties on KGS Server” dialog.

The 'Search for Counties on KGS Server' dialog box displays a table with two columns: 'Code' and 'County'. The table lists 27 counties, with 'STANTON' (code 187) highlighted in yellow. At the bottom of the dialog are 'Select' and 'Close' buttons.

Code	County
139	OSAGE
141	OSBORNE
145	PAWNEE
147	PHILLIPS
149	POTTAWATOMIE
151	PRATT
153	RAWLINS
155	RENO
159	RICE
161	RILEY
163	ROOKS
165	RUSH
167	RUSSELL
169	SALINE
171	SCOTT
173	SEDGWICK
175	SEWARD
179	SHERIDAN
181	SHERMAN
185	STAFFORD
187	STANTON
189	STEVENS
191	SUMNER
193	THOMAS
195	TREGO
197	WABAUNSEE
199	WALLACE
203	WICHITA
205	WILSON
207	WOODSON

In this example Stanton County is selected. To import the Stanton county production history data click the “Select” button, which will transfer the data back to the “Load Data” Dialog.

Data Source

KGS: Search KGS Production Data

☐ By Lease ☐ By Field ☒ By County ☐ By Operator

PC: Read Production ASCII Data Text File

☐ AS XML (Extensible Markup Language) ASCII File ☒ AS CSV (Comma Delimited) ASCII File

Production Data Table (Editable)

☐ Lease ☐ Field ☒ County ☐ Operator

County Name: Stanton

KGS Primary KEY: 187 DOR: 0

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL, GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1945	0	0	OIL	6,285	1
1946	0	0	OIL	11,921	2
1947	0	0	OIL	19,248	2
1948	0	0	OIL	16,291	2
1949	0	0	OIL	12,131	2
1950	0	0	OIL	9,469	2
1951	0	0	OIL	7,650	3
1952	0	0	OIL	7,510	3
1953	0	0	OIL	7,395	3
1954	0	0	OIL	6,100	3
1955	0	0	OIL	4,832	3
1956	0	0	OIL	4,543	3
1957	-1	0	GAS		224
1957	0	0	OIL	9,776	7
1958	0	0	OIL	24,610	7
1958	2	0	GAS	1,294,693	231
1958	3	0	GAS	1,296,220	231
1958	4	0	GAS	1,238,677	231
1958	5	0	GAS	1,238,722	231
1958	6	0	GAS	1,012,376	231
1958	7	0	GAS	834,877	231
1958	8	0	GAS	870,114	231
1958	9	0	GAS	768,871	231
1958	10	0	GAS	713,025	231
1958	11	0	GAS	1,208,240	231

Add Row Remove Row Sort Data

Plot Data Clear Exit

Production Data Table (Editable)

- Header Information for production data, sets the “County” radio button to identify the search, the County Name, i.e. Stanton and the KGS Primary Key 187.
- List of Raw Oil & Gas Production Records

Click on the “Plot Data” to display the Production Plot and Control Dialogs.

Importing PC Data - Download Production Data to PC

Download either the ASCII Text Files directly or the Zip files extracting the contents into a directory. The problem with the ASCII Text Files being downloaded directly from a web page is that the web page will alter the contents so it does not retain the basic structure and add HTML text to the file. The preferred method if you have Zip or WinZip is to download the zip files to your PC and extract.

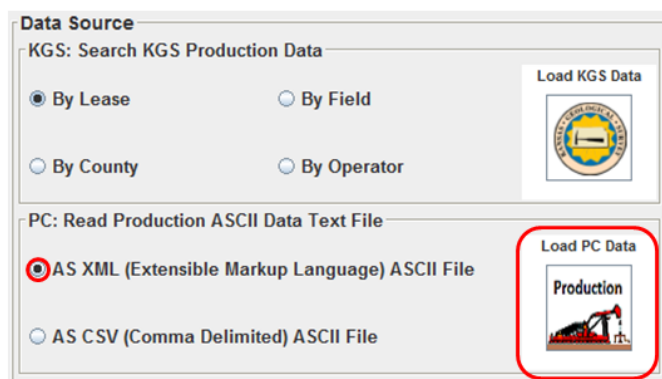
Arroyo Field Production Data Stanton County, Kansas

Type	ASCII Text Files
CSV	http://www.kgs.ku.edu/Gemini/Tools/documentation/production-Arroyo-Field.csv
XML	http://www.kgs.ku.edu/Gemini/Tools/documentation/production-Arroyo-Field-XML.xml

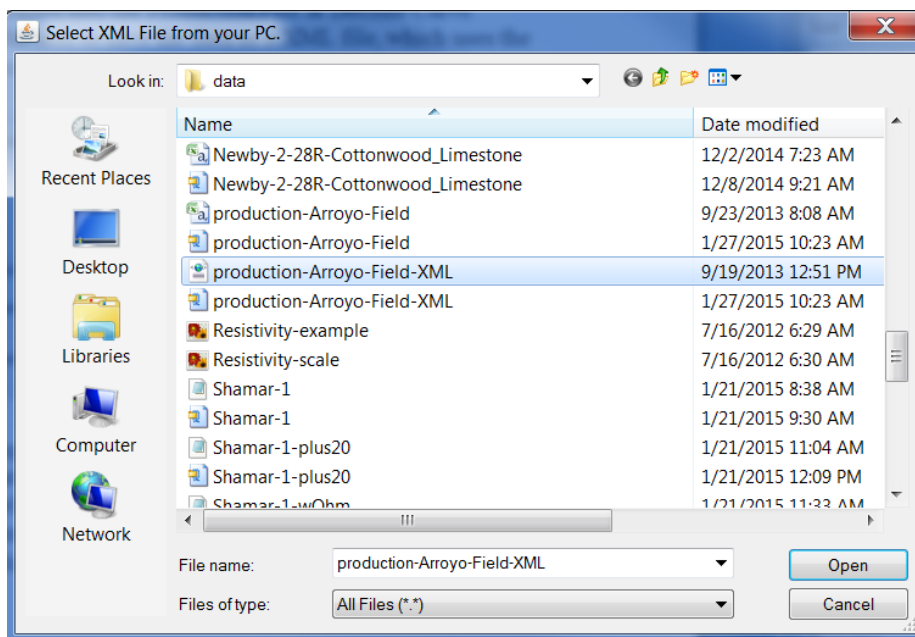
Type	Zip Files
CSV	http://www.kgs.ku.edu/Gemini/Tools/documentation/production-Arroyo-Field.zip
XML	http://www.kgs.ku.edu/Gemini/Tools/documentation/production-Arroyo-Field-XML.zip

Importing PC Data – Field Production XML (Extensible Markup Language) ASCII File.

This web app allows the user to save and read Production Data as Extensible Markup Language (XML) file. The data that is retrieved from the Kansas Geological Survey database is retrieved as a XML data stream that is parsed and loaded into the Production Plot & Decline Curve Analysis web app. This program allows the user to save the data as a XML file, which uses the same Document Type Definition (DTD) to format the data.



Select the “XML (Extensible Markup Language) ASCII File” radio button and then left click on the “Load PC Data” Icon Button in the Data Source Panel of the Load Data Dialog. This will display the “Select XML File from your PC” Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the Arroyo Field Production XML file production-Arroyo-Field-XML.xml, highlighted below.



Select the “Open” button to load the contents of the XML File into the “Load Data” dialog.

Production Data Extensible Markup Language (XML) Document Type Definition (DTD).

The Production Data DTD defines the contents of the Extensible Markup Language (XML) File. The Document Type Definition (DTD) for the Production Data is as follows,

```
<?xml version="1.0"?>
<!DOCTYPE production [
<!ELEMENT production (data*)>
<!ATTLIST production records CDATA #REQUIRED
                key    CDATA #REQUIRED
                id     CDATA #IMPLIED
                type   CDATA #REQUIRED
                name    CDATA #REQUIRED
                app     CDATA #IMPLIED
                v1      CDATA #IMPLIED
                v2      CDATA #IMPLIED
                v3      CDATA #IMPLIED>
<!ELEMENT data EMPTY>
<!ATTLIST data year CDATA #REQUIRED
                month CDATA #IMPLIED
                quarter CDATA #IMPLIED
                product CDATA #REQUIRED
                unit    CDATA #IMPLIED
                output  CDATA #REQUIRED
                sources CDATA #IMPLIED>]>
```

where **production** contents are,

records – The number of data records in file

key – Primary key for the production data, present if the data was retrieved from the KGS Database otherwise key="0".

id – KS Department of Revenue Lease Code (DOR) Code

type – Type of search (Lease, Field, County, Operator)

Name – Name of data, e.g., Arroyo (Field Name)

app – URL used to retrieve the data only for KGS Data

v1 – Search Criteria, e.g., Field=arroyo

v2, v3 not used

where **data** contents are,

year – Date - Year of production (format YYYY)

month – Date - Month of production, e.g., 1,2,3, ... 11 or 12

quarter – Date – Quarter or production, e.g., 1,2,3, or 4

product – OIL or GAS (The web app assumes upper case)

unit – Data of production data, BBL for Oil or MCF for GAS

output – Production Value

sources – Number of Wells contributing to data

Load Data

Data Source

KGS: Search KGS Production Data

☐ By Lease
 ☐ By Field
 ☒ By County
 ☐ By Operator

Load KGS Data

PC: Read Production ASCII Data Text File

☒ AS XML (Extensible Markup Language) ASCII File
 ☐ AS CSV (Comma Delimited) ASCII File

Load PC Data

Production Data Table (Editable)

☐ Lease
 ☒ Field
 ☐ County
 ☐ Operator

Field Name: Arroyo

KGS Primary KEY: 1000152060 DOR: 0

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL; GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1989	11	0	OIL	348	1
1989	12	0	OIL	1,364	1
1990	1	0	OIL	1,364	1
1990	2	0	OIL	957	1
1990	3	0	OIL	1,386	1
1990	4	0	OIL	968	1
1990	5	0	OIL	1,124	1
1990	6	0	OIL	728	1
1990	7	0	OIL	1,093	1
1990	8	0	OIL	908	1
1990	9	0	OIL	915	1
1990	10	0	OIL	917	1
1990	11	0	OIL	922	1
1990	12	0	OIL	729	1
1991	1	0	OIL	960	2
1991	2	0	OIL	728	2
1991	3	0	OIL	723	2
1991	4	0	OIL	735	2
1991	5	0	OIL	726	2
1991	6	0	OIL	725	2
1991	7	0	OIL	541	2
1991	8	0	OIL	1,084	2
1991	9	0	OIL	707	2
1991	10	0	GAS	41,553	3
1991	10	0	OIL	913	2

Add Row Remove Row Sort Data

Plot Data Clear Exit

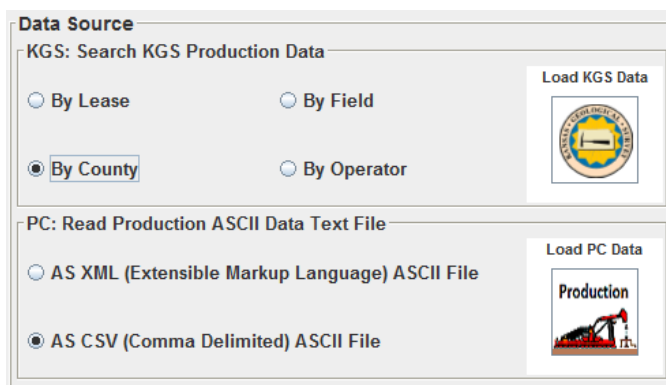
Production Data Table (Editable)

- Header Information for production data, sets the “Field” radio button to identify the search, the Field Name, i.e. Arroyo and the KGS Primary Key 1000152060.
- List of Raw Oil & Gas Production Records

Click on the “Plot Data” to display the Production Plot and Control Dialogs.

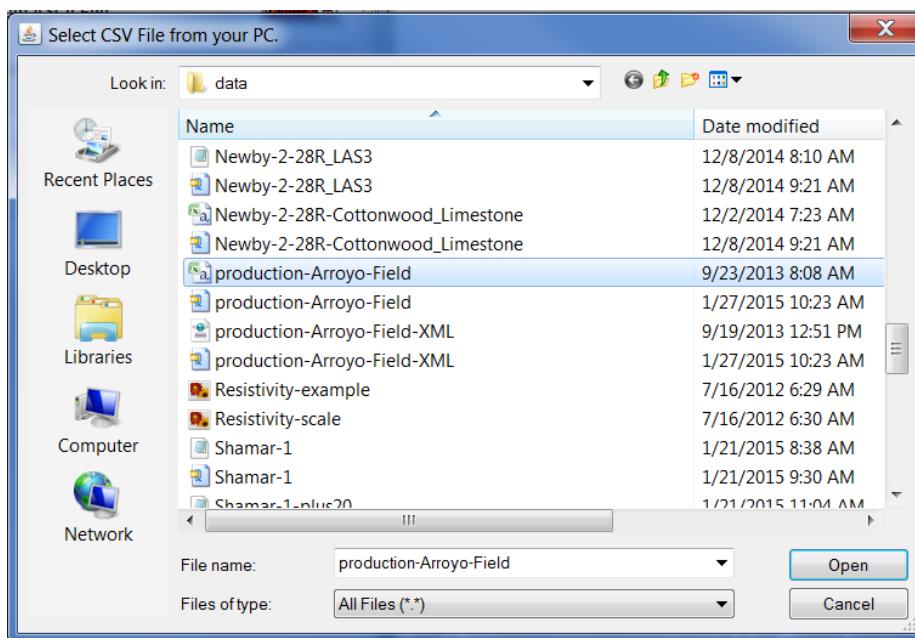
Importing PC Data – Field Production CSV (Comma Separated Values) ASCII File.

This web app allows the user to save and read Production Data as Comma Separated Values (CSV) file. The data that is retrieved from the Kansas Geological Survey database is retrieved as a XML data stream that is parsed and loaded into the Production Plot & Decline Curve Analysis web app. This program allows the user to save the data as a CSV file.



The 'Data Source' dialog box is divided into two sections. The top section, 'KGS: Search KGS Production Data', contains four radio buttons: 'By Lease', 'By Field', 'By County' (which is selected), and 'By Operator'. To the right of these buttons is a 'Load KGS Data' button with a circular icon. The bottom section, 'PC: Read Production ASCII Data Text File', contains two radio buttons: 'AS XML (Extensible Markup Language) ASCII File' and 'AS CSV (Comma Delimited) ASCII File' (which is selected). To the right of these buttons is a 'Load PC Data' button with a square icon labeled 'Production' showing an oil pumpjack.

Select the “CSV (Comma Delimited) ASCII File” radio button and then left click on the “Load PC Data” Icon Button in the Data Source Panel of the Load Data Dialog. This will display the “Select CSV File from your PC” Dialog. This dialog allows the user to search their PC for the file of interest. In this example it is the Production Field CSV file production-Arroyo-Field.csv, highlighted below. Select the Open button to display the “Map File Column Number to Production Column” Dialog.



Select the “Open” button to load the contents of the XML File into the “Load Data” dialog. Click on the “Plot Data” to display the Production Plot and Control Dialogs.

production.csv – Comma Delimited ASCII File

KEY=1000152060 FIELD=Arroyo app=http://chasm.kgs.ku.edu/pls/abyss/iqstrat.production_pkg.getXML?sField=1000152060

Year, Month, Product, Output, sources

1989, 11, OIL, 348.0, 1
1989, 12, OIL, 1364.0, 1
1990, 1, OIL, 1364.0, 1
1990, 2, OIL, 957.0, 1
1990, 3, OIL, 1386.0, 1
1990, 4, OIL, 968.0, 1
1990, 5, OIL, 1124.0, 1
1990, 6, OIL, 728.0, 1
1990, 7, OIL, 1093.0, 1
1990, 8, OIL, 908.0, 1
1990, 9, OIL, 915.0, 1
1990, 10, OIL, 917.0, 1
1990, 11, OIL, 922.0, 1
1990, 12, OIL, 729.0, 1
1991, 1, OIL, 960.0, 2
1991, 2, OIL, 728.0, 2
1991, 3, OIL, 723.0, 2
1991, 4, OIL, 735.0, 2
1991, 5, OIL, 726.0, 2
1991, 6, OIL, 725.0, 2
1991, 7, OIL, 541.0, 2
1991, 8, OIL, 1084.0, 2
1991, 9, OIL, 707.0, 2
1991, 10, GAS, 41553.0, 3
1991, 10, OIL, 913.0, 2
1991, 11, GAS, 57569.0, 3
1991, 11, OIL, 739.0, 2
1991, 12, GAS, 144027.0, 3
1991, 12, OIL, 909.0, 2
1992, 1, GAS, 146182.0, 12
1992, 1, OIL, 865.0, 12
1992, 2, GAS, 140563.0, 12
1992, 2, OIL, 887.0, 12
1992, 3, GAS, 154415.0, 12
1992, 3, OIL, 1235.0, 12
1992, 4, GAS, 149544.0, 12
1992, 4, OIL, 2146.0, 12
...

The “Map File Column Number to Production Column” Dialog was created to read a Comma Delimited ASCII File containing raw production data. The first two lines of the Comma Delimited File should contain the following

- 1st Line – The production data information
- 2nd Line – Column Labels

The user only needs to map any missing the File Columns to the Program Data Columns. Also set the Type Radio button to the type of production data, i.e., Lease, Field, County or Operator. Enter the Name of the production data in the “Name:” text field. Also set the starting line number to begin reading the data, i.e. this example is line 3 the default.

Step 2: Map the Comma Delimited File columns to the Production Data Columns, i.e., this example

Columns		
No.	File	Production Data
1	Year	Year of Production
2	Month	Month of Production
4	Product	Product
5	Output	Product Output
6	sources	Number of Sources.

Select the “Load Data” Button.

Production Data Comma-Separated Values (CSV) File Format

The Production CSV Header is very simple in that it only requires two lines of the data file. The first two lines of the Comma Delimited File should contain the following

- 1st Line – The production data information
 - Type of production data (lease, field, operator, county),
 - Name of the data, e.g., Arroyo
- 2nd Line – Column Labels, i.e., Year, Month, Quarter, Product, Output, sources
 - year – Date - Year of production (format YYYY)
 - month – Date - Month of production, e.g., 1,2,3, ... 11 or 12
 - quarter – Date – Quarter or production, e.g., 1,2,3, or 4
 - product – OIL or GAS (The web app assumes upper case)
 - unit – Data of production data, BBL for Oil or MCF for GAS
 - output – Production Value
 - sources – Number of Wells contributing to data

Arroyo.csv – Example File Snippet - Created by the Production Applet

KEY=1000152060 FIELD=Arroyo

app=http://chasm.kgs.ku.edu/pls/abyss/iqstrat.production_pkg.getXML?sField=1000152060

Year, Month, Product, Output, sources

1989, 11, OIL, 348.0, 1

1989, 12, OIL, 1364.0, 1

1990, 1, OIL, 1364.0, 1

1990, 2, OIL, 957.0, 1

1990, 3, OIL, 1386.0, 1

1990, 4, OIL, 968.0, 1

1990, 5, OIL, 1124.0, 1

1990, 6, OIL, 728.0, 1

1990, 7, OIL, 1093.0, 1

...

Load Data

Data Source

KGS: Search KGS Production Data

☐ By Lease ☐ By Field ☒ By County ☐ By Operator

Load KGS Data

PC: Read Production ASCII Data Text File

☐ AS XML (Extensible Markup Language) ASCII File ☒ AS CSV (Comma Delimited) ASCII File

Load PC Data

Production Data Table (Editable)

☐ Lease ☒ Field ☐ County ☐ Operator

Field Name: Arroyo

KGS Primary KEY: 0 DOR: 0

Month: as a number, i.e. January = 1, February = 2, etc.

Quarter: as a number, i.e. 1st Quarter = 1, 2nd Quarter = 2, etc.

Output: OIL in BBL; GAS in MCF Units

Year	Month	Quarter	OIL or GAS	Output	Wells
1989	11	0	OIL	348	1
1989	12	0	OIL	1,364	1
1990	1	0	OIL	1,364	1
1990	2	0	OIL	957	1
1990	3	0	OIL	1,386	1
1990	4	0	OIL	968	1
1990	5	0	OIL	1,124	1
1990	6	0	OIL	728	1
1990	7	0	OIL	1,093	1
1990	8	0	OIL	908	1
1990	9	0	OIL	915	1
1990	10	0	OIL	917	1
1990	11	0	OIL	922	1
1990	12	0	OIL	729	1
1991	1	0	OIL	960	2
1991	2	0	OIL	728	2
1991	3	0	OIL	723	2
1991	4	0	OIL	735	2
1991	5	0	OIL	726	2
1991	6	0	OIL	725	2
1991	7	0	OIL	541	2
1991	8	0	OIL	1,084	2
1991	9	0	OIL	707	2
1991	10	0	GAS	41,553	3
1991	10	0	OIL	913	2

Add Row Remove Row Sort Data

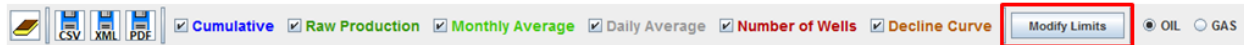
Plot Data Clear Exit

Production Data Table (Editable)

- Header Information for production data, the “Field” radio button had to be selected since the CSV File was not parsed for that information. The Field Name, i.e. Arroyo had to be added since the CSV File was not parse for that information.
- List of Raw Oil & Gas Production Records

Click on the “Plot Data” to display the Production Plot and Control Dialogs.

Production Plot Dialog Control & Modify Limits Dialog



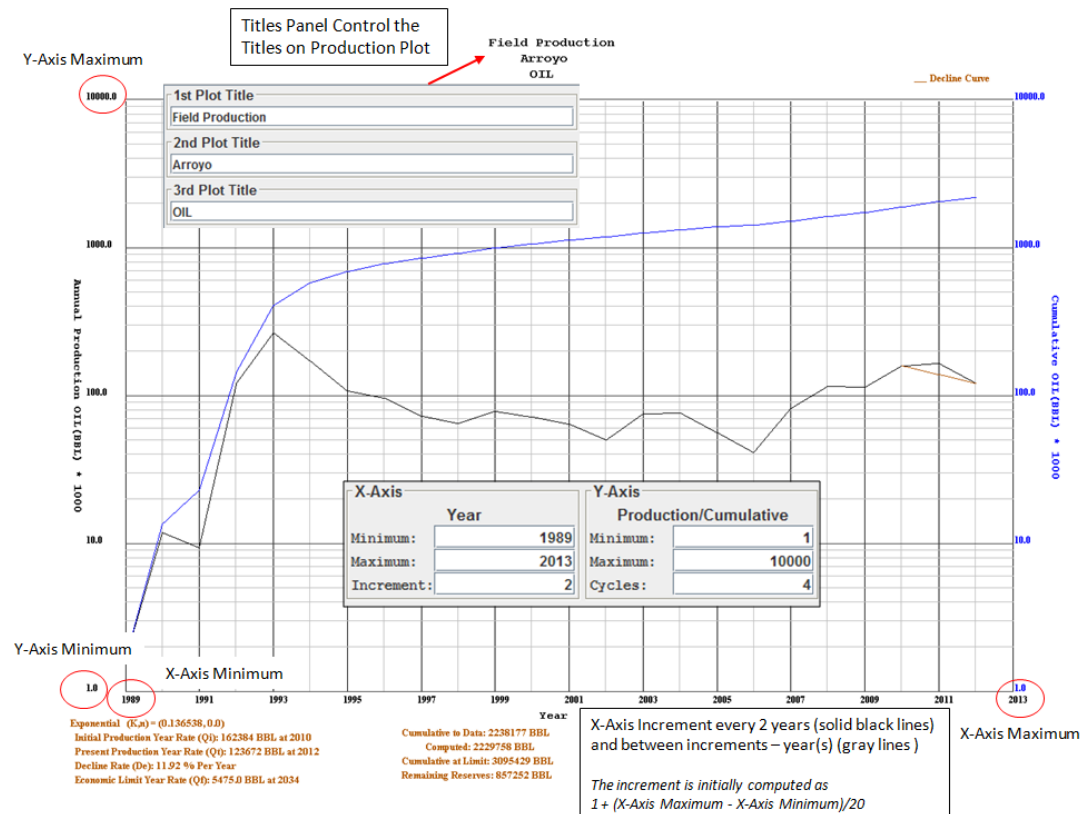
Click on the "Modify Limits" button to display the "Limits" dialog.

Limits Dialog

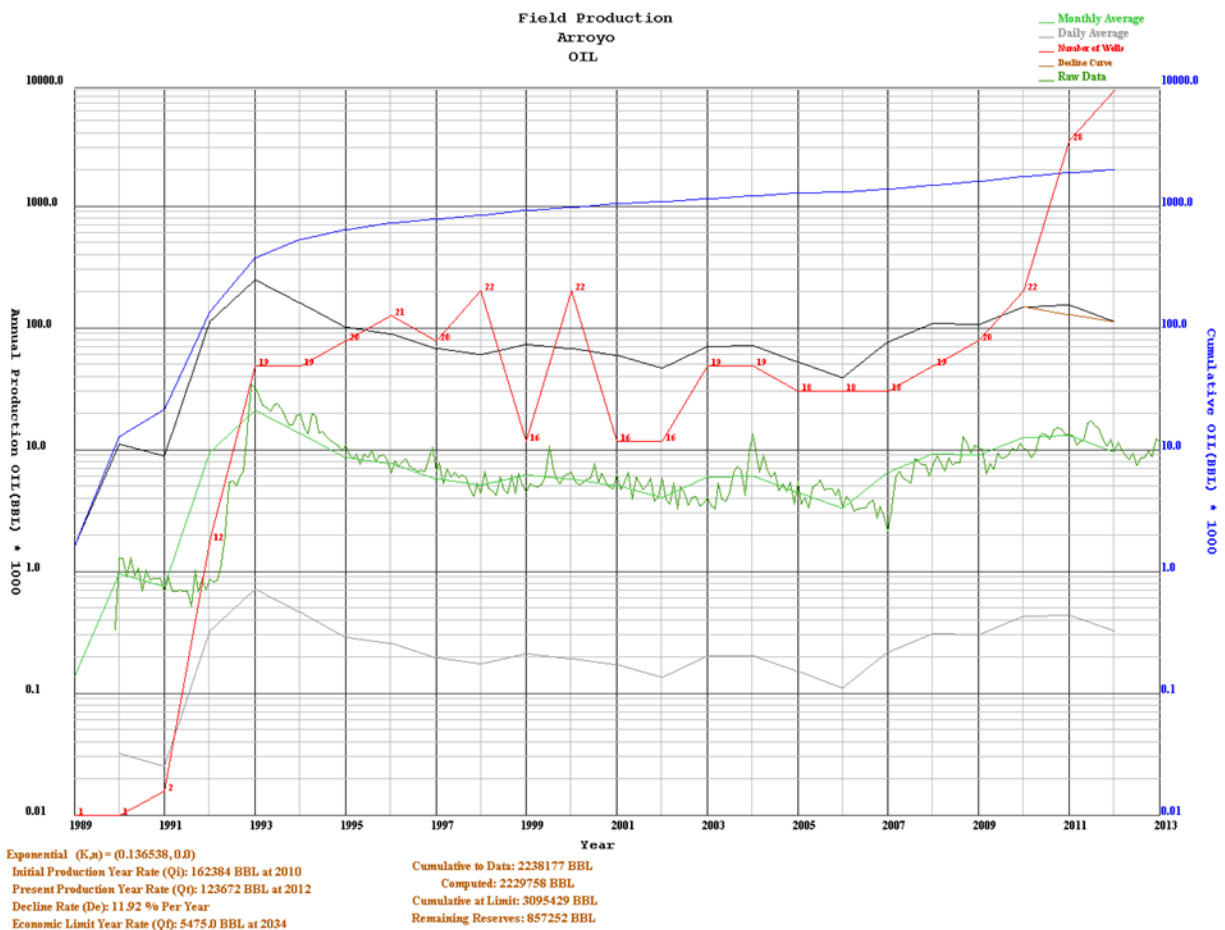
Change the plot titles

Change the plot x-y axis minimum, maximum and increment.

X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	1
Maximum:	2015	Maximum:	10000
Increment:	2	Cycles:	4



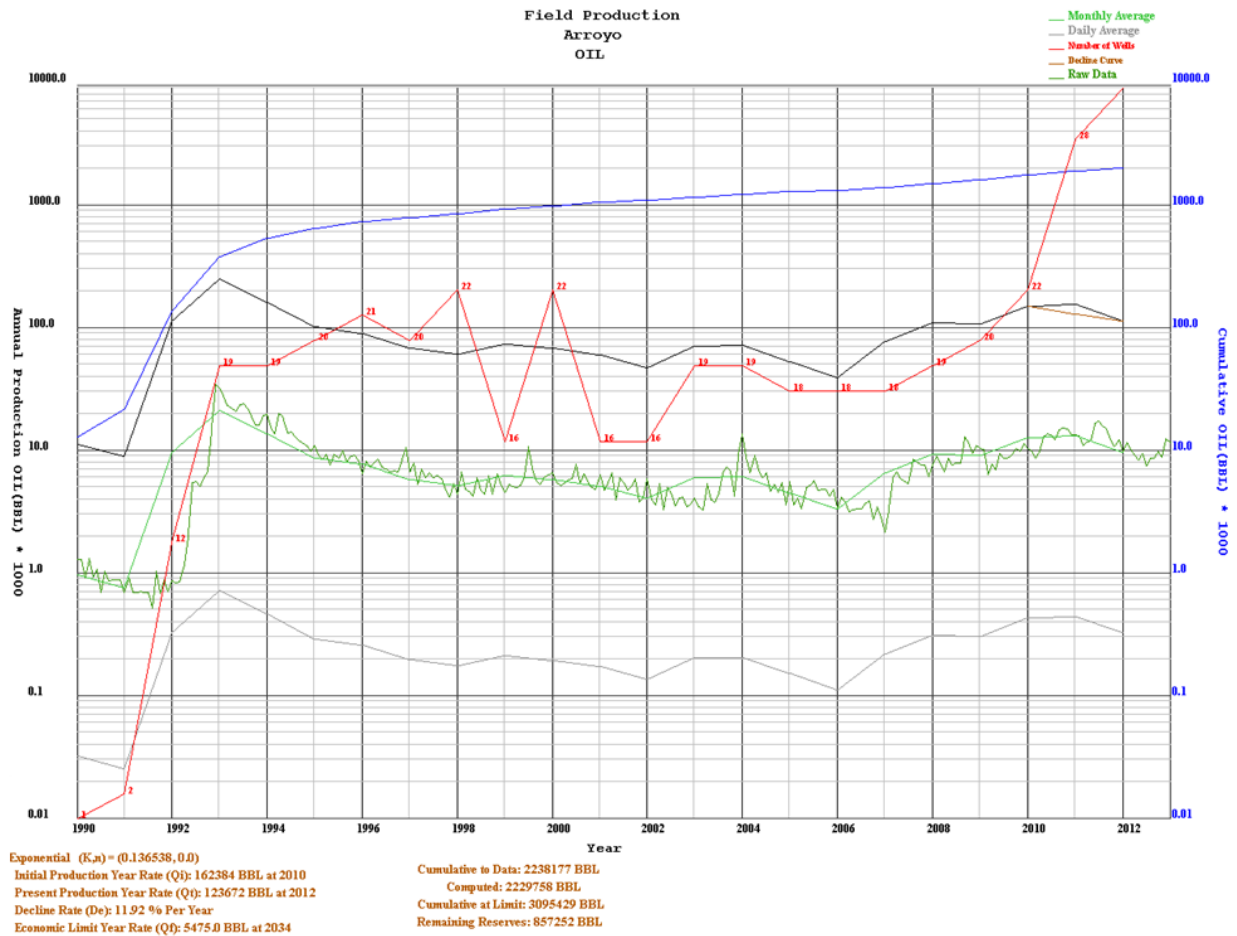
Changing the X-Axis Minimum Value



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	1
Maximum:	2013	Maximum:	10000
Increment:	2	Cycles:	4

Changing the Minimum X-Axis:

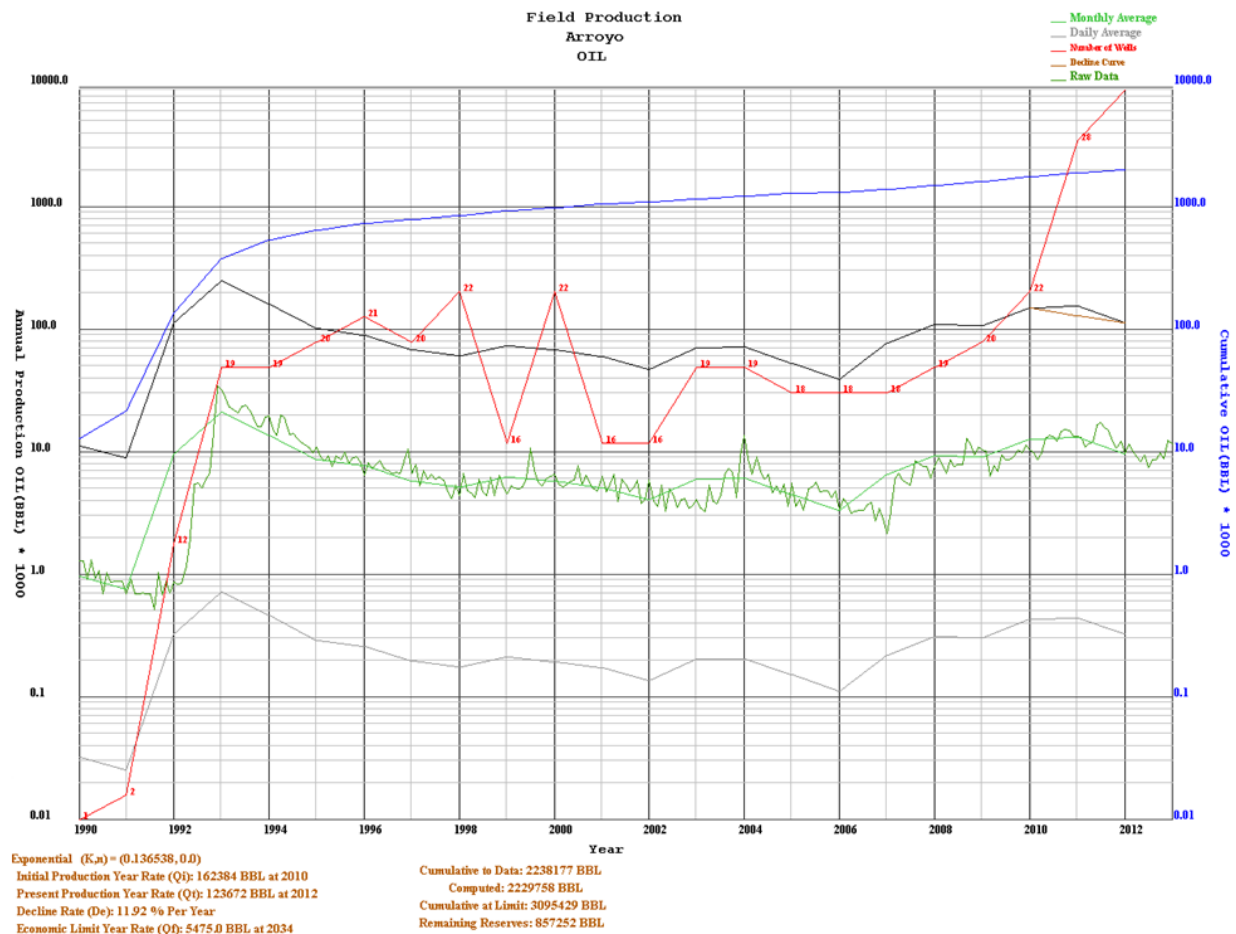
Notice the plot above all the curves are present, but lets change the lower x-axis limit to 1990. Edit the X-Axis Minimum text field from 1989 to 1990 and tab out to text field the plot limits will automatically change.



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1990	Minimum:	0.01
Maximum:	2013	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Minimum X-Axis:
 Notice the plot x-axis limits automatically changed from 1989 to 1990.

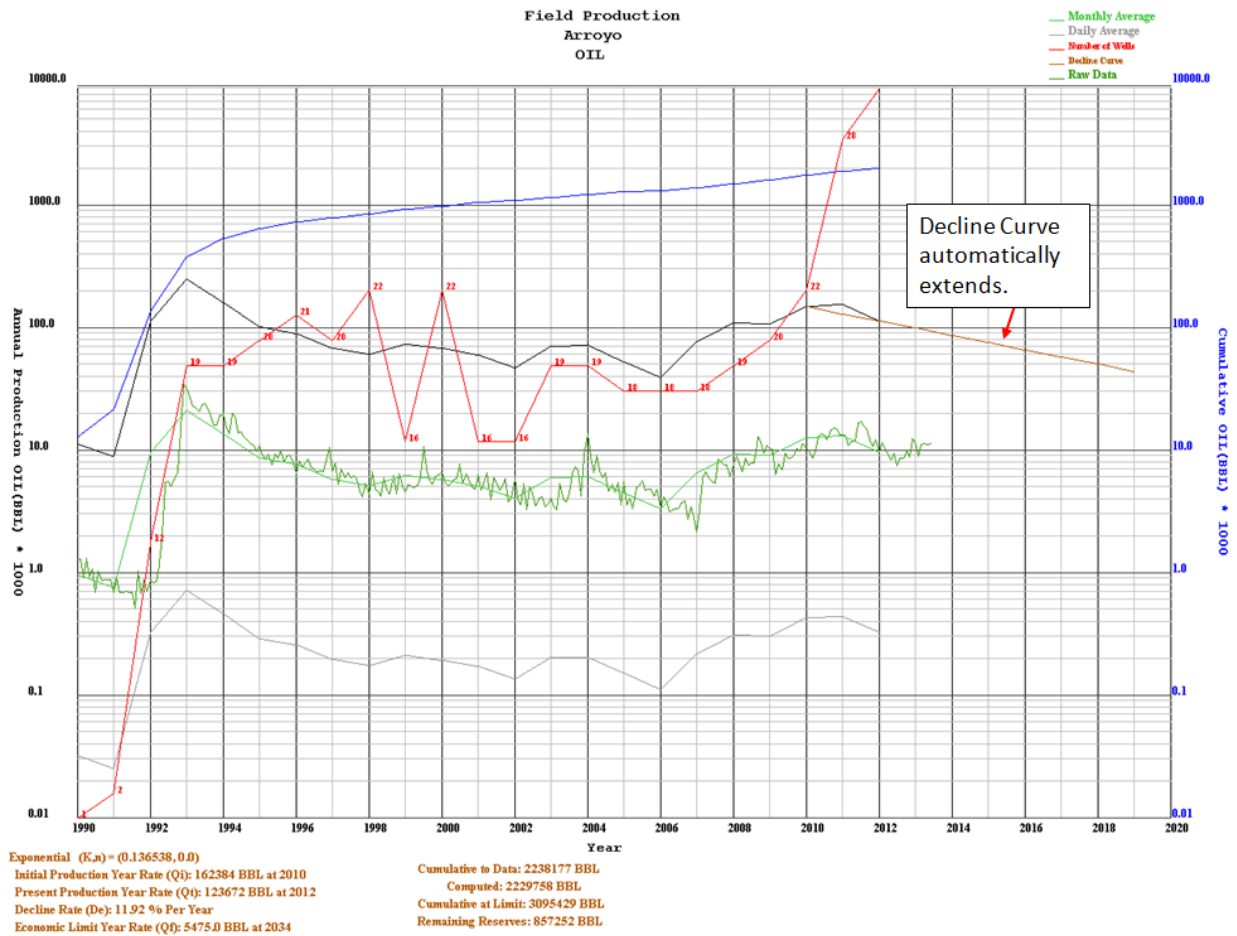
Changing the X-Axis Maximum Value



X-Axis		Y-Axis	
	Year		Production/Cumulative
Minimum:	1990	Minimum:	0.01
Maximum:	2013	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Maximum X-Axis:

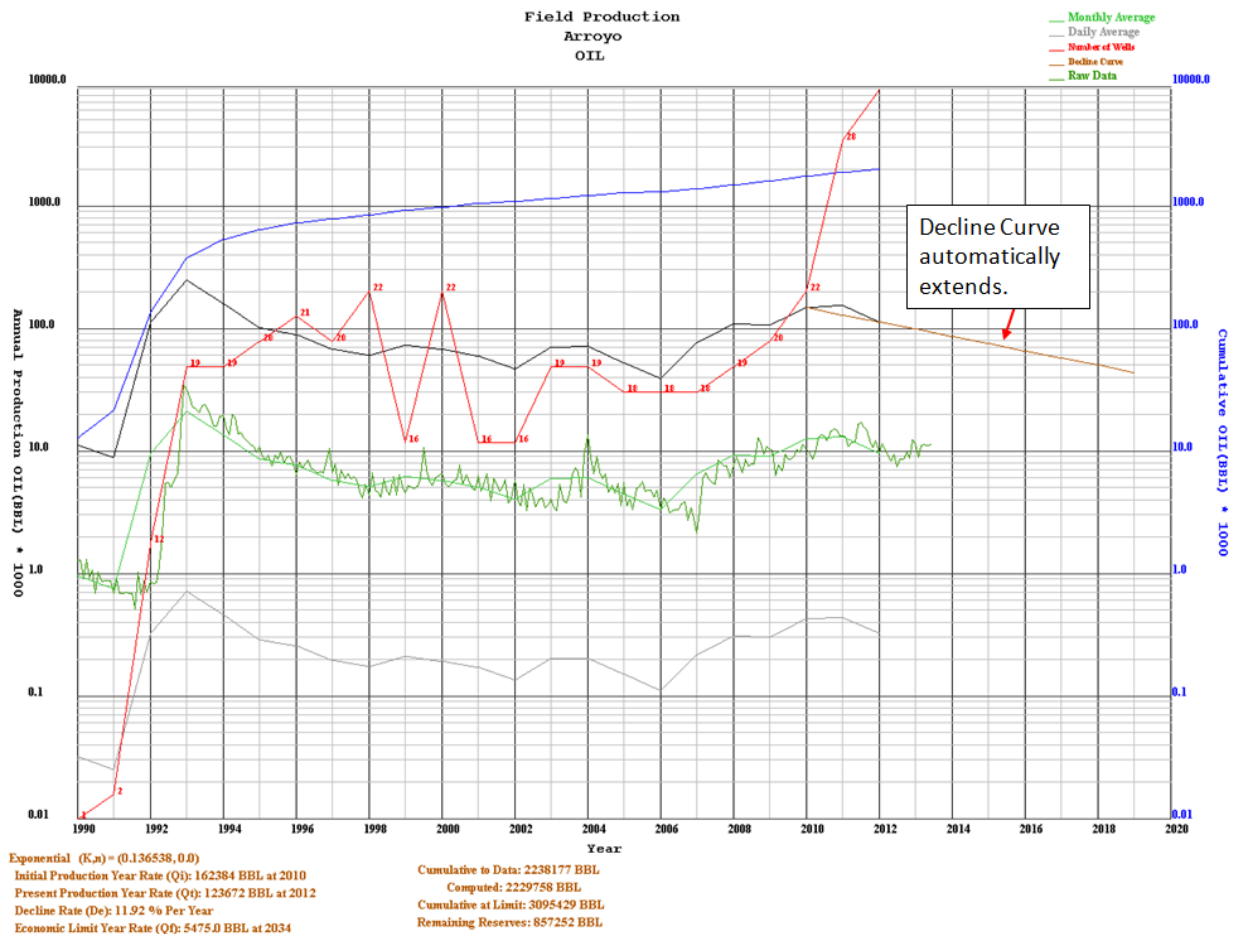
Now change the upper x-axis limit to 2020. Edit the X-Axis Maximum text field from 2013 to 2020 and tab out to text field the plot limits will automatically change.



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1990	Minimum:	0.01
Maximum:	2020	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Maximum X-Axis:
Notice the plot x-axis limits automatically changed from 2013 to 2020.

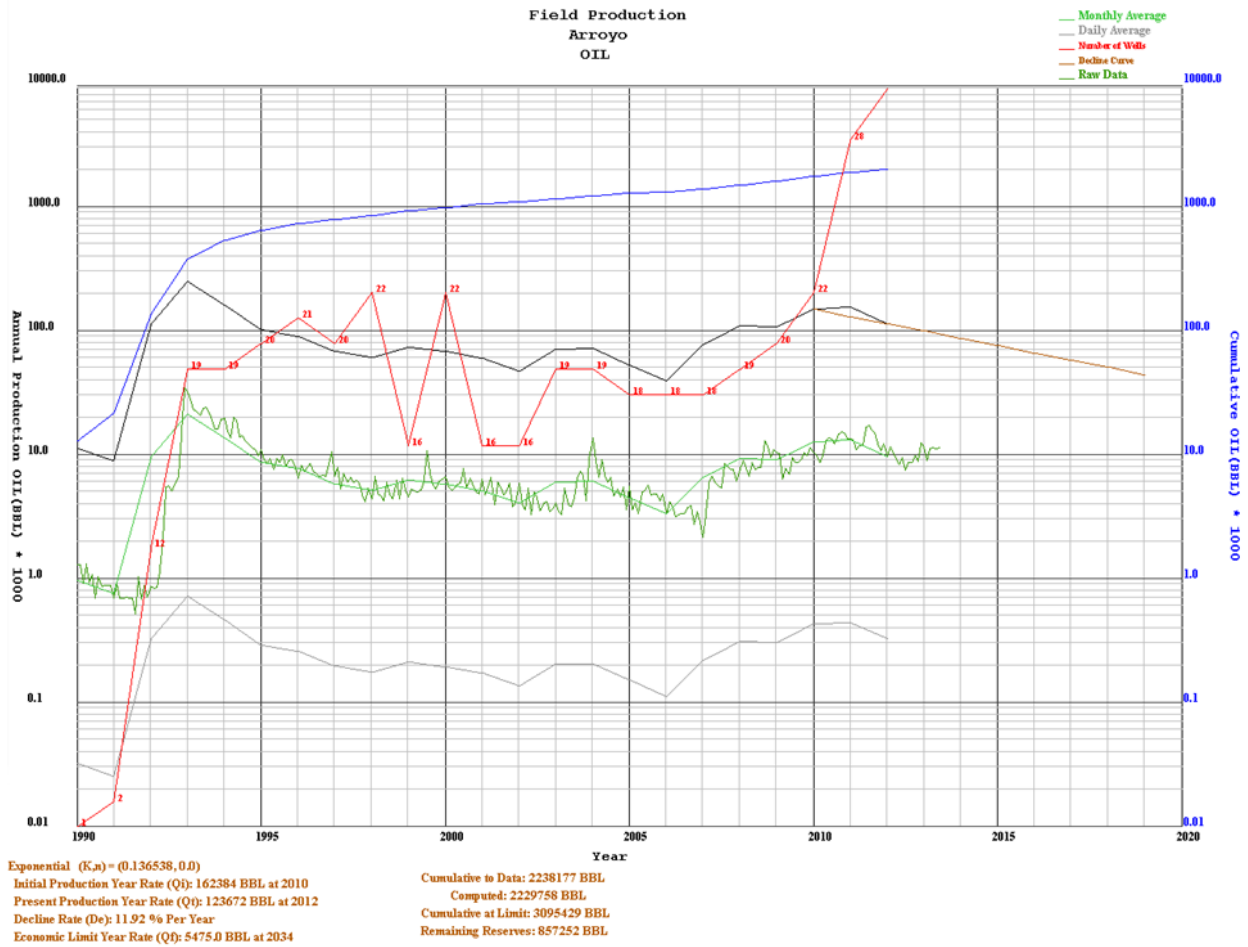
Changing the X-Axis Increment Value



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1990	Minimum:	0.01
Maximum:	2020	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Increment X-Axis:

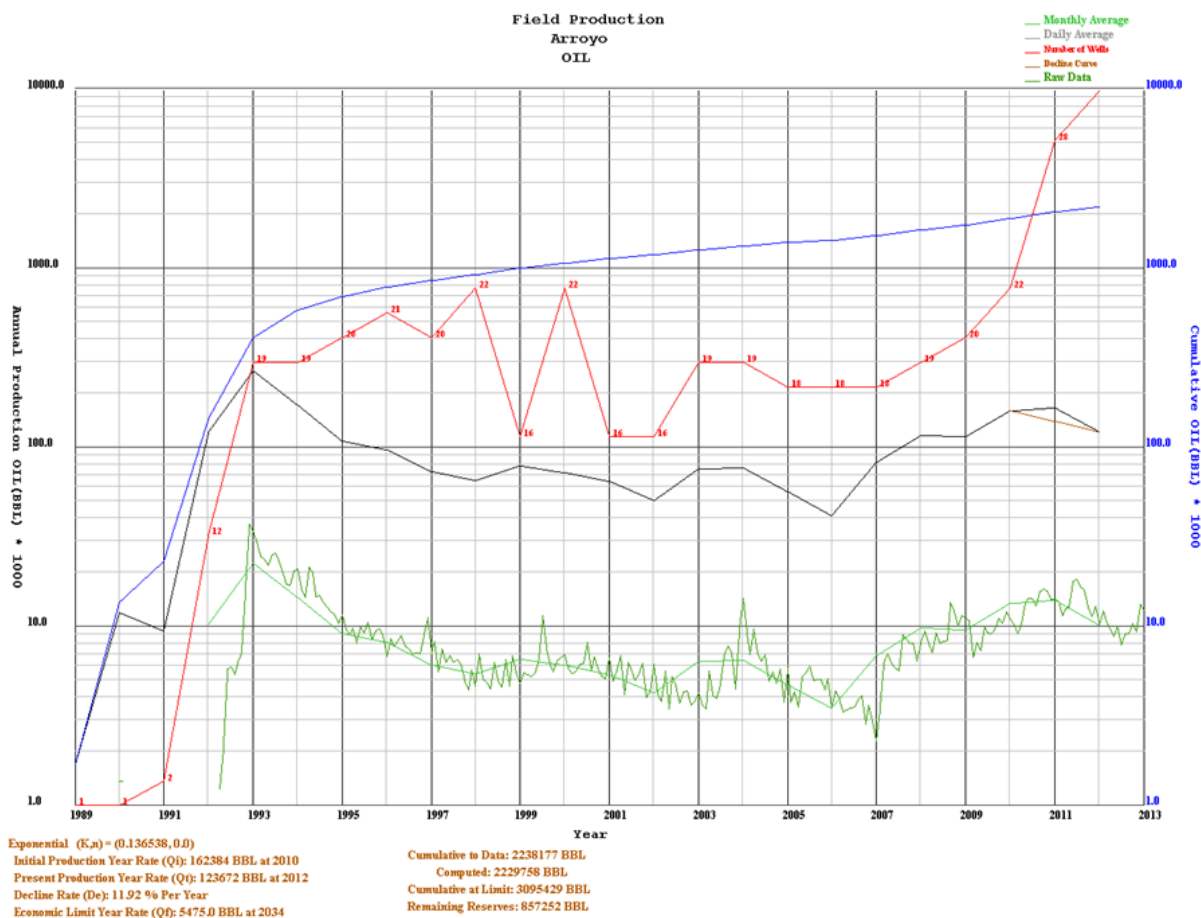
Now change the increment x-axis to 5 years. Edit the X-Axis Increment text field from 2 to 5 years and tab out to text field the plot limits will automatically change.



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1990	Minimum:	0.01
Maximum:	2020	Maximum:	10000.0
Increment:	5	Cycles:	6

Changing the Increment X-Axis:
Notice the plot x-axis increment automatically changed from 2 to 5 years.

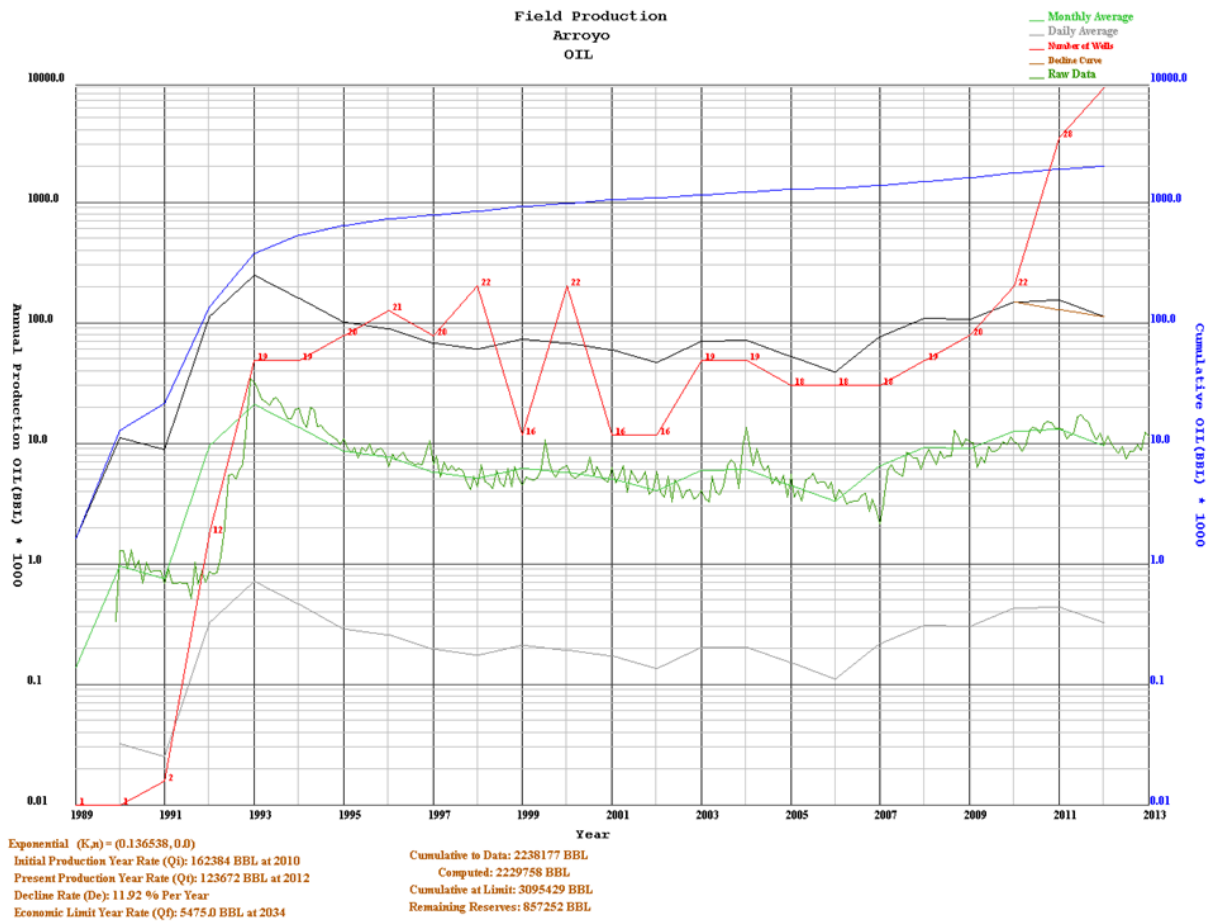
Changing the Y-Axis Minimum Value



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	1
Maximum:	2013	Maximum:	10000
Increment:	2	Cycles:	4

Changing the Minimum Y-Axis:

Notice the plot above all curves have been selected but the Daily Average Curve does not appear on the plot. Edit the Y-Axis Minimum text field from 1 to .01 and tab out to text field the plot limits will automatically change.

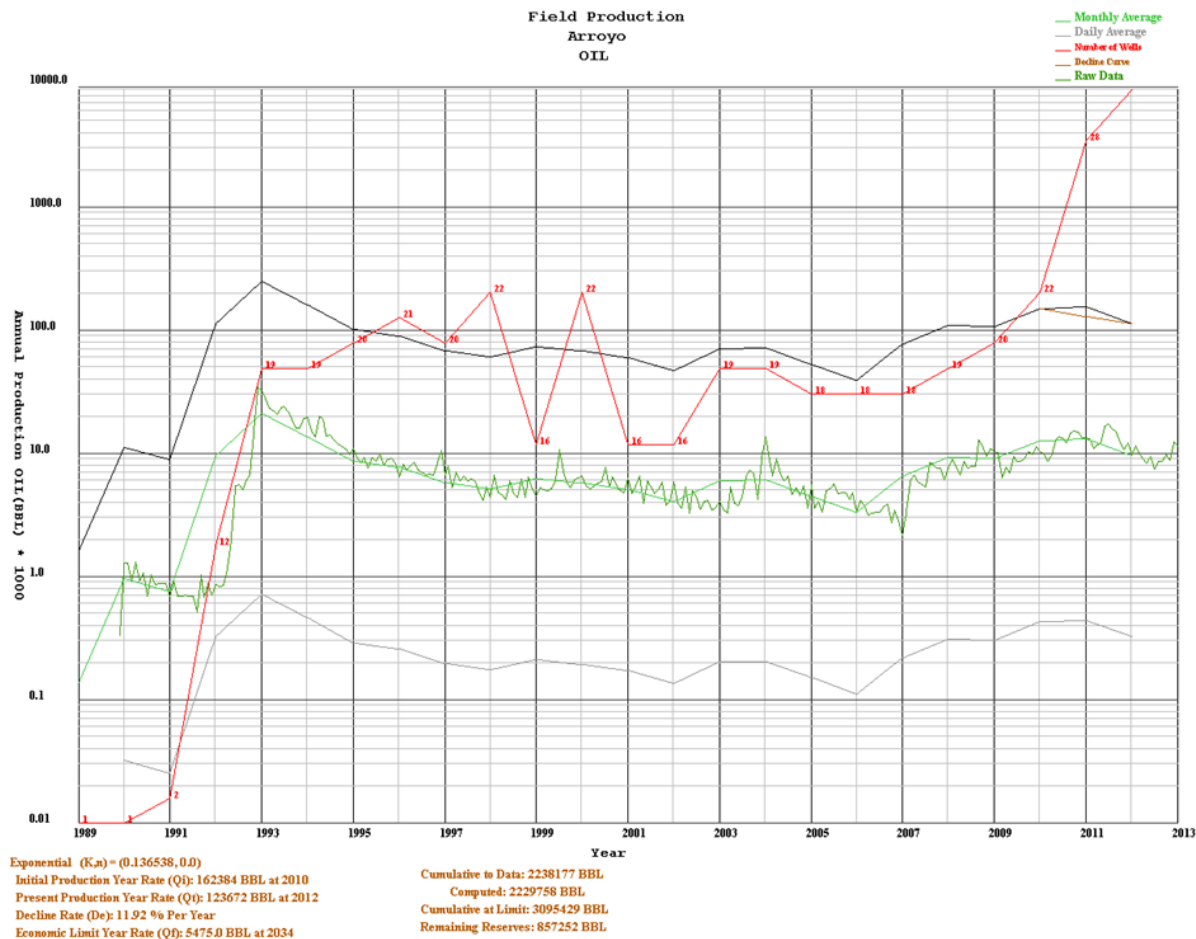


X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	0.01
Maximum:	2013	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Minimum Y-Axis:

Notice the plot above all curves are now visible. Also notice the Y-Axis Cycles automatically changed to 6.

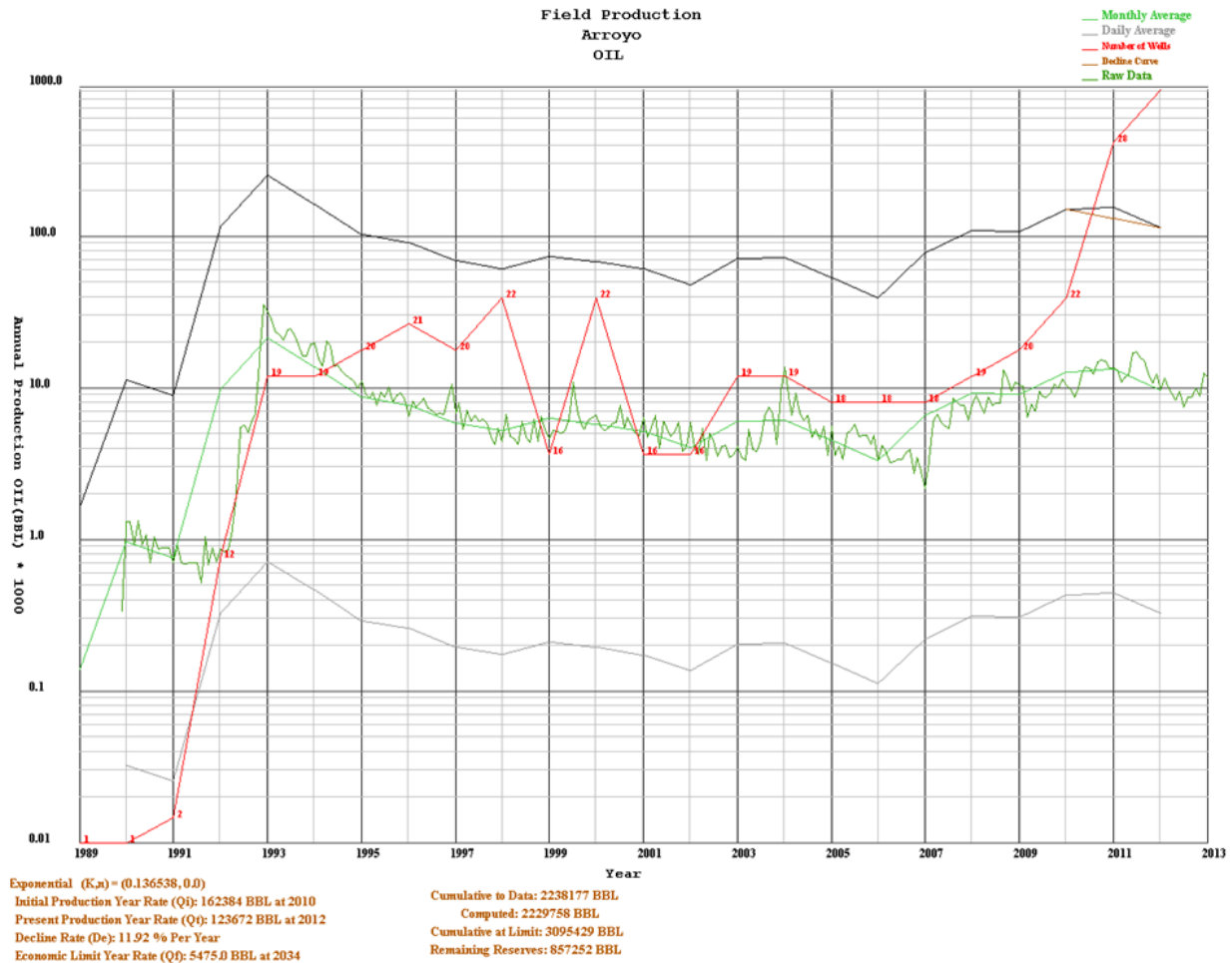
Changing the Y-Axis Maximum Value



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	0.01
Maximum:	2013	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Maximum Y-Axis:

Notice the plot above all curves have been selected but the Cumulative Curve does not appear on the plot. Edit the Y-Axis Maximum text field from 10000 to 1000 and tab out to text field the plot limits will automatically change.

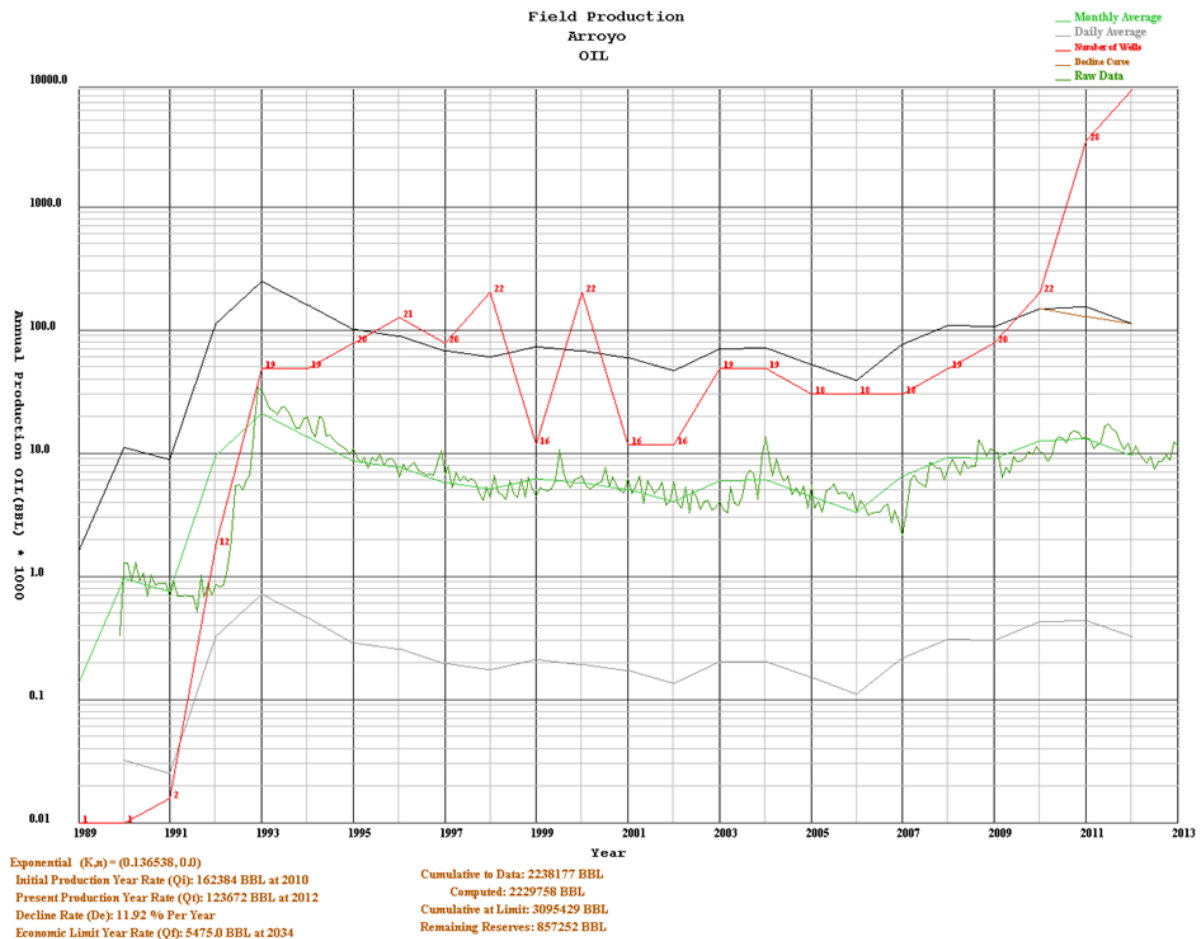


X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	0.01
Maximum:	2013	Maximum:	1000.0
Increment:	2	Cycles:	5

Changing the Maximum Y-Axis:

Notice the plot above the upper Y-Axis has changed to fit the data better. Also notice the Y-Axis Cycles automatically changed to 5.

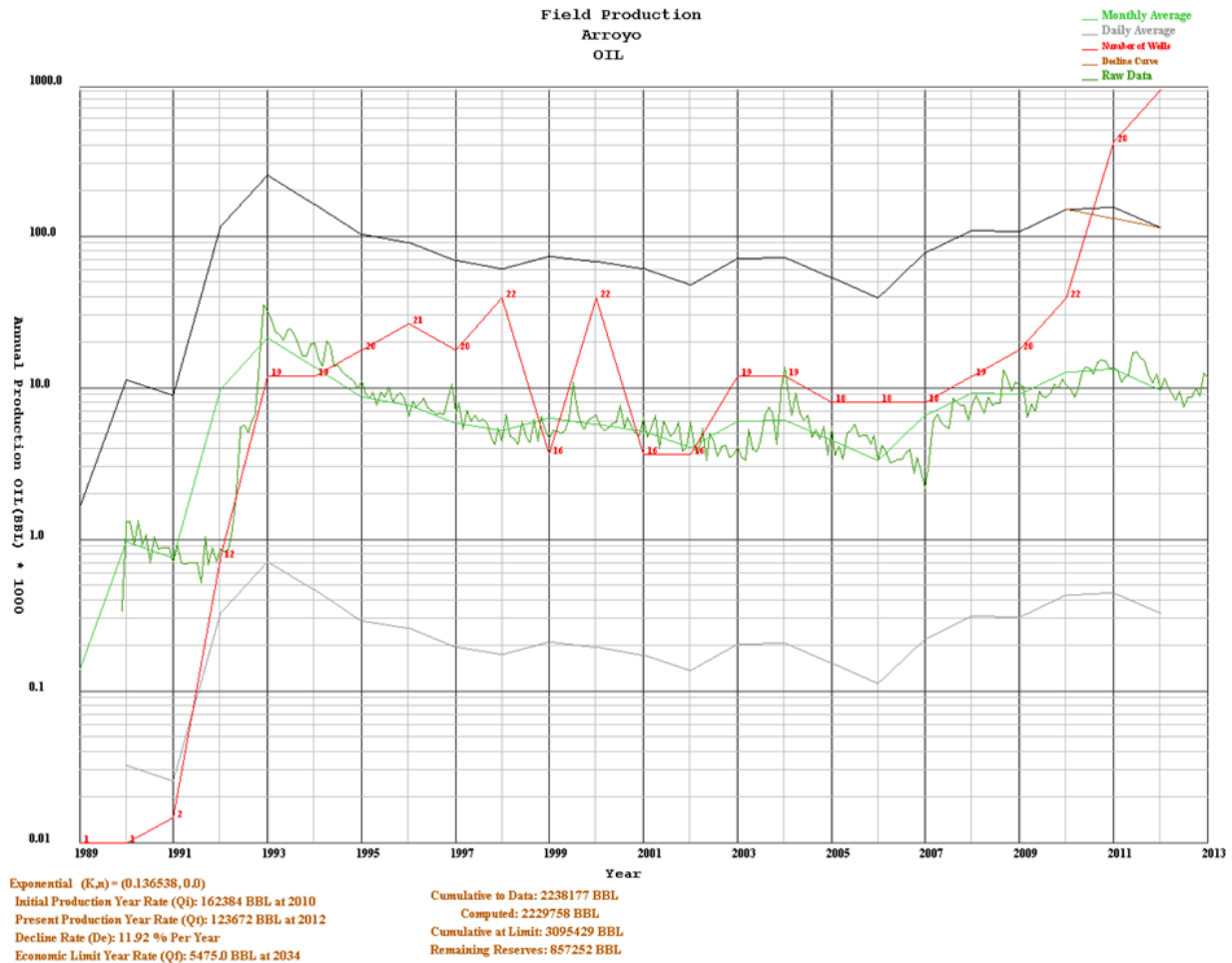
Changing the Y-Axis Increment Value



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	0.01
Maximum:	2013	Maximum:	10000.0
Increment:	2	Cycles:	6

Changing the Cycles Y-Axis:

Notice the plot above all curves have been selected but the Cumulative Curve does not appear on the plot. Edit the Y-Axis Cycles text field from 6 to 5 and tab out to text field the plot limits will automatically change.



X-Axis		Y-Axis	
Year		Production/Cumulative	
Minimum:	1989	Minimum:	0.01
Maximum:	2013	Maximum:	1000.0
Increment:	2	Cycles:	5

Changing the Cycles Y-Axis:

Notice the plot above the upper Y-Axis has changed to fit the data better. When the Cycles are changed the Y-Axis Maximum is computed from the Y-Axis Minimum and the number of Cycles Entered.

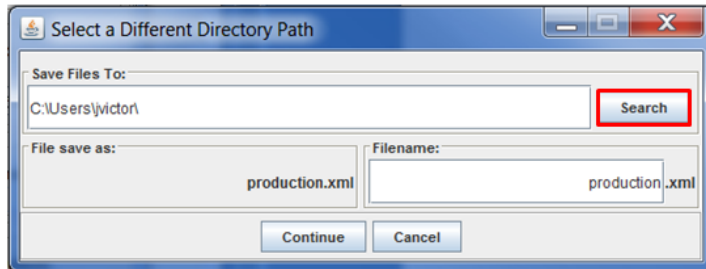
Dialog Menu Options

File Menu Option

Save Production Data as an Extensible Markup Language (XML) ASCII File



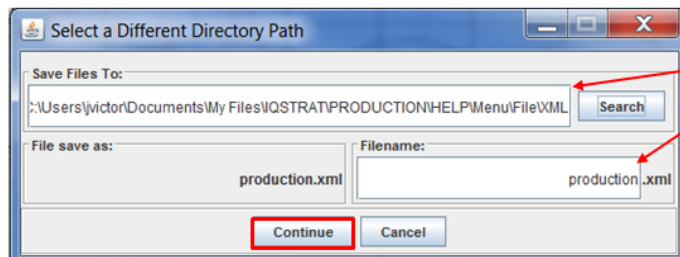
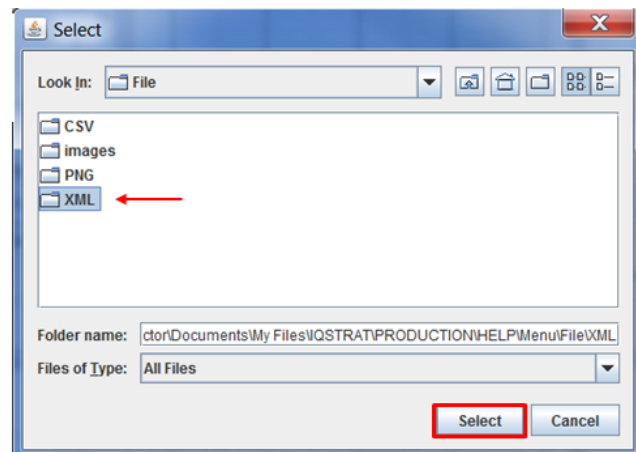
Click on the XML Icon Button **XML** at the top of the “Production Plot” dialog to open the “Select a Different Directory Path” Dialog.



Select the “Search” Button in the “Select a Different Directory Path” Dialog to search your PC for the correct directory path.

Highlight the Directory you wish to place the XML File.

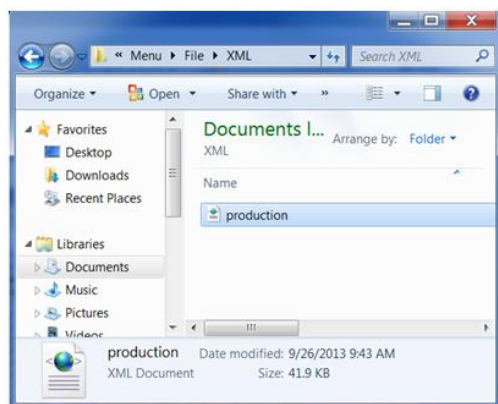
Select the “Select” Button.



The Directory path is transferred to the “Save Files To:” text field.

“production” is the default filename, you can alter the name to any name you wish. The “File save as:” text field will show what the file name will be saved as.


Select the “Continue” Button to save file.

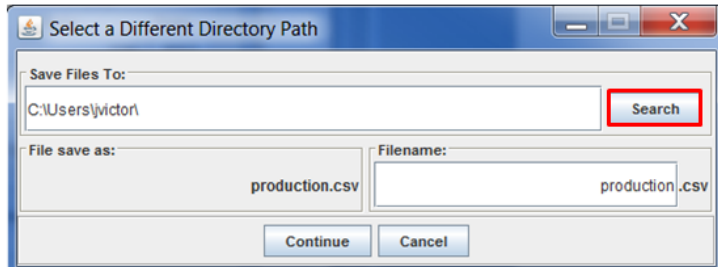


To view the XML File created just go to the directory you saved the XML file and double click and a web page will display the production plot XML File. Since this data was originally retrieved from the KGS Database it will contain the URL and search term to retrieve the data as well as the Primary Key of the record as well as Name.



Save Production Data as a Comma Separated Values (CSV) ASCII File

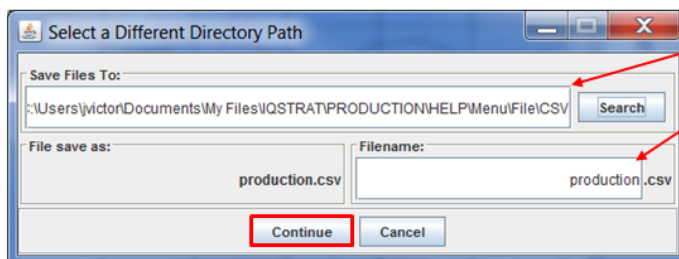
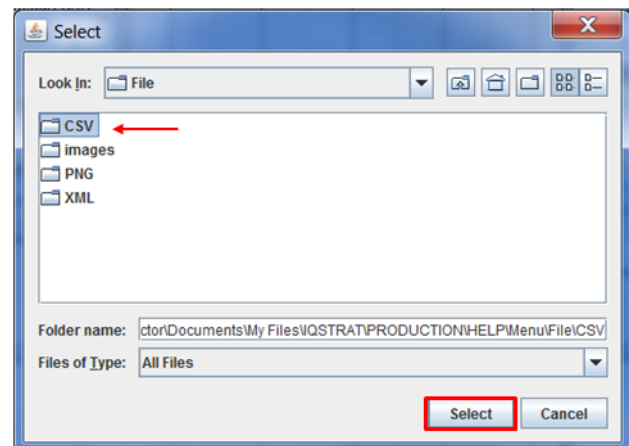
Click on the CSV Icon Button  at the top of the “Production Plot” dialog to open the “Select a Different Directory Path” Dialog.



Select the “Search” Button in the “Select a Different Directory Path” Dialog to search your PC for the correct directory path.

Highlight the Directory you wish to place the CSV File.

Select the “Select” Button.



The Directory path is transferred to the “Save Files To:” text field.

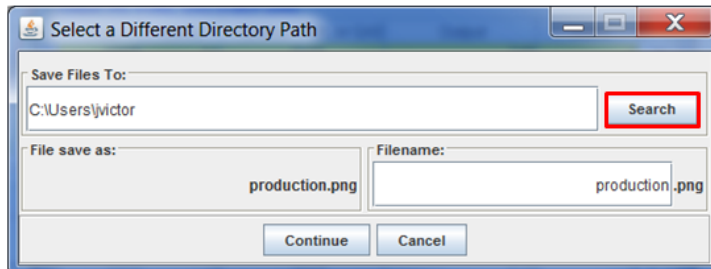
“production” is the default filename, you can alter the name to any name you wish. The “File save as:” text field will show what the file name will be saved as.

Select the “Continue” Button to save file.

Save Production Image as a Portable Network Graphics (PNG) Image File



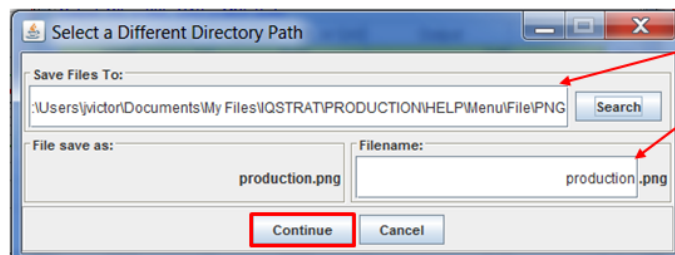
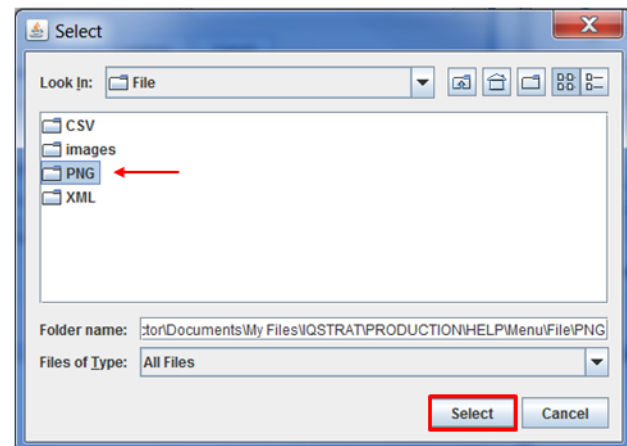
Click on the PDF Icon Button **PDF** at the top of the “Production Plot” dialog to open the “Select a Different Directory Path” Dialog.



Select the “Search” Button in the “Select a Different Directory Path” Dialog to search your PC for the correct directory path.

Highlight the Directory you wish to place the PNG File.

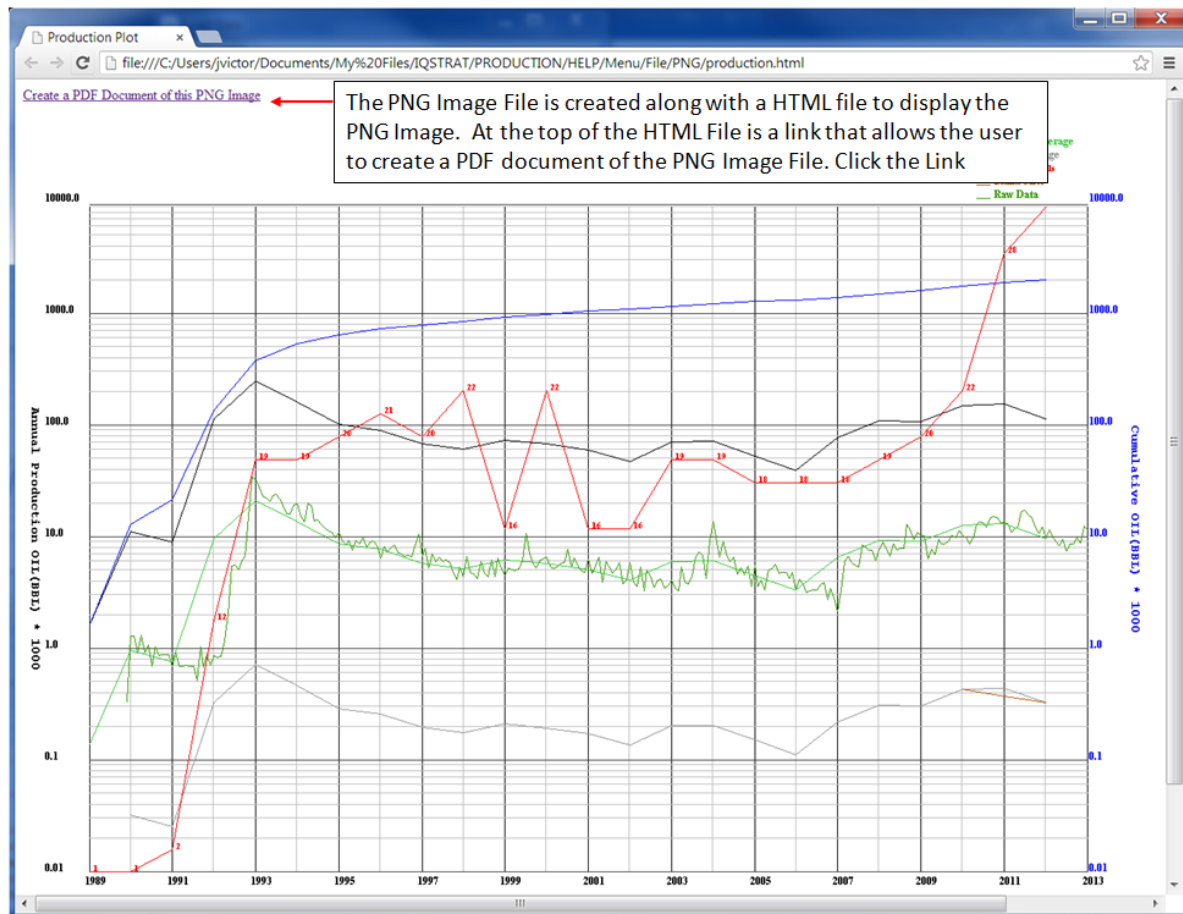
Select the “Select” Button.



The Directory path is transferred to the “Save Files To:” text field.


“production” is the default filename, you can alter the name to any name you wish. The “File save as:” text field will show what the file name will be saved as.

Select the “Continue” Button to save file.



Create PDF Document

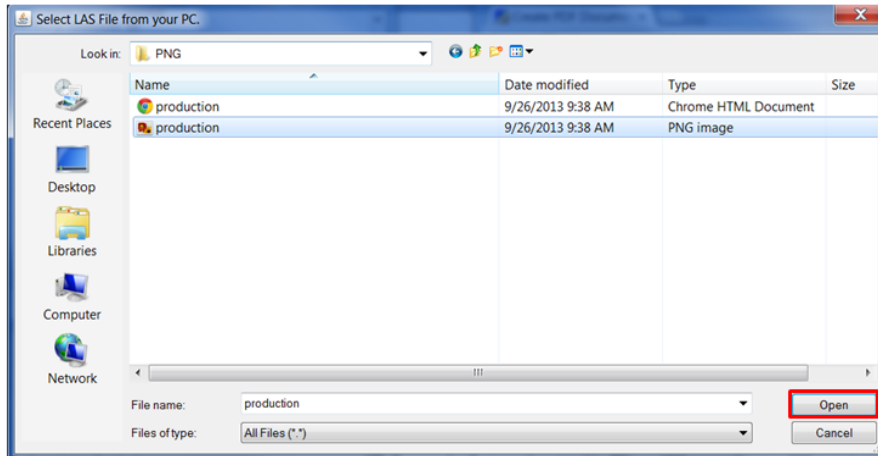
www.kgs.ku.edu/PRS/Ozark/TYPE_LOG/PDF.html

 Create PDF (Portable Document Format) from Image Applet

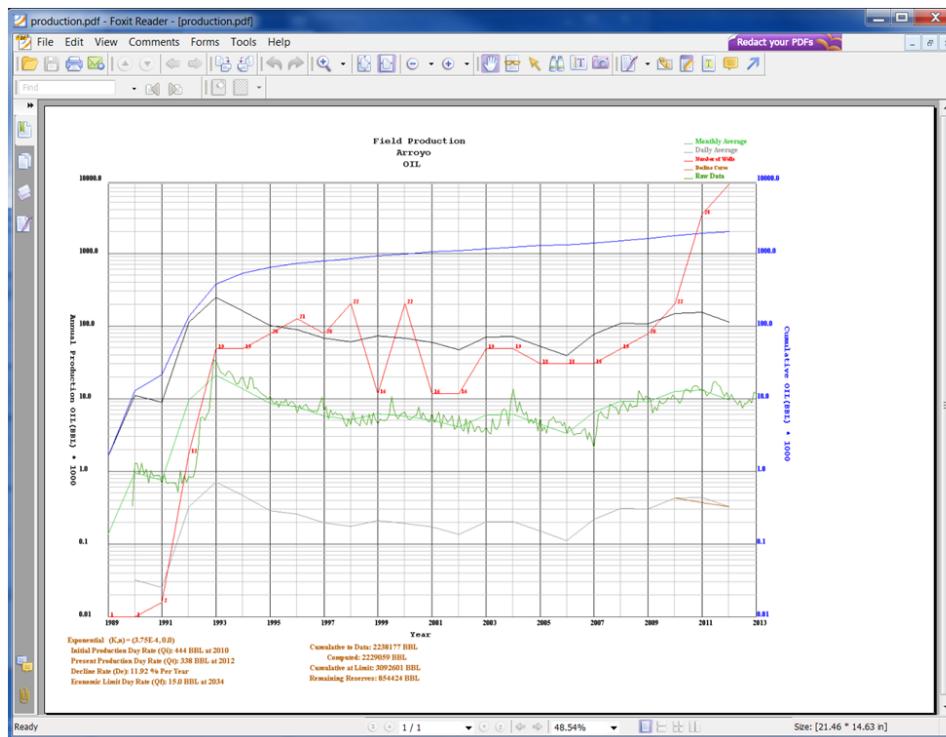
This applet allows the user to create a PDF (Portable Document Format) from a PNG (Portable Network Graphics), JPEG (Joint Photographic Experts Group) or GIF (Graphics Interchange Format) image file.

Author: John R. Victorine jvictor@kgs.ku.edu

The URL for this page is http://www.kgs.ku.edu/PRS/Ozark/TYPE_LOG/PDF.html

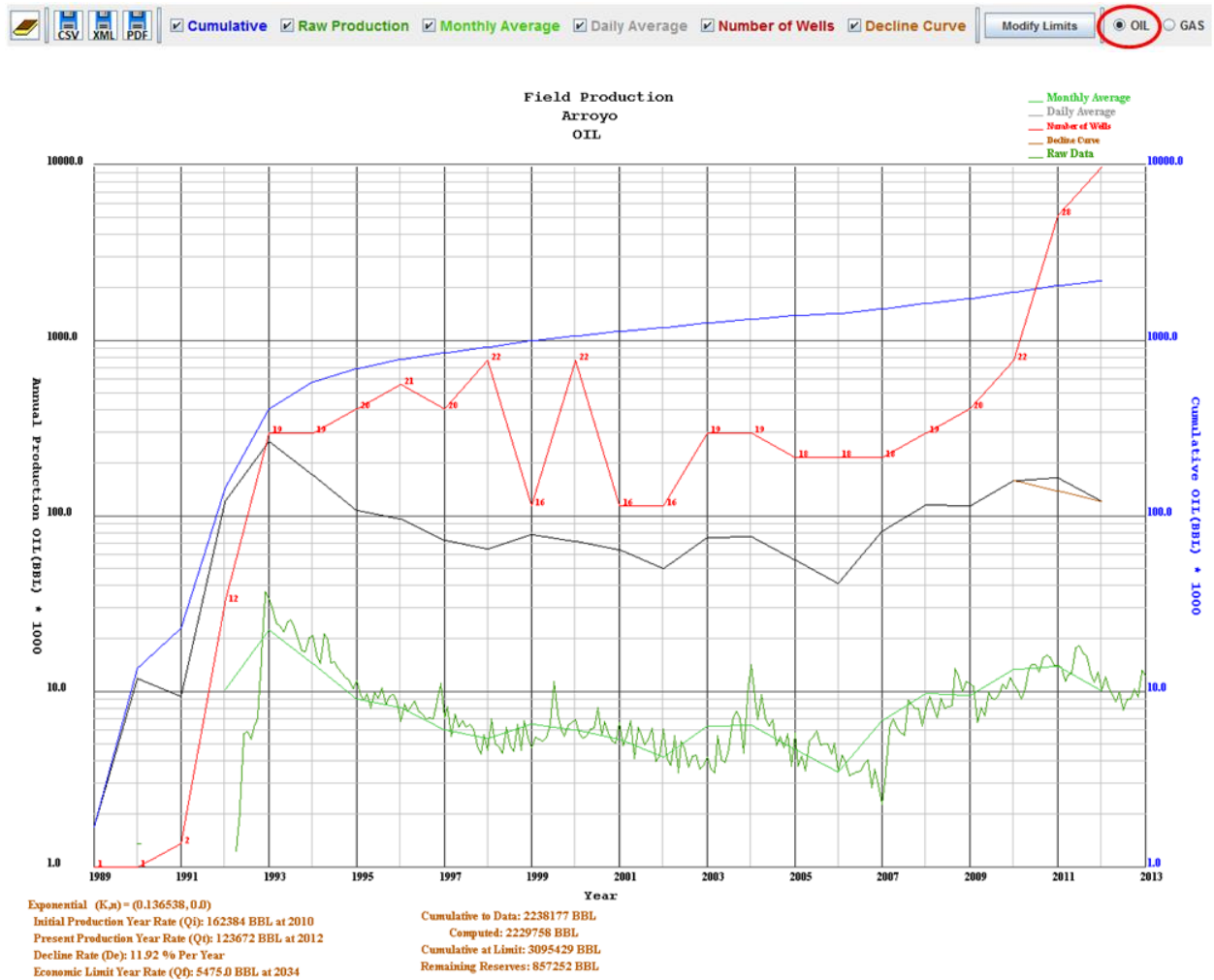


The Create PDF from Image Applet will run. Displaying a "Select LAS File from your PC" Dialog, select the PNG Image and select the "Open" Button, to build the PDF Document File. The PDF document will automatically display the document.

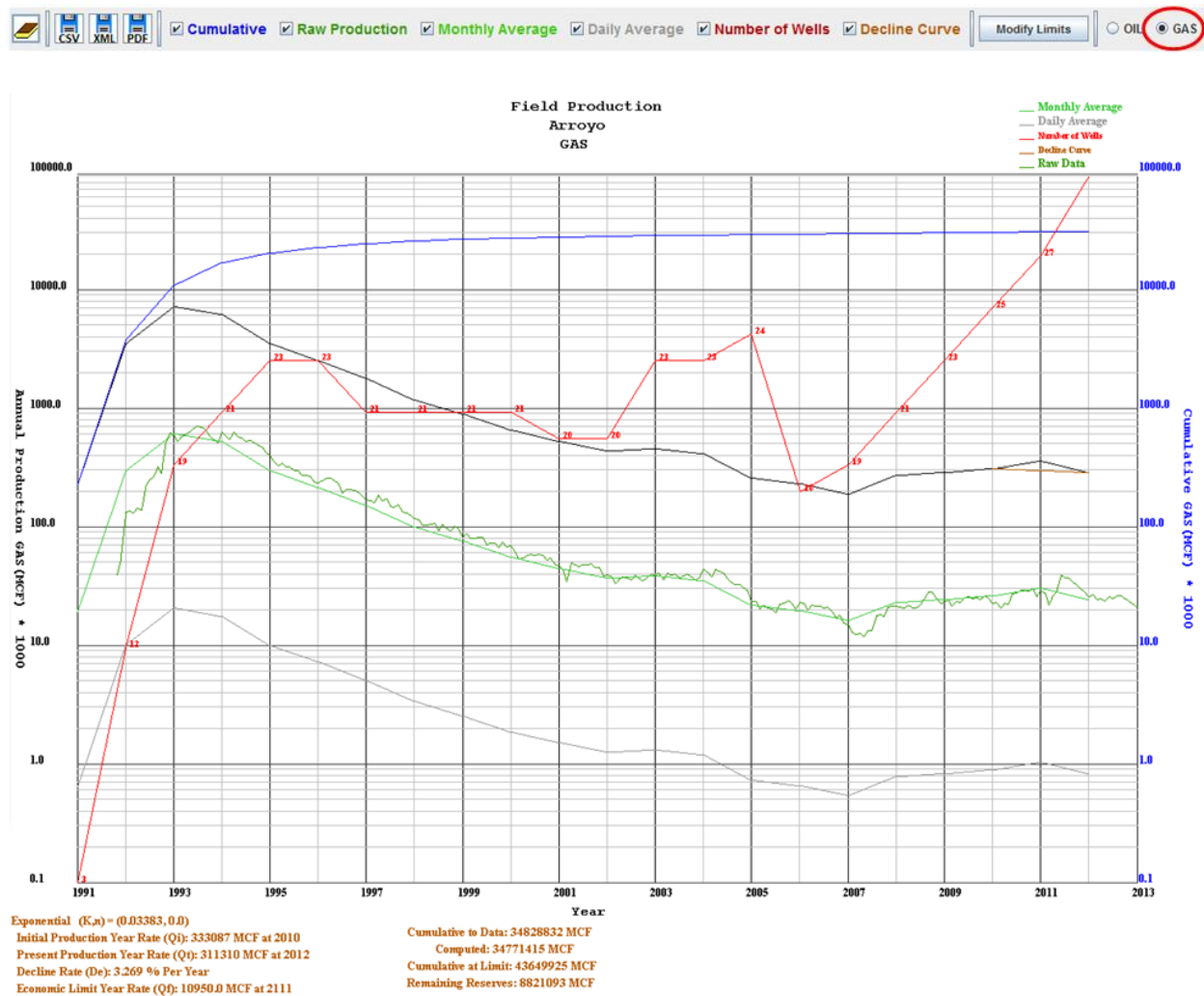


Product Menu Option

Go to the top of the “Production Plot” dialog and click on the “OIL” radio button to display the Oil Production Data. The Default Product data is Oil or if OIL not available then GAS.



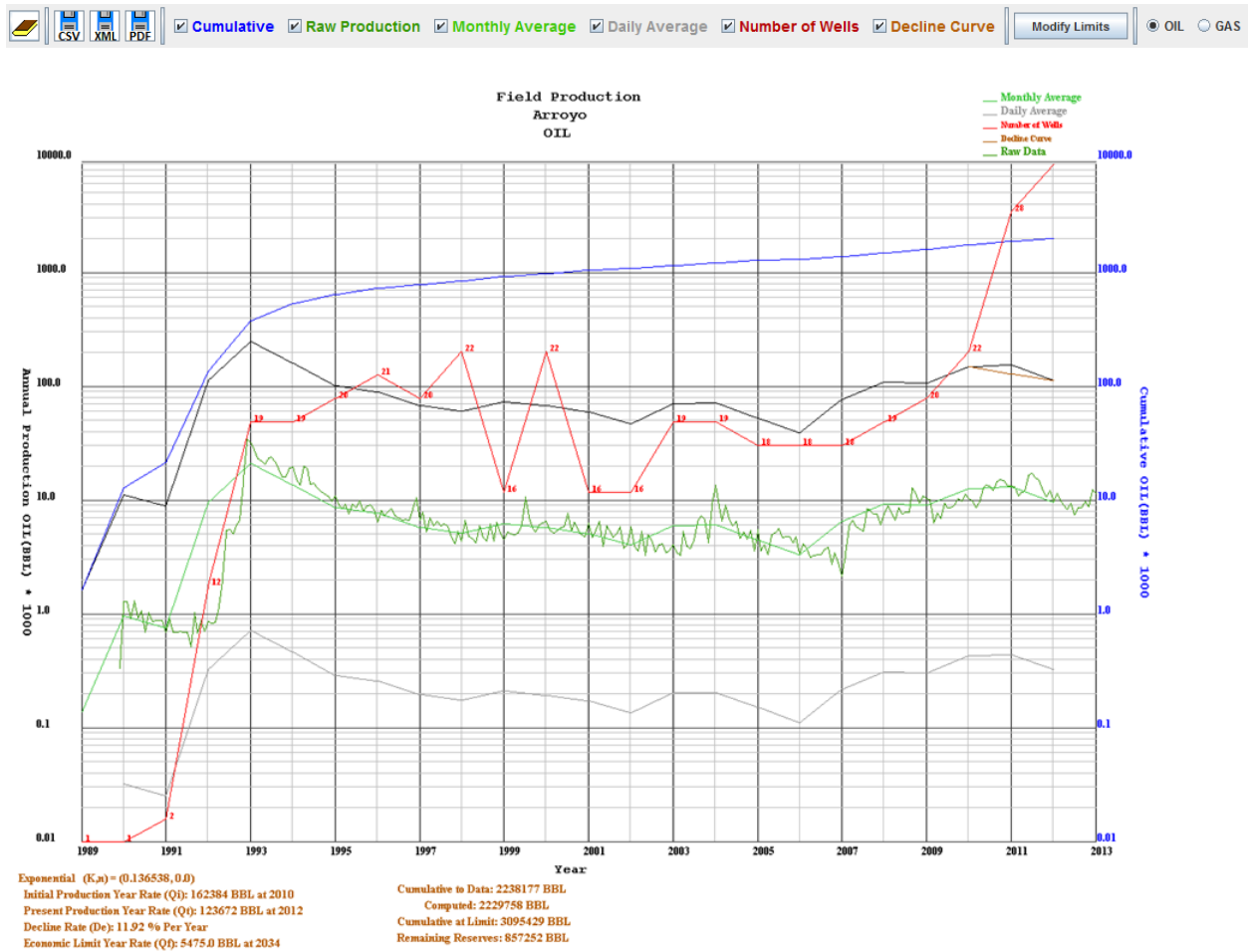
Go to the top of the “Production Plot” dialog and click on the “Gas” radio button to display the Gas Production Data. Note if you turned on any of the Other Curves then the plot will display the other curves when the new product is loaded.



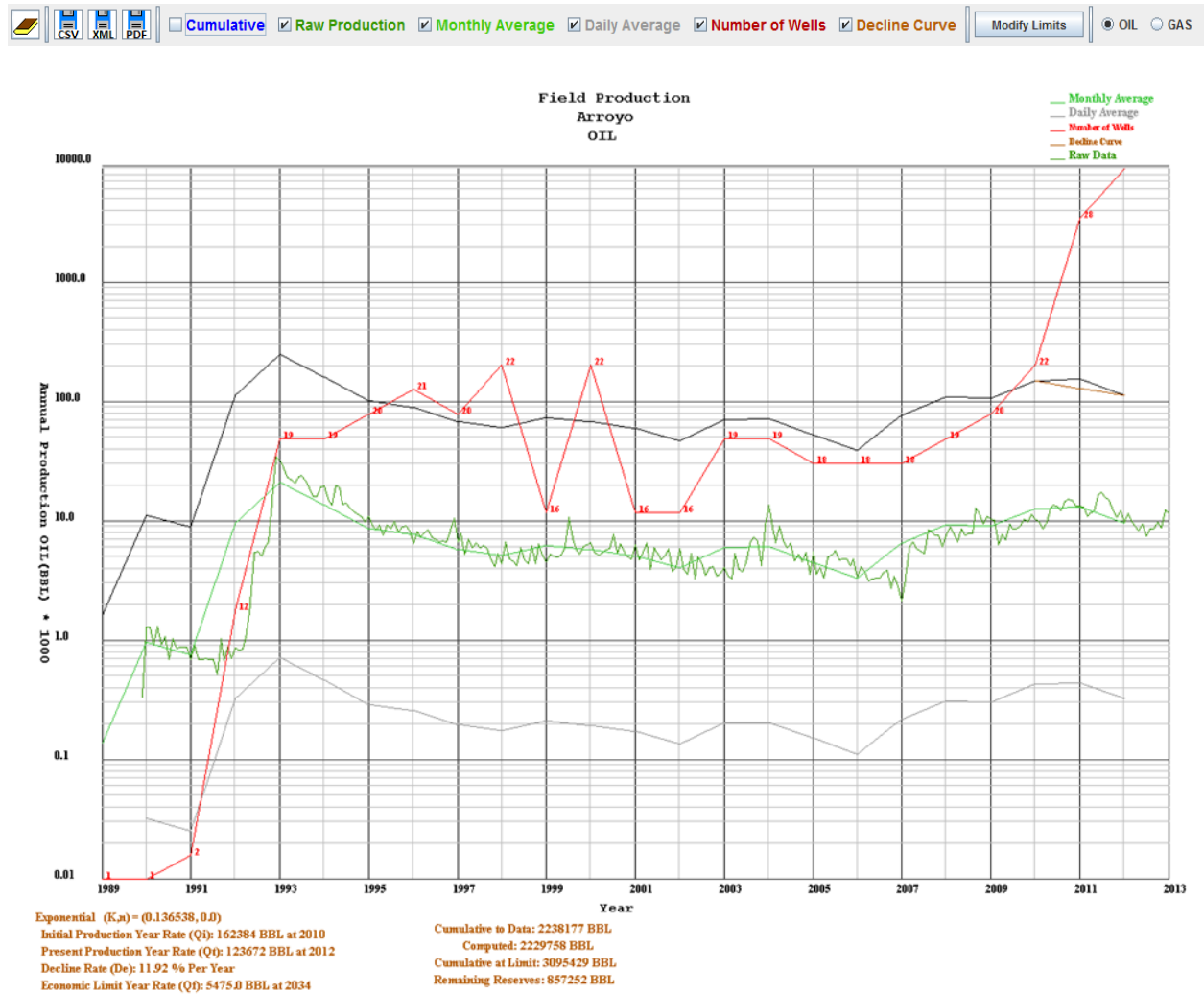
Plot Curves ON/OFF Menu Option

Production/Cumulative Curves ON/OFF Radio Buttons

Go to the top of the “Production Plot”, all the curves are selected. The check boxes are the same color as the plotted curve.

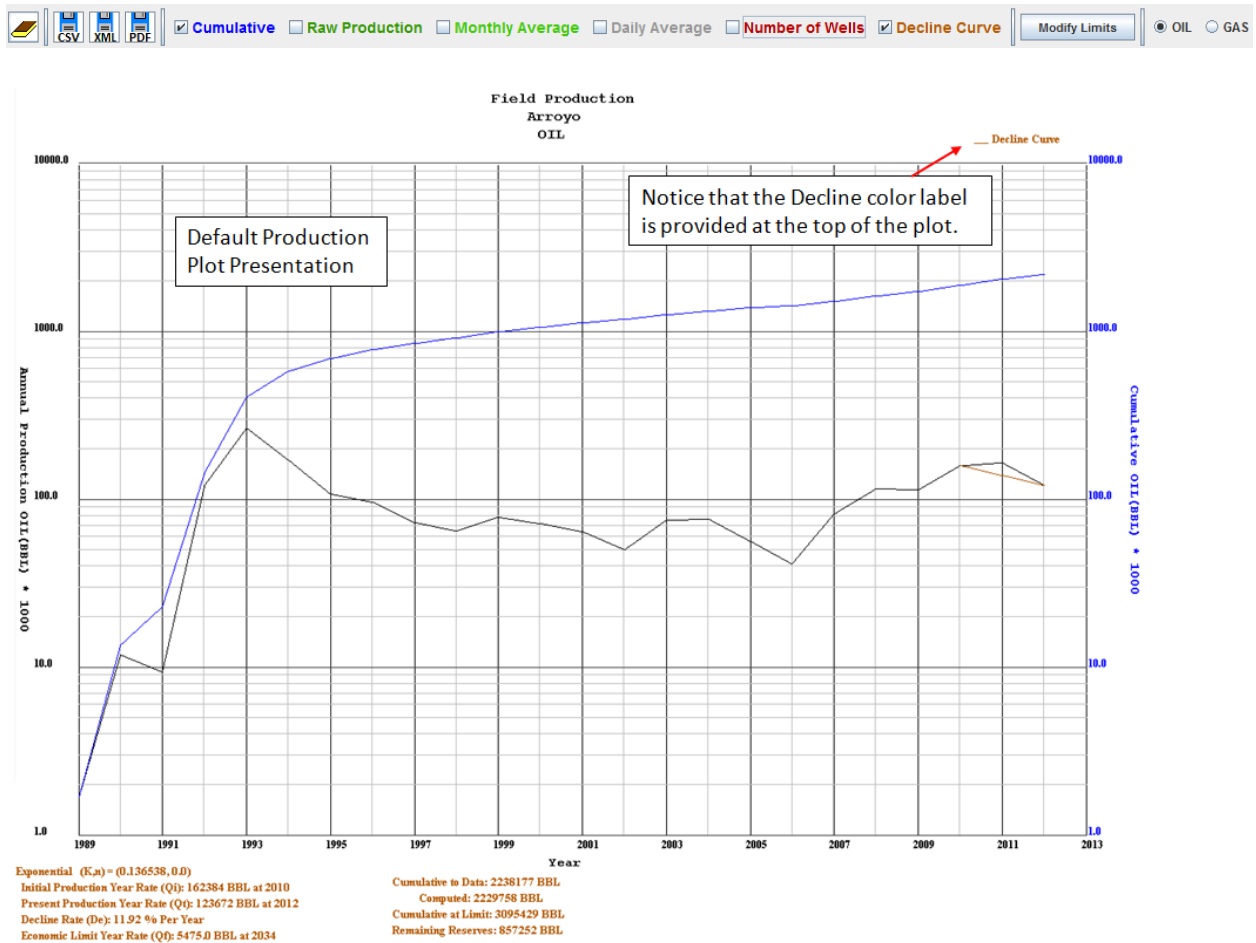


Go to the top of the “Production Plot” Dialog and deselect the “Cumulative” checkbox to remove the Cumulative Production Curve from the Production Plot.

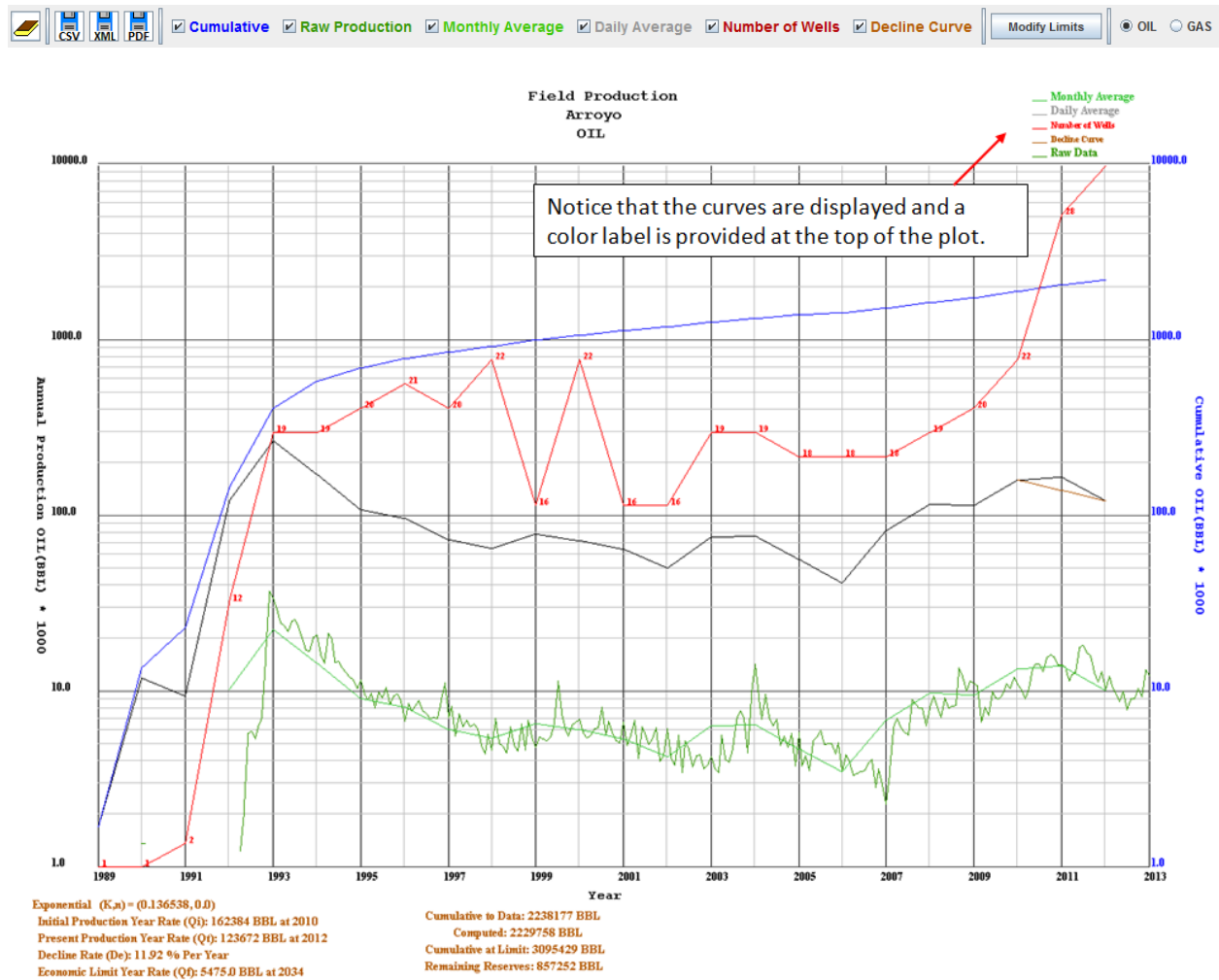


Other Plot Curves ON/OFF Radio Buttons

Go to the top of the “Production Plot” Dialog. Only the Cumulative and Decline Curves are selected.



Go to the top of the “Production Plot”. The Raw Production, Monthly Average Production, Daily Average Production and the Number of Wells Curves are not selected. Click on the each of the check boxes to turn on the curve you wish to view on the production plot.



Decline Curve Analysis Calculator Panel

Decline Curve Analysis Methods:

☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:

☐ Daily ☐ Monthly ☒ Yearly

Initial (Qi): Final (Qt):

Rate: Year: Rate: Year:

162384 2010 123672 2012

Decline Curve Equation:

Qt = Qi * exp(-Kt)

t=time Constant (K): Exponent (n):

0.136538 0.0

Decline Curve Analysis Methods:

☐ Exponential ☒ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:

☐ Daily ☐ Monthly ☒ Yearly

Initial (Qi): Final (Qt):

Rate: Year: Rate: Year:

162384 2010 123672 2012

Decline Curve Equation:

Qt = Qi / (1+Kt)

t=time Constant (K): Exponent (n):

0.157 0.0

Decline Curve Analysis Methods:

☐ Exponential ☐ Harmonic ☒ Hyperbolic

Enter Production Rate for Computations:

☐ Daily ☐ Monthly ☒ Yearly

Initial (Qi): Final (Qt):

Rate: Year: Rate: Year:

162384 2010 123672 2012

Decline Curve Equation:

Qt = Qi / (1+nKt)^(1/n)

t=time Constant (K): Exponent (n):

0.157 1.0

These panels illustrate the change to the Decline Curve Constant (K) for different decline curve methods. The user decides how to fit the curve to the production data plotted. The Decline Curve will define the economic limit depending on the parameters selected. By Default the “Exponential” Decline Method is selected. The time in this case is in units of year.

Exponential:

$$K = \ln(Q_i/Q_t) / t$$

Harmonic:

$$K = [(Q_i/Q_t) - 1.0] / t$$

Hyperbolic:

$$K = \{\exp[n * \ln(Q_i/Q_t)] - 1.0\} / (n*t)$$

where

Q_i – Initial Production Rate

Q_t – Final Production Rate

Q_{iy} – Initial Production Year

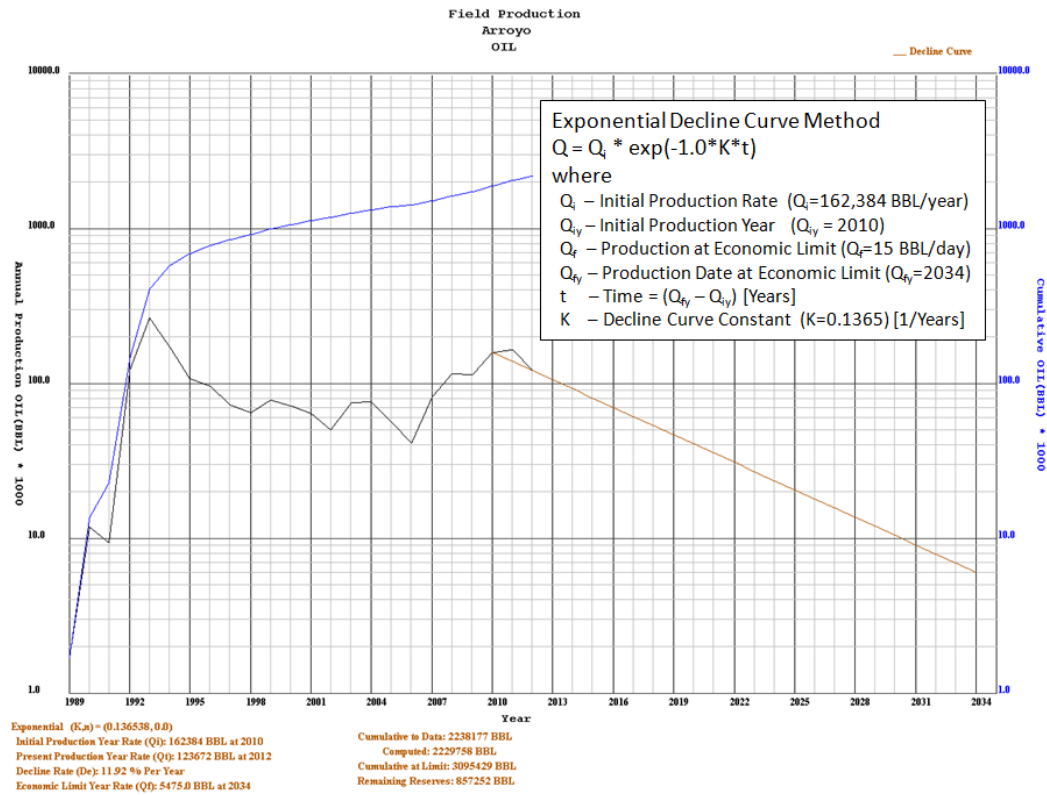
Q_{ty} – Final Production Year

t – Time = ($Q_{ty} - Q_{iy}$)

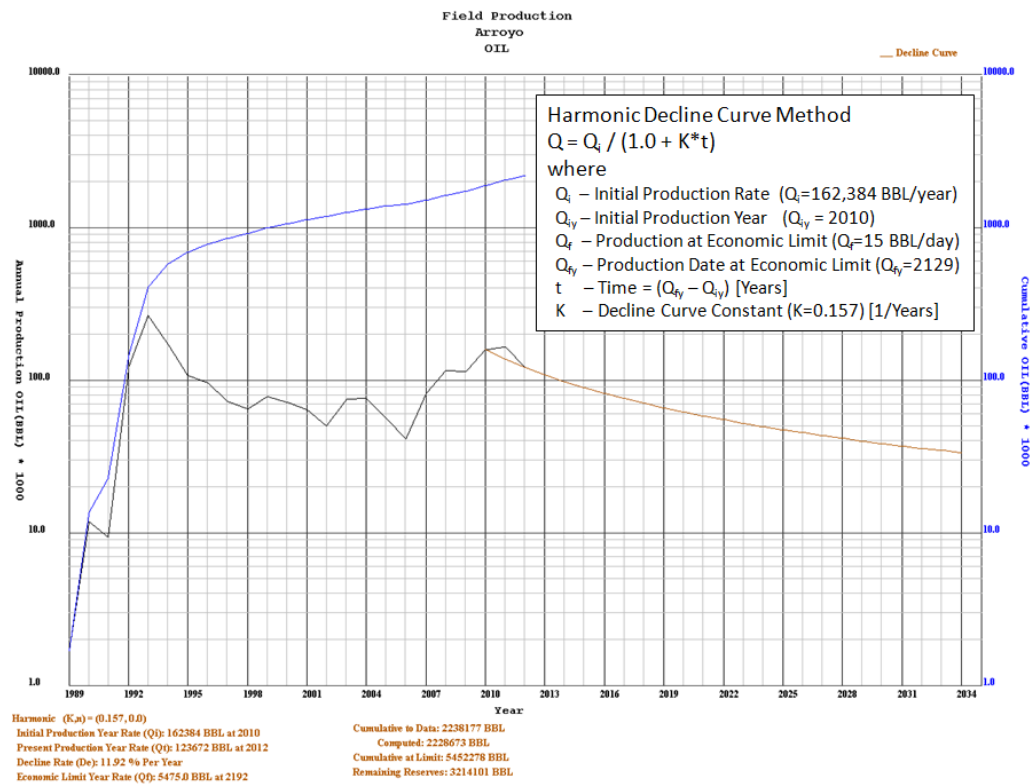
n – Decline Curve Exponent

K – Decline Curve Constant

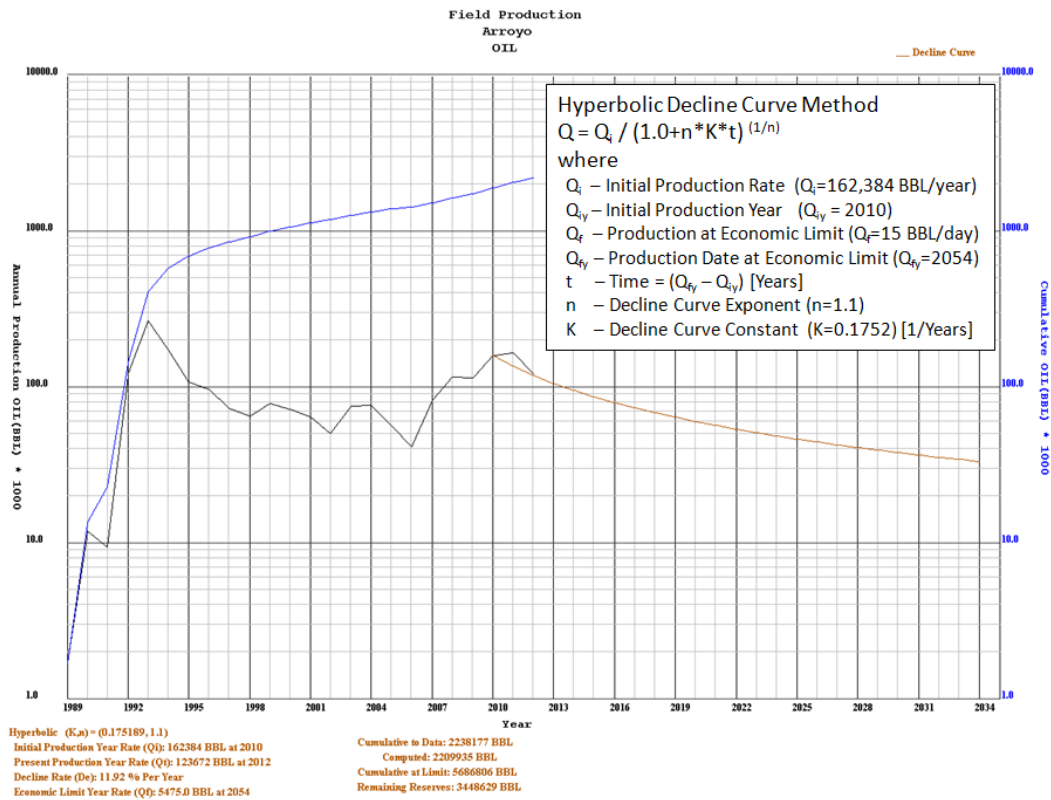
Exponential Decline Curve Method



Harmonic Decline Curve Method



Hyperbolic Decline Curve Method



Compute Decline Curve Constant (K) Production Rate By Date

Decline Curve Analysis Methods:
☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:
☒ Daily ☐ Monthly ☐ Yearly

Initial (Qi):
 Rate: 444 Year: 2010

Final (Qt):
 Rate: 338 Year: 2012

Decline Curve Equation:
 $Q_t = Q_i \cdot \exp(-Kt)$
 t=time Constant (K): 3.75E-4 Exponent (n): 0.0

Decline Curve Analysis Methods:
☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:
☐ Daily ☒ Monthly ☐ Yearly

Initial (Qi):
 Rate: 13532 Year: 2010

Final (Qt):
 Rate: 10306 Year: 2012

Decline Curve Equation:
 $Q_t = Q_i \cdot \exp(-Kt)$
 t=time Constant (K): 0.011379 Exponent (n): 0.0

Decline Curve Analysis Methods:
☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:
☐ Daily ☐ Monthly ☒ Yearly

Initial (Qi):
 Rate: 162384 Year: 2010

Final (Qt):
 Rate: 123672 Year: 2012

Decline Curve Equation:
 $Q_t = Q_i \cdot \exp(-Kt)$
 t=time Constant (K): 0.136538 Exponent (n): 0.0

These panels illustrate the change to the Decline Curve Constant (K) for different Production Times. The user decides which time factor suites the data that is plotted. The Decline Curve will define the economic limit depending on the parameters selected. By Default the “Exponential” Decline Method is selected and the time & production rates are set to units of year. Notice that changing the radio buttons will automatically change the “Rate” for both the initial and production, where the units for the rate depend on the radio buttons.

Daily:

$$t = (Q_{ty} - Q_{ty}) * 365.0 \text{ [Days]}$$

Monthly:

$$t = (Q_{ty} - Q_{ty}) * 12.0 \text{ [Months]}$$

Yearly:

$$t = (Q_{ty} - Q_{ty}) \text{ [Years]}$$

Decline Curve Method: Exponential

$$K = \ln(Q_i / Q_t) / t$$

where

Q_i – Initial Production Rate

Q_t – Final Production Rate

Q_{ty} – Initial Production Year

Q_{ty} – Final Production Year

t – Time, units depend on radio button

n – Decline Curve Exponent

K – Decline Curve Constant

Plot By-Yearly Production Rate

Production Decline Curve Calculator

Decline Curve Analysis Methods:
☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:
☐ Daily ☐ Monthly ☒ Yearly

Initial (Qi):
 Rate: 162384 Year: 2010 Final (Qt):
 Rate: 123672 Year: 2012

Decline Curve Equation:
 $Q_t = Q_i \cdot \exp(-Kt)$
 t=time Constant (K): 0.136538 Exponent (n): 0.0

Cumulative Production:
 Production (Actual): 2238177 BBL Present (Computed): 2229758 BBL

Production at Economic Limit:
 Economic Limit Rate (Qf):
 Rate: 15 BBL Per ☒ Day ☐ Month ☐ Year Date: 2034

Economic Limit (EUR): 3095429 BBL Reserves (RR): 857252 BBL

Reset Plot Limit

The Decline Curve Calculator Panel illustrate the Yearly Production Rate. The user decides which time factor suites the data that is plotted. The Decline Curve will define the economic limit depending on the parameters selected. By Default the "Exponential" Decline Method is selected and the time & production rates are set to units of year. The Initial Production Rate (Q_i) and the Final Production Rate (Q_f) are both yearly rates.

Yearly:

$$t = (Q_{ey} - Q_{iy}) \quad [\text{Years}]$$

Decline Curve Method: Exponential

$$K = \ln(Q_i/Q_f) / t$$

where

Q_i – Initial Production Rate

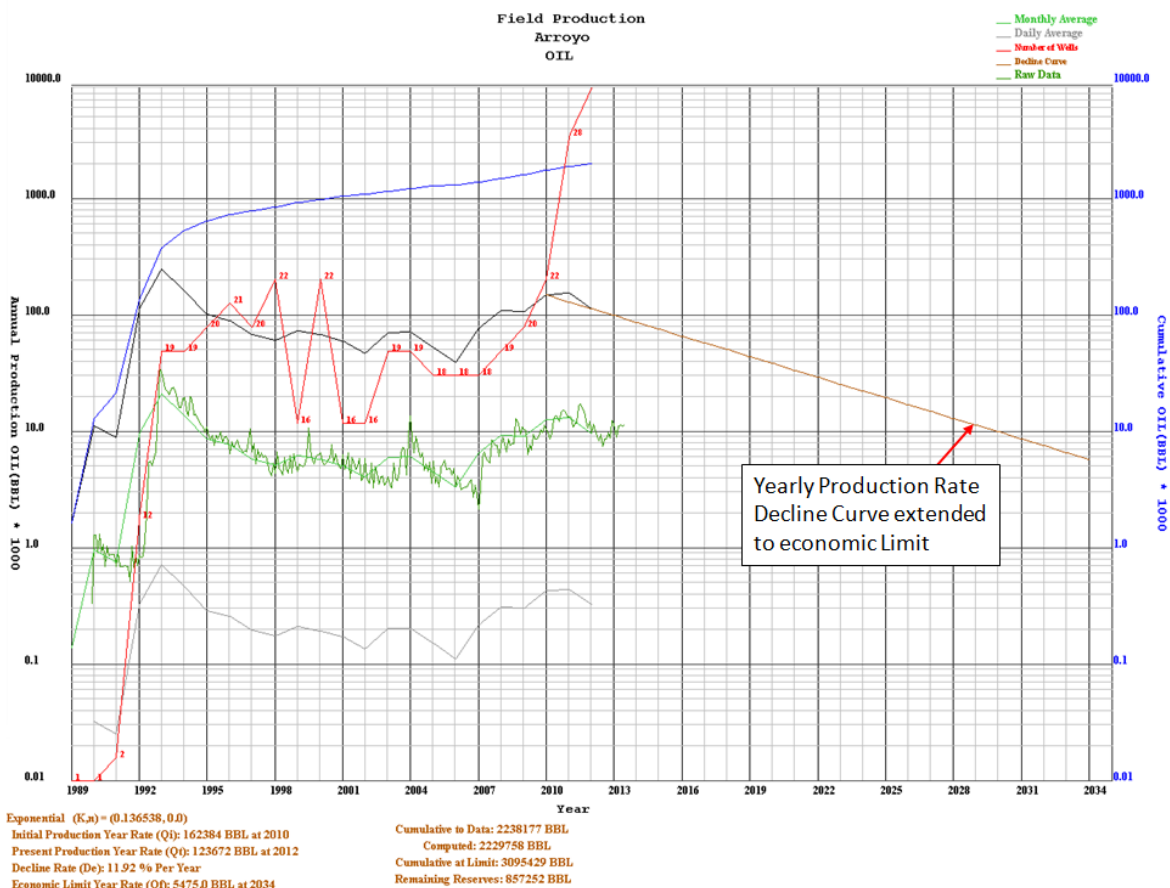
Q_f – Final Production Rate

Q_{iy} – Initial Production Year

Q_{ey} – Final Production Year

t – Time, units depend on radio button

K – Decline Curve Constant



Plot By-Monthly Production Rate

Production Decline Curve Calculator

Decline Curve Analysis Methods:

☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:

☐ Daily ☒ Monthly ☐ Yearly

Initial (Qi): Rate: 13532 Year: 2010 Final (Qt): Rate: 10306 Year: 2012

Decline Curve Equation:

$Q_t = Q_i \cdot \exp(-Kt)$

t=time Constant (K): 0.011379 Exponent (n): 0.0

Cumulative Production:

Production (Actual): 2238177 BBL Present (Computed): 2229737 BBL

Production at Economic Limit:

Economic Limit Rate (Qf): Rate: 15 BBL Per ☒ Day ☐ Month ☐ Year Date: 2041

Economic Limit (EUR): 3119622 BBL Reserves (RR): 881445 BBL

Reset Plot Limit

The Decline Curve Calculator Panel illustrate the Monthly Production Rate. The user decides which time factor suites the data that is plotted. The Decline Curve will define the economic limit depending on the parameters selected. Selecting the “Monthly” Production Radio Button will automatically change the Initial Production Rate (Q_i) and the Final Production Rate (Q_f) to monthly rates.

Monthly:

$$t = (Q_{iy} - Q_{fy}) * 12.0 \text{ [Months]}$$

Decline Curve Method: Exponential

$$K = \ln(Q_i/Q_f) / t$$

where

Q_i – Initial Production Rate

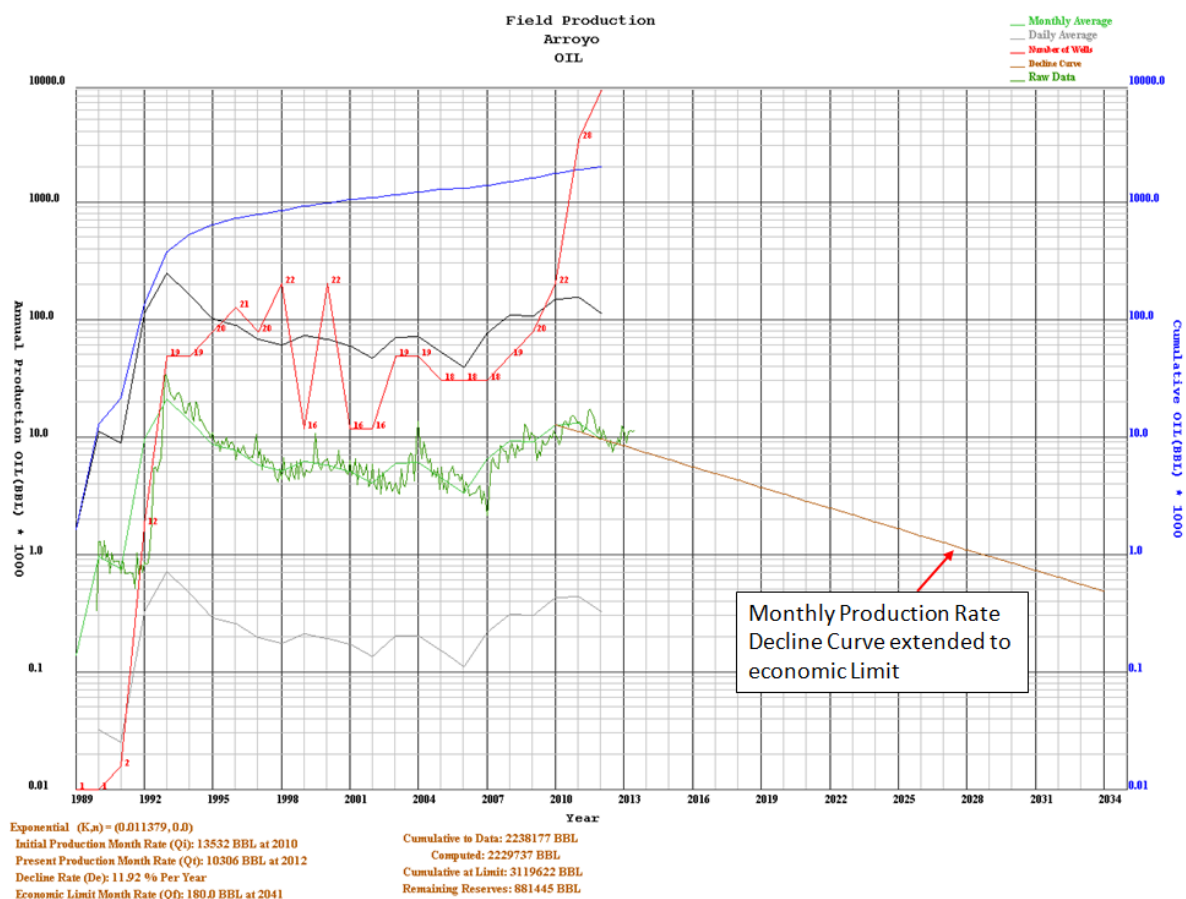
Q_f – Final Production Rate

Q_{iy} – Initial Production Year

Q_{fy} – Final Production Year

t – Time, units depend on radio button

K – Decline Curve Constant



Plot By-Daily Production Rate

Production Decline Curve Calculator

Decline Curve Analysis Methods:

☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:

☒ Daily ☐ Monthly ☐ Yearly

Initial (Qi): Rate: 444 Year: 2010

Final (Qt): Rate: 338 Year: 2012

Decline Curve Equation:

$Q_t = Q_i \cdot \exp(-Kt)$

Constant (K): 3.75E-4 Exponent (n): 0.0

Cumulative Production:

Production (Actual): 2238177 BBL Present (Computed): 2229059 BBL

Production at Economic Limit:

Economic Limit Rate (Qf): Rate: 15 BBL Per ☒ Day ☐ Month ☐ Year Date: 2034

Economic Limit (EUR): 3092601 BBL Reserves (RR): 854424 BBL

Reset Plot Limit

The Decline Curve Calculator Panel illustrate the Daily Production Rate. The user decides which time factor suites the data that is plotted. The Decline Curve will define the economic limit depending on the parameters selected. Selecting the “Daily” Production Radio Button will automatically change the Initial Production Rate (Q_i) and the Final Production Rate (Q_f) to daily rates.

Daily:

$$t = (Q_{ty} - Q_{iy}) * 365.0 \text{ [Days]}$$

Decline Curve Method: Exponential

$$K = \ln(Q_i/Q_f) / t$$

where

Q_i – Initial Production Rate

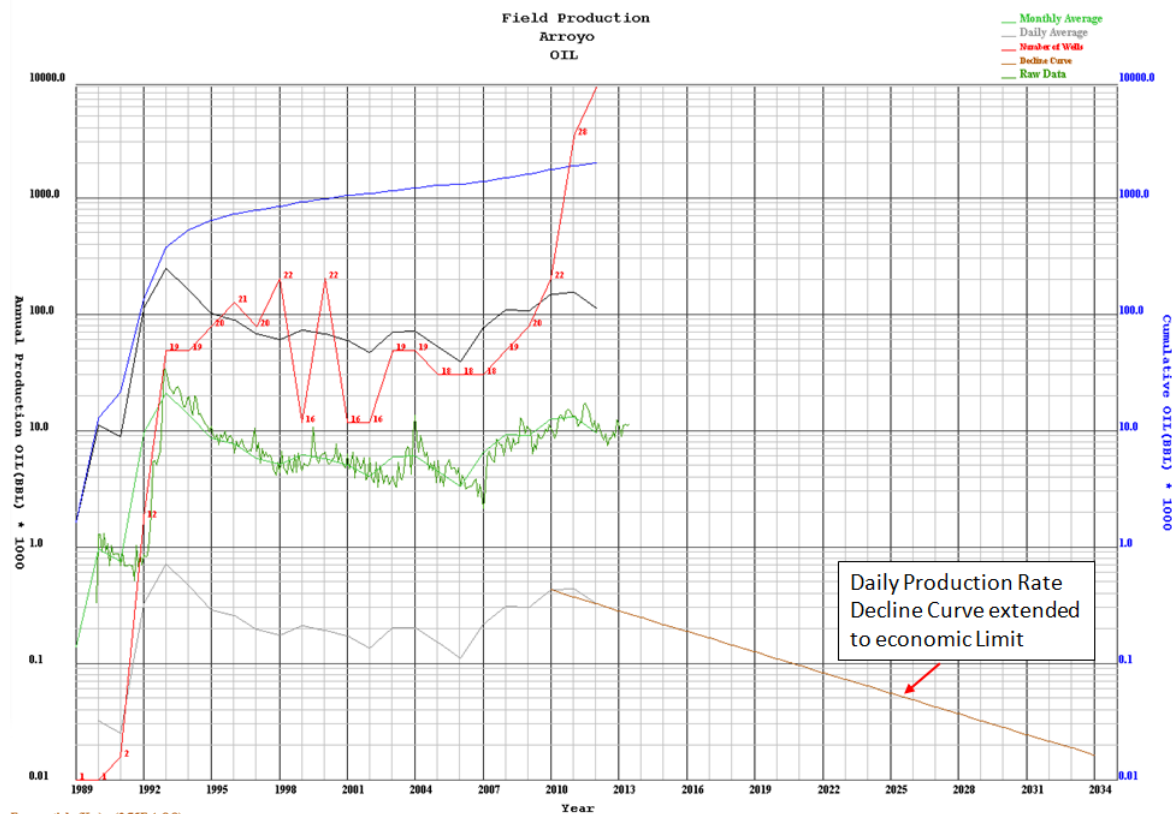
Q_f – Final Production Rate

Q_{iy} – Initial Production Year

Q_{ty} – Final Production Year

t – Time, units depend on radio button

K – Decline Curve Constant



Exponential ($K_a = 3.75E-4, 0.0$)
Initial Production Day Rate (Q_i): 444 BBL at 2010
Present Production Day Rate (Q_f): 338 BBL at 2012
Decline Rate (D_e): 11.92 % Per Year
Economic Limit Day Rate (Q_f): 15.0 BBL at 2034

Cumulative to Date: 2238177 BBL
Computed: 2229059 BBL
Cumulative at Limit: 3092601 BBL
Remaining Reserves: 854424 BBL

Compute Present Cumulative Production

Production Decline Curve Calculator

Decline Curve Analysis Methods:
☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:
☐ Daily ☐ Monthly ☒ Yearly
 Initial (Qi): Rate: 162384 Year: 2010
 Final (Qt): Rate: 123672 Year: 2012

Decline Curve Equation:
 $Q_t = Q_i \cdot \exp(-Kt)$
 t=time Constant (K): 0.136538 Exponent (n): 0.0

Cumulative Production:
 Production (Actual): 2238177 BBL
 Present (Computed): 2229758 BBL

Production at Economic Limit:
 Economic Limit Rate (Qf):
 Rate: 15 BBL Per ☒ Day ☐ Month ☐ Year Date: 2034
 Economic Limit (EUR): 3095429 BBL Reserves (RR): 857252 BBL
 Extend to Limit

Computed Cumulative Production for Present is found by finding the Cumulative Production at the Initial Production Rate (Q_i) and computing the Production Rate (Q_c) out to the Present Date.

Cumulative (Computed) = Cumulative @ Q_{iy} + Q_c @ Present

where Q_c is computed by Decline Curve Method as follows,
 Exponential:

$$Q_c = (Q_i - Q_f) / K$$

Harmonic:

$$Q_c = Q_i \cdot \ln(Q_i / Q_f) / K$$

Hyperbolic:

$$Q_c = \{Q_i - Q_f \cdot \exp[n \cdot \ln(Q_i / Q_f)]\} / [(1.0 - n) \cdot K]$$

where

Q_i – Initial Production Rate

Q_{iy} – Initial Production Year

Q_f – Final Production Rate

n – Decline Curve Exponent

K – Decline Curve Constant

Q_c – Cumulative Production Rate

Compute Production Economic Limit Date (Qf)

Production Decline Curve Calculator

Decline Curve Analysis Methods:
☒ Exponential ☐ Harmonic ☐ Hyperbolic

Enter Production Rate for Computations:
☐ Daily ☐ Monthly ☒ Yearly
 Initial (Qi): Rate: 162384 Year: 2010
 Final (Qt): Rate: 123672 Year: 2012

Decline Curve Equation:
 $Q_t = Q_i \cdot \exp(-Kt)$
 t=time Constant (K): 0.136538 Exponent (n): 0.0

Cumulative Production:
 Production (Actual): 2238177 BBL
 Present (Computed): 2229758 BBL

Production at Economic Limit:
 Economic Limit Rate (Qf):
 Rate: 15 BBL Per ☒ Day ☐ Month ☐ Year Date: 2034
 Economic Limit (EUR): 3095429 BBL Reserves (RR): 857252 BBL
 Extend to Limit

The Production Date at Economic Limit (Q_{fy}) is computed from the Production Rate at Economic Limit (Q_f) by first computing the time from the Decline Curve Equations and converting the time to years as follows,

Time by Decline Curve Analysis Method:

Exponential: $t = \ln(Q_i / Q_f) / K$

Harmonic: $t = [(Q_i / Q_f) - 1.0] / K$

Hyperbolic: $t = \{\exp[n \cdot \ln(Q_i / Q_f)] - 1.0\} / (K \cdot t)$

Time converted to Date:

Day: $Q_{fy} = Q_{iy} + t / 365.0$

Month: $Q_{fy} = Q_{iy} + t / 12.0$

Year: $Q_{fy} = Q_{iy} + t$

where

Q_i – Initial Production Rate

Q_{iy} – Initial Production Year

Q_f – Production Rate at Economic Limit

Q_{fy} – Production Date at Economic Limit

t – Time

n – Decline Curve Exponent

K – Decline Curve Constant

Compute Economic Limit (EUR) and Reserves (RR)

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Extend to Limit

Economic Limit (EUR) is computed by finding the Cumulative Production at the Initial Production Rate (Q_i) and compute the Production Rate (Q_c) out to the economic limit date.

$$\text{Economic Limit (EUR)} = \text{Cumulative @ } Q_{iy} + Q_c @ Q_{fy}$$

where Q_c is computed by Decline Curve Method as follows,
 Exponential:

$$Q_c = (Q_i - Q_f) / K$$

Harmonic:

$$Q_c = Q_i \cdot \ln(Q_i / Q_f) / K$$

Hyperbolic:

$$Q_c = \{Q_i - Q_f \cdot \exp[n \cdot \ln(Q_i / Q_f)]\} / [(1.0 - n) \cdot K]$$

where

Q_i – Initial Production Rate

Q_{iy} – Initial Production Year

Q_f – Production Rate at Economic Limit

Q_{fy} – Production Date at Economic Limit

n – Decline Curve Exponent

K – Decline Curve Constant

Q_c – Cumulative Production Rate

The Reserves (RR) is computed from the Economic Limit (EUR) subtracting the Actual Cumulative Production.

$$\text{Reserves (RR)} = \text{Economic Limit (EUR)} - \text{Actual Cumulative}$$

Extend to Limit Button

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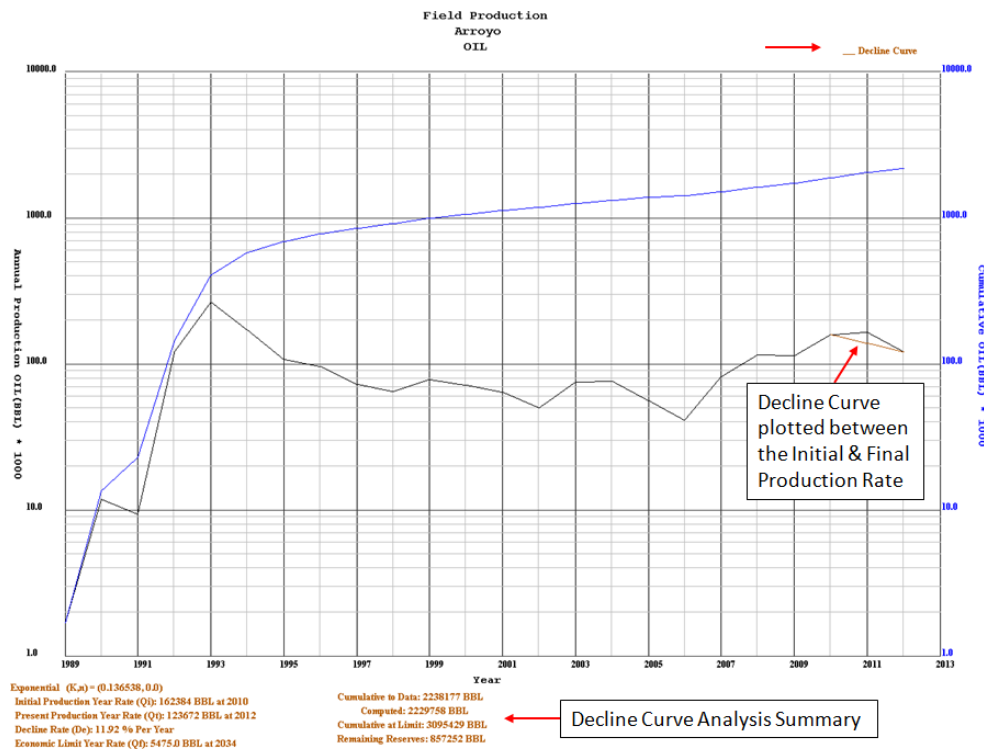
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Extend to Limit

The decline curve analysis control dialog allows the user to extend the outer plot limit to the economic limit. In the “Production at Economic Limit” Panel the “Date” text field must have a value greater than the Initial Production Year. Select the “Extend to Limit” Button at the bottom of the panel to extend the production plot limit and note that the X-Axis Maximum text field will automatically change.



Notice that the X-Axis Maximum automatically changed to the Economic Limit Date plus 1 year. The “Extend to Limit” Button changed the text to “Reset Plot Limit”, which will allow the user to restore the plot back to the original outer limit.

