Chapter AA

PROCEDURES FOR ALLOCATION AND AGGREGATION OF RESOURCES

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INTRODUCTION

The 246 quantitative assessments of the World Petroleum Assessment 2000 were all made at the assessment unit (AU) level, but for maximum utility, results are needed at many different levels. These levels include not only the hierarchical levels of world, region, province, total petroleum system (TPS), and AU, but also country, and political organization. The assessment hierarchy is documented in chapter RH. The separate reporting of onshore versus offshore undiscovered resources is important to economic analysis. All these levels of the assessment results were derived using the allocation and aggregation procedures documented in this chapter.

ALLOCATION PROCEDURE

The Seventh Approximation input form (fig. AA-1), described in chapters AM and OP, contains a section for assigning fractional allocations of the AU results. Any type of geographic parcel can be defined, and the volume percent of the AU resources assigned to that parcel can be entered on the form. The allocation percentages for oil fields and for gas fields are assigned separately.

The input form records minimum, median, and maximum values of volume percent that are needed to show a range of uncertainty. When AU results are divided

among several countries (or provinces), the allocation percentages should add up to 100 percent. In cases with three or more parcels, it is difficult to retain both the distributions of uncertainty and the constraint of adding up to 100 percent. Therefore the uncertainty in allocation percent was not part of the model and only point estimates of the allocation percent were made.

The country boundaries shown on the maps were provided by and used with the permission of Environmental Systems Research Institute, Inc. Many country boundaries are in dispute, especially offshore boundaries, something the assessment team was aware of when allocation percents were assigned to countries. However, the allocation percents are volume percents of the resource and are not based solely on the areal percent of a parcel in an AU. The allocations take into account the spatial heterogeneity in the AU that gives some areas a higher or lower percent of volume of resource because of more or less favorable geologic conditions in those areas. The allocation percents do not imply any U.S. policy relating to disputed boundaries.

In making allocations to onshore versus offshore parcels, small bodies of water in coastal zones were usually considered to be onshore. Large estuaries were considered to be offshore. These determinations were made on the basis of whether an area would require exploration and development using equipment and practices typical of onshore or offshore.

Most of the AUs were contained entirely in a single province, and in these cases allocations were made only to countries (and their onshore and offshore portions). When an AU fell in more than one province, allocations were made both to provinces and to countries. In these cases, onshore versus offshore components were given for both the provinces and the countries. The total offshore volume of resource for the AU should be the same whether calculated using the country allocations or the province allocations. To ensure that the two values were consistent, the allocation of offshore components of countries was considered the primary allocation. Offshore components of province allocations were adjusted to give a total percent of resource offshore for the AU consistent with the country values (within limits of rounding).

AGGREGATION AT TOTAL PETROLEUM SYSTEM, PROVINCE, COUNTRY, AND REGION LEVELS

Once allocations were made to country, province, onshore, and offshore areas at the AU level, these volumes could be aggregated to the TPS, province, region, and country levels. Aggregation of mean values was simple because means are additive under any dependency assumptions. Calculating the other fractiles, though, required assumptions as to the dependency among the components being aggregated.

Dependency is expressed by correlation. When two result distributions are independent, the correlation is 0 and the value of one is unaffected by the value of the other. When two distributions are aggregated with an assumption of independence, the mean values add directly but the fractiles do not. With independence, the F_{95} to F_5 range of the aggregate is smaller than what it would be with some amount of positive correlation. This is because if one distribution has a high value, the other could have an offsetting low value.

In the extreme case of perfect positive correlation (+1), a high value in one distribution implies just as high a value in the other. In this case, the range from F_{95} value of the aggregate to F_5 value of the aggregate is larger than with lesser values of positive correlation. Not only are the means directly additive, but so are all the fractiles. Negative correlations between distributions are also possible, but only in specific types of cases not found in this assessment.

Several factors contribute to dependency, or lack thereof, between the results of assessments of two AUs. Nearby AUs may share geologic features such as tectonic environment and source rocks. Geologic differences are expected to be larger in AUs on opposite sides of the world. Thus, on the basis of geology, one would expect higher correlations among the assessment results from AUs in the same TPS and lower correlations among the results of AUs in different regions.

Similarly, the oil fields in a given AU are expected to have relatively high geologic similarity to the gas fields in that AU. Thus the assessment results from the oil fields are expected to be highly correlated to those from the gas fields.

Nongeologic factors also cause dependency among the assessment results. The assessments were conducted using essentially the same review team members for all 246 assessments. The review team members had different individual viewpoints, but there tended to be a persistent average of these views. The assessments were conducted using a single methodology and much of the data were from a common database (chapters OP and DS). All these factors lead to increased positive correlation among the results.

Simplicity was one of the important considerations in choosing an aggregation methodology for this assessment. The USGS has experimented with several methods of aggregating results with different degrees of dependency. The problem is not in performing the calculations, but in making reasonable estimates of dependency between pairs of components to be aggregated. Where many components exist and intermediate levels of dependency must be estimated between each possible pair of components, the task is formidable.

After some experimentation, it was decided that aggregations up to the regional level would assume perfect positive correlation. This assumption greatly

simplified the numeric calculations because all fractiles, as well as the mean, were directly additive. This seemed justified because, at these levels, the geologic and nongeologic factors all cause high correlation. Above the regional level, however, the geologic factors contribute less to the positive correlation.

AGGREGATION AT WORLD LEVEL

At the level of aggregation from regions to the world, geologic similarity does not contribute as much to positive correlation as at lower levels, but nongeologic factors still contribute toward positive correlation. Neither extreme of complete independence (correlation of 0) nor complete positive dependency (correlation of +1) was deemed appropriate. To retain simplicity, an assumption was made of intermediate positive dependency between each pair of regions. Because there are 8 regions, a total of 28 pairs of regions existed. Each pair was arbitrarily assigned an intermediate value of +0.5 correlation.

Aggregation from the region to world level was performed using a 50,000-iteration Monte Carlo simulation that took into account the pairwise +0.5 dependency. The Monte Carlo results are presented in Appendix 1. World-level aggregations for total oil, total gas, and total NGL were performed in a Monte Carlo simulation separate from that for gas in oil fields, gas in gas fields, NGL in oil fields, and NGL in gas fields. That is why the first two lines of the World Undiscovered

do not add precisely to the third line. The

differences are less than 1 percent, which is attributable to the Monte Carlo

method.

SUMMARY

The original estimates of undiscovered resources were made at the AU level.

Allocations of these estimates apportioned the resource among province, country,

onshore, and offshore parcels. Aggregation to TPS, province, country, and region

levels assumed a perfect positive (+1) correlation among the results. Aggregation

from region to world level assumed a +0.5 correlation among the results.

Appendix 1

Aggregation of Undiscovered Oil, Gas, and NGL Volumes Of

Regions to World Total Monte Carlo Simulation Results

This appendix contains the results of the Monte Carlo simulations used to aggregate the regional volumes to the world level. Pages AAapp-2 through AAapp-15 present the aggregated world level volume distributions. Pages AAapp-16 through AAapp-71 present the region level volume distributions used as input to the Monte Carlo aggregations.

The original region level volume distributions were aggregated by addition of province level fractiles, as described in this chapter. Lognormal distributions were fit to these region level distributions. These lognormal distributions use the exact region level means from the regional aggregations. Standard deviations for the region level volume distributions were calculated using the F_{50} and F_5 of the region level aggregations. A check was made to ensure that the mean of the lognormal fit was approximately that of the actual aggregated mean. The lognormal distributions were then used as input to the Monte Carlo aggregation to world level. These lognormal distributions are presented on pages AAapp-16 through AAapp-71 of the appendix.

Forecast: Total Oil and Oil in Oil Fields (in MMBO)

Summary:
  Display range is from 100,000.00 to 1,300,000.00
  Entire range is from 145,739.45 to 2,655,461.62
  After 50,000 trials, the standard error of the mean is 1,095.10

Statistics:	Value
Trials	50000
Mean (calculated)	648,628.26
Mean (Monte Carlo)	649,043.44
Median	607,458.20
Mode	---
Standard Deviation	244,872.07
Variance	6.00E+10
Skewness	1.17
Kurtosis	5.34
Coefficient of Variability	0.38
Range Minimum	145,739.45
Range Maximum	2,655,461.62
Range Width	2,509,722.17
Mean Standard Error	1,095.10
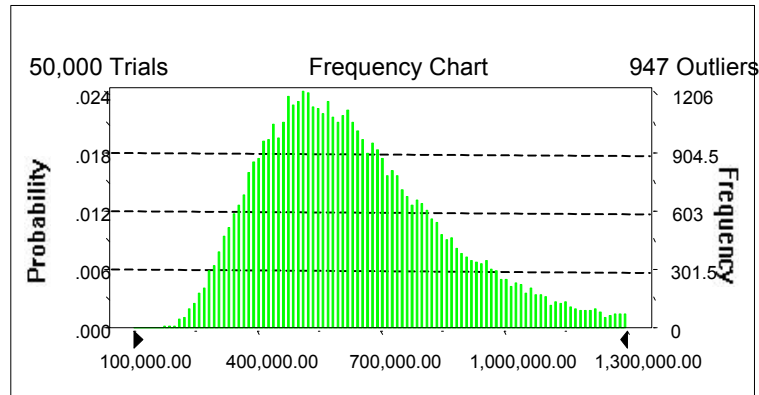
**Forecast: Total Oil and Oil in Oil Fields (cont'd)**

Percentiles:

Percentile	Value (in MMBO)
100%	145,739.45
95%	333,880.51
90%	380,660.64
85%	416,027.49
80%	446,337.43
75%	475,512.39
70%	501,467.15
65%	526,575.91
60%	552,410.36
55%	579,220.47
50%	607,458.20
45%	634,884.77
40%	665,339.36
35%	697,834.51
30%	734,290.04
25%	776,193.25
20%	824,251.05
15%	885,714.97
10%	970,540.41
5%	1,107,468.40
0%	2,655,461.62

Forecast: Total Gas (in BCFG)

Summary:
Display range is from 0.00 to 10,000,000.00
Entire range is from 984,816.36 to 20,952,213.17
After 50,000 trials, the standard error of the mean is 8,338.58

| Statistics:	Value
Trials	50000
Mean (calculated)	4,669,487.67
Mean (Monte Carlo)	4,670,124.86
Median	4,333,376.98
Mode	---
Standard Deviation	1,864,563.31
Variance	3.48E+12
Skewness	1.22
Kurtosis	5.58
Coefficient of Variability	0.40
Range Minimum	984,816.36
Range Maximum	20,952,213.17
Range Width	19,967,396.82
Mean Standard Error	8,338.58
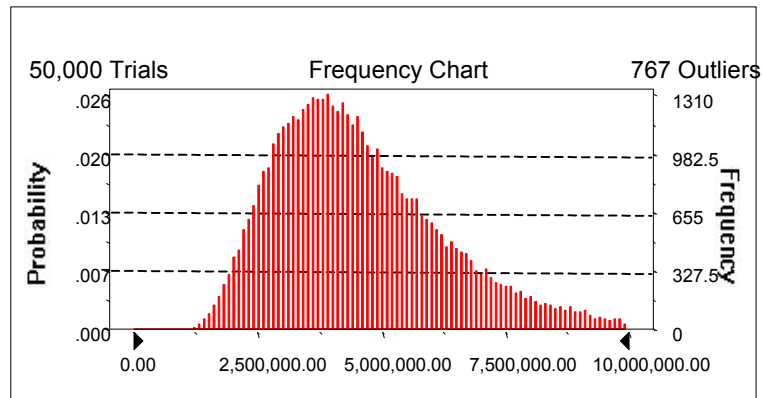
Forecast: Total Gas (cont'd)

Percentiles:

Percentile	Value (in BCFG)
100%	984,816.36
95%	2,298,553.56
90%	2,642,455.53
85%	2,905,167.74
80%	3,127,766.96
75%	3,343,232.22
70%	3,545,882.36
65%	3,741,522.23
60%	3,934,525.74
55%	4,129,788.39
50%	4,333,376.98
45%	4,547,847.07
40%	4,773,293.38
35%	5,028,927.53
30%	5,312,717.34
25%	5,636,901.82
20%	6,008,718.62
15%	6,478,085.21
10%	7,116,472.02
5%	8,173,731.07
0%	20,952,213.17

Forecast: Total NGL (in MMBNGL)

Summary:
Display range is from 0.00 to 450,000.00
Entire range is from 40,083.54 to 1,008,630.35
After 50,000 trials, the standard error of the mean is 405.95

Statistics:	Value
Trials	50000
Mean (calculated)	207,016.91
Mean (Monte Carlo)	206,848.55
Median	189,105.01
Mode	---
Standard Deviation	90,772.07
Variance	8,239,568,312.79
Skewness	1.33
Kurtosis	5.96
Coefficient of Variability	0.44
Range Minimum	40,083.54
Range Maximum	1,008,630.35
Range Width	968,546.81
Mean Standard Error	405.95

Frequency Chart — 50,000 Trials — 1,015 Outliers
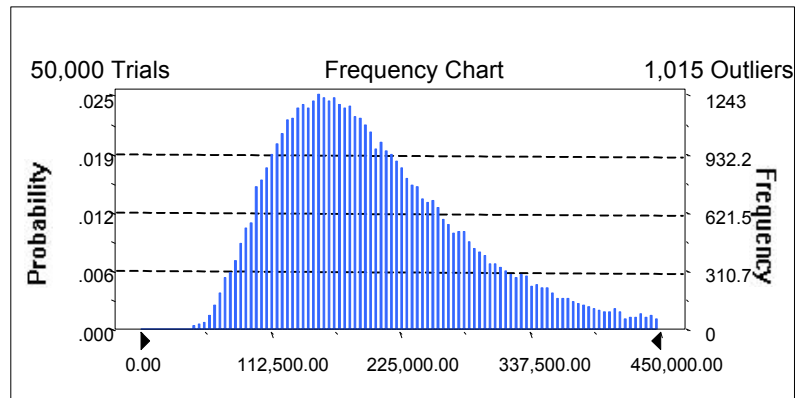
Forecast: Total NGL (cont'd)

Percentiles:

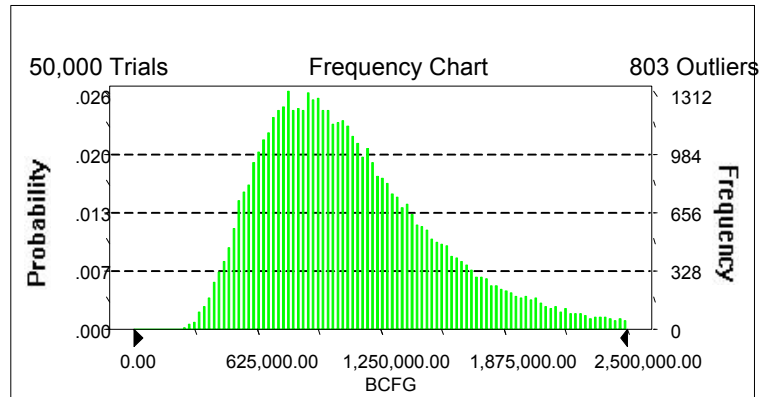| Percentile	Value (in MMBNGL)
100%	40,083.54
95%	94,842.35
90%	110,293.48
85%	122,183.60
80%	132,565.81
75%	142,158.23
70%	151,594.47
65%	160,707.59
60%	169,972.60
55%	179,423.44
50%	189,105.01
45%	199,313.64
40%	210,727.04
35%	222,889.09
30%	236,228.78
25%	251,995.22
20%	270,118.93
15%	293,149.71
10%	325,652.84
5%	378,367.58
0%	1,008,630.35

Forecast: Gas in Oil Fields (in BCFG)

Summary:
    Display range is from 0.00 to 2,500,000.00 BCFG
    Entire range is from 205,021.07 to 4,827,053.75 BCFG
    After 50,000 trials, the standard error of the mean is 2,165.97

Statistics:	Value
Trials	50000
Mean (calculated)	1,122,364.94
Mean (Monte Carlo)	1,121,812.14
Median	1,029,752.79
Mode	---
Standard Deviation	484,325.80
Variance	2.35E+11
Skewness	1.33
Kurtosis	6.01
Coefficient of Variability	0.43
Range Minimum	205,021.07
Range Maximum	4,827,053.75
Range Width	4,622,032.68
Mean Standard Error	2,165.97

Frequency Chart — 50,000 Trials — 803 Outliers

Forecast: Gas in Oil Fields (cont'd)

Percentiles:

Percentile	Value (in BCFG)
100%	205,021.07
95%	525,103.56
90%	606,104.97
85%	669,311.01
80%	725,479.43
75%	776,600.92
70%	826,365.97
65%	877,645.60
60%	925,770.33
55%	976,097.46
50%	1,029,752.79
45%	1,084,223.31
40%	1,142,485.46
35%	1,206,244.16
30%	1,278,761.38
25%	1,361,965.04
20%	1,460,611.10
15%	1,584,456.29
10%	1,752,737.08
5%	2,039,029.91
0%	4,827,053.75

Forecast: Gas in Gas Fields (in BCFG)

Summary:
Display range is from 0.00 to 8,000,000.00 BCFG
Entire range is from 802,318.85 to 17,479,084.10 BCFG
After 50,000 trials, the standard error of the mean is 6,259.27

Statistics:	Value
Trials	50000
Mean (calculated)	3,547,122.72
Mean (Monte Carlo)	3,552,188.13
Median	3,297,447.94
Mode	---
Standard Deviation	1,399,614.97
Variance	1.96E+12
Skewness	1.25
Kurtosis	5.80
Coefficient of Variability	0.39
Range Minimum	802,318.85
Range Maximum	17,479,084.10
Range Width	16,676,765.25
Mean Standard Error	6,259.27
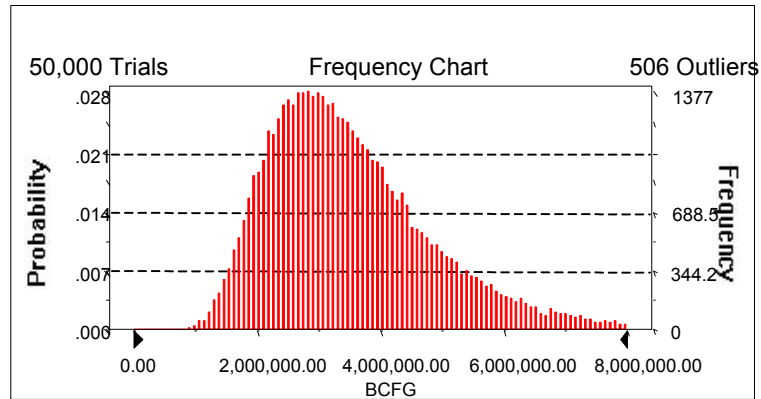
**Forecast: Gas in Gas Fields (cont'd)**

Percentiles:

Percentile	Value (in BCFG)
100%	802,318.85
95%	1,787,042.59
90%	2,037,827.80
85%	2,231,636.21
80%	2,401,973.28
75%	2,552,414.19
70%	2,703,757.16
65%	2,849,299.14
60%	2,995,601.98
55%	3,143,340.83
50%	3,297,447.94
45%	3,459,589.42
40%	3,632,485.37
35%	3,820,934.67
30%	4,024,879.16
25%	4,263,917.61
20%	4,540,025.70
15%	4,906,226.90
10%	5,393,523.66
5%	6,188,050.22
0%	17,479,084.10

Forecast: NGL in Oil Fields (in MMBNGL)

Summary:
    Display range is from 0.00 to 150,000.00 MMBNGL
    Entire range is from 9,804.11 to 278,517.89 MMBNGL
    After 50,000 trials, the standard error of the mean is 125.91

| Statistics:	Value
Trials	50000
Mean (calculated)	59,354.67
Mean (Monte Carlo)	59,323.32
Median	53,365.56
Mode	---
Standard Deviation	28,153.66
Variance	792,628,827.34
Skewness	1.45
Kurtosis	6.43
Coefficient of Variability	0.47
Range Minimum	9,804.11
Range Maximum	278,517.89
Range Width	268,713.79
Mean Standard Error	125.91
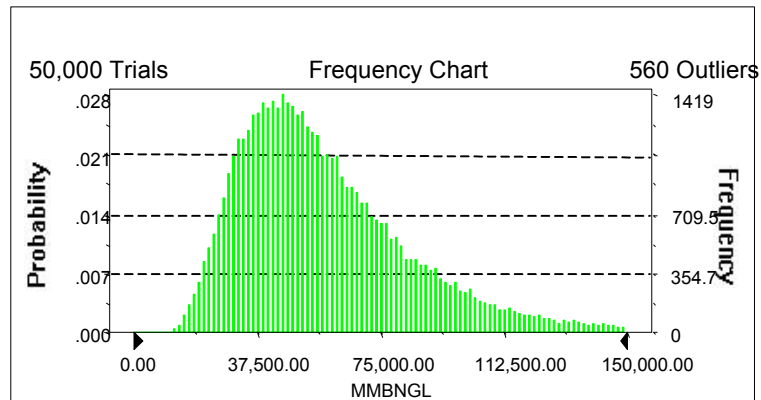
Forecast: NGL in Oil Fields (cont'd)

Percentiles:

Percentile	Value (in MMBNGL)
100%	9,804.11
95%	25,606.06
90%	30,096.84
85%	33,462.54
80%	36,590.27
75%	39,433.58
70%	42,196.26
65%	44,971.17
60%	47,667.34
55%	50,423.12
50%	53,365.56
45%	56,485.95
40%	59,986.60
35%	63,677.78
30%	67,958.82
25%	72,755.05
20%	78,463.60
15%	85,960.44
10%	95,848.37
5%	112,824.53
0%	278,517.89

Forecast: NGL in Gas Fields (in MMBNGL)

Summary:
    Display range is from 25,000.00 to 325,000.00 MMBNGL
    Entire range is from 33,020.26 to 637,674.93 MMBNGL
    After 50,000 trials, the standard error of the mean is 279.57

Statistics:	Value
Trials	50000
Mean (calculated)	147,662.24
Mean (Monte Carlo)	147,404.10
Median	135,388.44
Mode	---
Standard Deviation	62,514.54
Variance	3,908,068,323.55
Skewness	1.28
Kurtosis	5.71
Coefficient of Variability	0.42
Range Minimum	33,020.26
Range Maximum	637,674.93
Range Width	604,654.67
Mean Standard Error	279.57

50,000 Trials — Frequency Chart — 804 Outliers
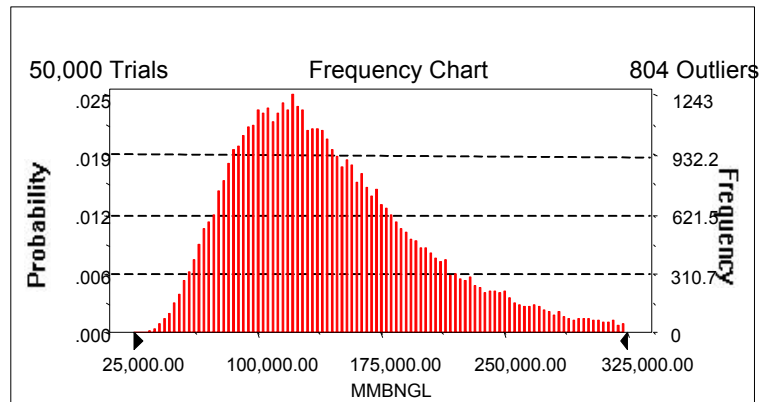
Forecast: NGL in Gas Fields (cont'd)

Percentiles:

Percentile	Value (in MMBNGL)
100%	33,020.26
95%	69,144.67
90%	80,664.32
85%	88,805.40
80%	96,135.48
75%	102,846.14
70%	109,292.77
65%	115,934.28
60%	122,175.04
55%	128,509.42
50%	135,388.44
45%	142,479.48
40%	150,252.75
35%	158,713.26
30%	168,170.60
25%	178,625.42
20%	191,150.71
15%	207,236.66
10%	229,657.64
5%	266,202.50
0%	637,674.93

Assumptions

Assumption: Oil in Oil Fields of Region 1 (in MMBO)

Lognormal distribution with parameters:
Mean	115,985.00
Standard Deviation	56,669.70

Selected range is from 0.00 to +Infinity
Mean value in simulation was 115,887.37

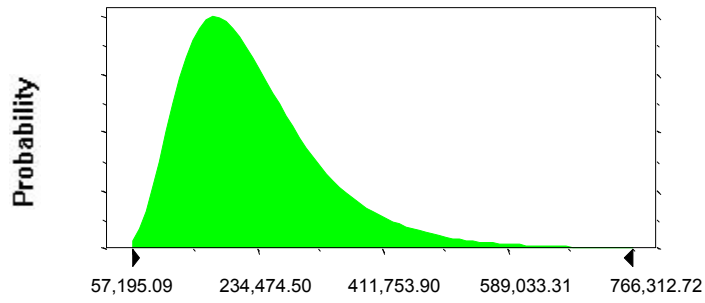| Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 2	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 4	0.50
Oil in Oil Fields of Region 5	0.50
Oil in Oil Fields of Region 6	0.50
Oil in Oil Fields of Region 7	0.50
Oil in Oil Fields of Region 8	0.50

26,006.52   123,901.52   221,796.53   319,691.53   417,586.54
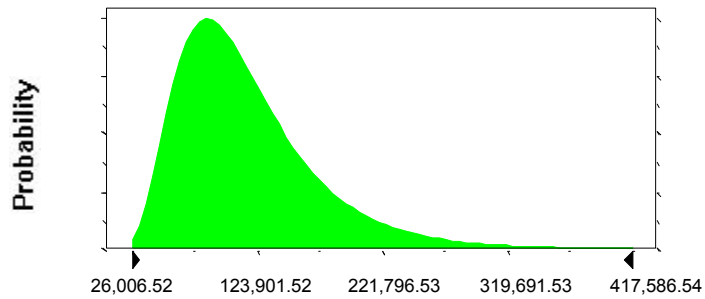
Assumption: Oil in Oil Fields of Region 2 (in MMBO)

Lognormal distribution with parameters:
Mean	229,882.00
Standard Deviation	104,265.20

Selected range is from 0.00 to +Infinity
Mean value in simulation was 230,506.12

Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 1	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 4	0.50
Oil in Oil Fields of Region 5	0.50
Oil in Oil Fields of Region 6	0.50
Oil in Oil Fields of Region 7	0.50
Oil in Oil Fields of Region 8	0.50

57,195.09	234,474.50	411,753.90	589,033.31	766,312.72

Assumption: Oil in Oil Fields of Region 3 (in MMBO)
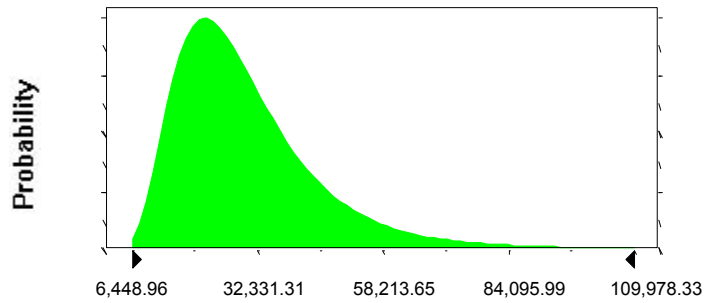
Lognormal distribution with parameters:
Mean   29,780.00
Standard Deviation   14,902.19

Selected range is from 0.00 to +Infinity
Mean value in simulation was 29,764.54

Correlated with: Correlation Coefficient
    Oil in Oil Fields of Region 1   0.50
    Oil in Oil Fields of Region 2   0.50
    Oil in Oil Fields of Region 4   0.50
    Oil in Oil Fields of Region 5   0.50
    Oil in Oil Fields of Region 6   0.50
    Oil in Oil Fields of Region 7   0.50
    Oil in Oil Fields of Region 8   0.50

6,448.96   32,331.31   58,213.65   84,095.99   109,978.33

Assumption: Oil in Oil Fields of Region 4 (in MMBO)
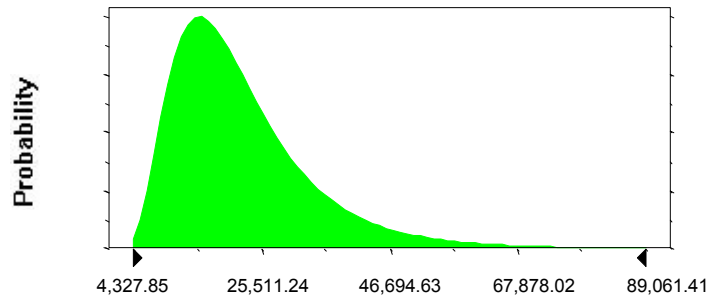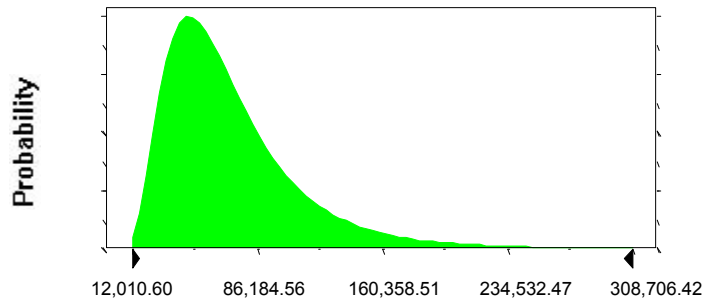
Lognormal distribution with parameters:
Mean   22,292.00
Standard Deviation   11,989.03

Selected range is from 0.00 to +Infinity
Mean value in simulation was 22,231.62

Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 1	0.50
Oil in Oil Fields of Region 2	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 5	0.50
Oil in Oil Fields of Region 6	0.50
Oil in Oil Fields of Region 7	0.50
Oil in Oil Fields of Region 8	0.50

4,327.85   25,511.24   46,694.63   67,878.02   89,061.41

Assumption: Oil in Oil Fields of Region 5 (in MMBO)

Lognormal distribution with parameters:

Mean	70,491.00
Standard Deviation	41,112.66

Selected range is from 0.00 to +Infinity
Mean value in simulation was 70,468.77

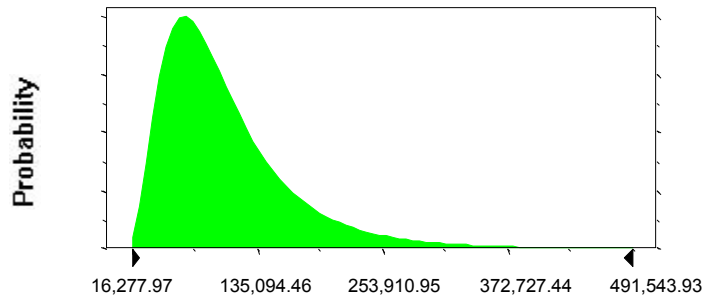| Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 1	0.50
Oil in Oil Fields of Region 2	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 4	0.50
Oil in Oil Fields of Region 6	0.50
Oil in Oil Fields of Region 7	0.50
Oil in Oil Fields of Region 8	0.50

12,010.60	86,184.56	160,358.51	234,532.47	308,706.42

Assumption: Oil in Oil Fields of Region 6 (in MMBO)

Lognormal distribution with parameters:
Mean	105,106.00
Standard Deviation	64,849.44

Selected range is from 0.00 to +Infinity
Mean value in simulation was 105,103.93

Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 1	0.50
Oil in Oil Fields of Region 2	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 4	0.50
Oil in Oil Fields of Region 5	0.50
Oil in Oil Fields of Region 7	0.50
Oil in Oil Fields of Region 8	0.50

16,277.97	135,094.46	253,910.95	372,727.44	491,543.93

Assumption: Oil in Oil Fields of Region 7 (in MMBO)

Lognormal distribution with parameters:
Mean	71,512.00
Standard Deviation	27,251.23

Selected range is from 0.00 to +Infinity
Mean value in simulation was 71,807.84

Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 1	0.50
Oil in Oil Fields of Region 2	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 4	0.50
Oil in Oil Fields of Region 5	0.50
Oil in Oil Fields of Region 6	0.50
Oil in Oil Fields of Region 8	0.50

22,139.85   67,028.72   111,917.59   156,806.45   201,695.32
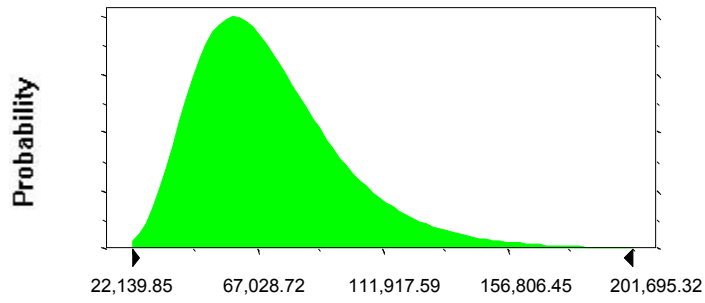
Assumption: Oil in Oil Fields of Region 8 (in MMBO)

Lognormal distribution with parameters:
Mean	3,580.00
Standard Deviation	1,735.40

Selected range is from 0.00 to +Infinity
Mean value in simulation was 3,588.80

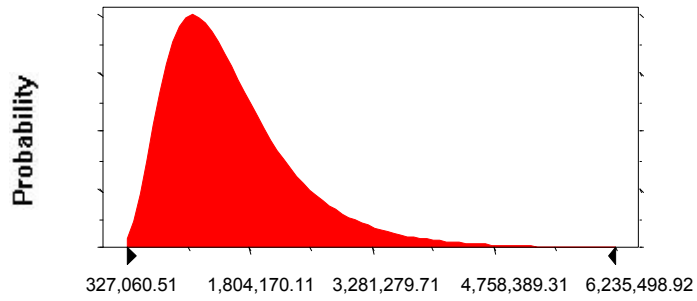| Correlated with:	Correlation Coefficient
Oil in Oil Fields of Region 1	0.50
Oil in Oil Fields of Region 2	0.50
Oil in Oil Fields of Region 3	0.50
Oil in Oil Fields of Region 4	0.50
Oil in Oil Fields of Region 5	0.50
Oil in Oil Fields of Region 6	0.50
Oil in Oil Fields of Region 7	0.50

811.89   3,804.49   6,797.08   9,789.68   12,782.27
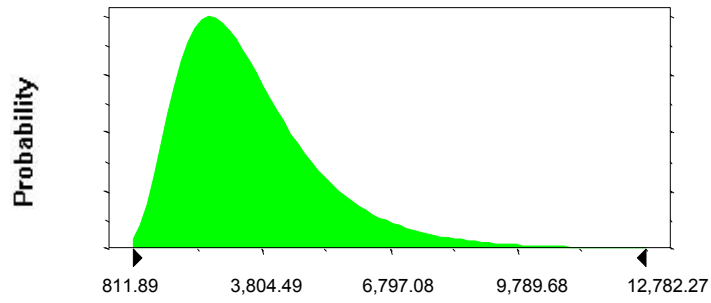
Assumption: Total Gas of Region 1 (in BCFG)

Lognormal distribution with parameters:
Mean	1,611,262.00
Standard Deviation	841,895.60

Selected range is from 0.00 to +Infinity
Mean value in simulation was 1,611,037.15

Correlated with:	Correlation Coefficient
Total Gas of Region 2	0.50
Total Gas of Region 3	0.50
Total Gas of Region 4	0.50
Total Gas of Region 5	0.50
Total Gas of Region 6	0.50
Total Gas of Region 7	0.50
Total Gas of Region 8	0.50

| 327,060.51 | 1,804,170.11 | 3,281,279.71 | 4,758,389.31 | 6,235,498.92 |

Assumption: Total Gas of Region 2 (in BCFG)

Lognormal distribution with parameters:
Mean	1,369,933.00
Standard Deviation	638,413.88

Selected range is from 0.00 to +Infinity
Mean value in simulation was 1,377,361.09

Correlated with:	Correlation Coefficient
Total Gas of Region 1	0.50
Total Gas of Region 3	0.50
Total Gas of Region 4	0.50
Total Gas of Region 5	0.50
Total Gas of Region 6	0.50
Total Gas of Region 7	0.50
Total Gas of Region 8	0.50

| 328,421.23 | 1,420,010.51 | 2,511,599.79 | 3,603,189.08 | 4,694,778.36 |
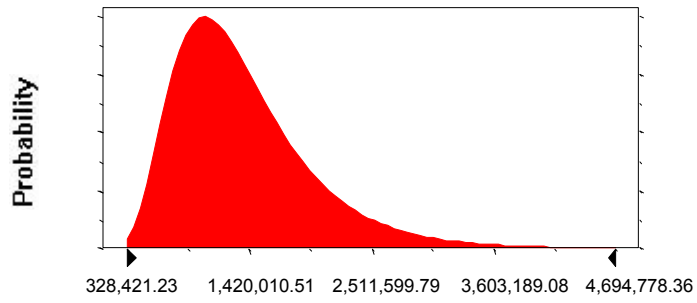
Assumption: Total Gas of Region 3 (in BCFG)

Lognormal distribution with parameters:
Mean	379,339.00
Standard Deviation	188,774.68

Selected range is from 0.00 to +Infinity
Mean value in simulation was 379,138.61

Correlated with:	Correlation Coefficient
Total Gas of Region 1	0.50
Total Gas of Region 2	0.50
Total Gas of Region 4	0.50
Total Gas of Region 5	0.50
Total Gas of Region 6	0.50
Total Gas of Region 7	0.50
Total Gas of Region 8	0.50

| 82,818.80 | 410,270.56 | 737,722.33 | 1,065,174.09 | 1,392,625.86 |
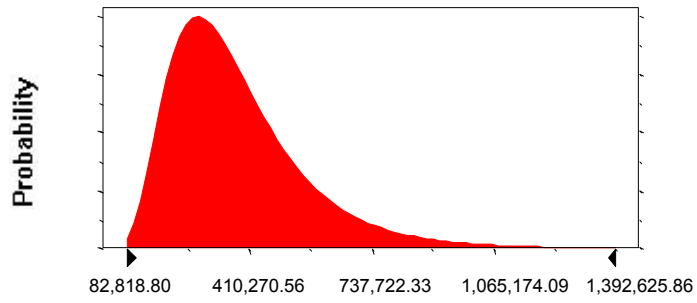
Assumption: Total Gas of Region 4 (in BCFG)

Lognormal distribution with parameters:
Mean	312,365.00
Standard Deviation	216,900.63

Selected range is from 0.00 to +Infinity
Mean value in simulation was 310,797.54

Correlated with:	Correlation Coefficient
Total Gas of Region 1	0.50
Total Gas of Region 2	0.50
Total Gas of Region 3	0.50
Total Gas of Region 5	0.50
Total Gas of Region 6	0.50
Total Gas of Region 7	0.50
Total Gas of Region 8	0.50

| 39,076.50 | 450,472.25 | 861,867.99 | 1,273,263.74 | 1,684,659.49 |
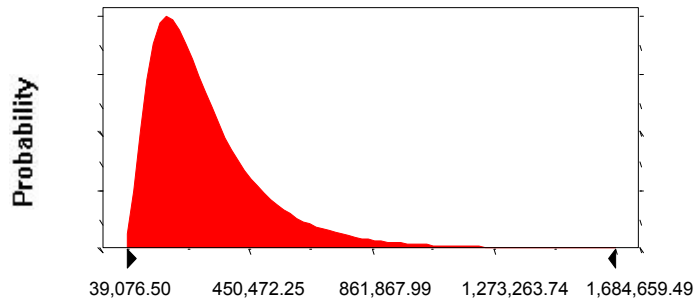
Assumption: Total Gas of Region 5 (in BCFG)

Lognormal distribution with parameters:
Mean	154,499.00
Standard Deviation	97,633.75

Selected range is from 0.00 to +Infinity
Mean value in simulation was 154,067.35

Correlated with:	Correlation Coefficient
Total Gas of Region 1	0.50
Total Gas of Region 2	0.50
Total Gas of Region 3	0.50
Total Gas of Region 4	0.50
Total Gas of Region 6	0.50
Total Gas of Region 7	0.50
Total Gas of Region 8	0.50

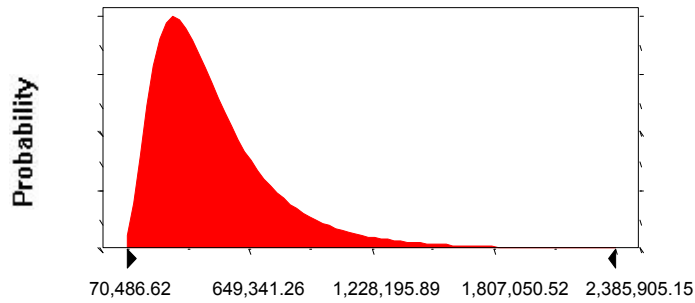| 22,947.49 | 203,047.23 | 383,146.97 | 563,246.71 | 743,346.45 |
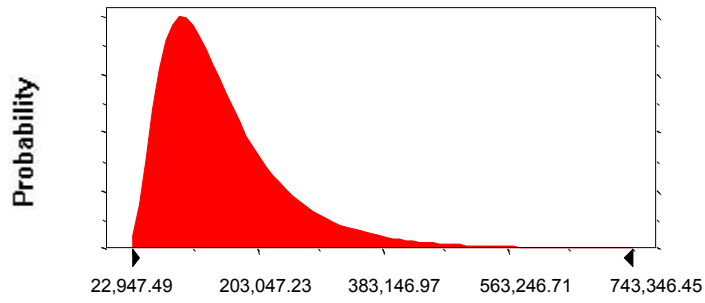
Assumption: Total Gas of Region 6 (in BCFG)

Lognormal distribution with parameters:
Mean   487,190.00
Standard Deviation   312,469.58

Selected range is from 0.00 to +Infinity
Mean value in simulation was 488,678.03

Correlated with: Correlation Coefficient
    Total Gas of Region 1   0.50
    Total Gas of Region 2   0.50
    Total Gas of Region 3   0.50
    Total Gas of Region 4   0.50
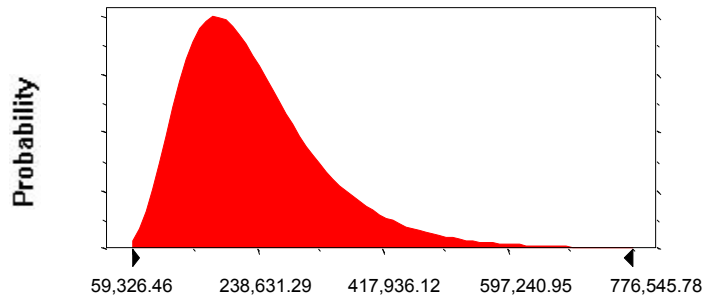   Total Gas of Region 5   0.50
   Total Gas of Region 7   0.50
    Total Gas of Region 8   0.50

| 70,486.62 | 649,341.26 | 1,228,195.89 | 1,807,050.52 | 2,385,905.15 |

Assumption: Total Gas of Region 7 (in BCFG)

Lognormal distribution with parameters:
Mean	235,290.00
Standard Deviation	105,667.79

Selected range is from 0.00 to +Infinity
Mean value in simulation was 235,410.72

Correlated with:	Correlation Coefficient
Total Gas of Region 1	0.50
Total Gas of Region 2	0.50
Total Gas of Region 3	0.50
Total Gas of Region 4	0.50
Total Gas of Region 5	0.50
Total Gas of Region 6	0.50
Total Gas of Region 8	0.50

| 59,326.46 | 238,631.29 | 417,936.12 | 597,240.95 | 776,545.78 |

Assumption: Total Gas of Region 8 (in BCFG)

Lognormal distribution with parameters:
Mean	119,610.00
Standard Deviation	66,819.88

Selected range is from 0.00 to +Infinity
Mean value in simulation was 119,317.72

Correlated with:	Correlation Coefficient
Total Gas of Region 1	0.50
Total Gas of Region 2	0.50
Total Gas of Region 3	0.50
Total Gas of Region 4	0.50
Total Gas of Region 5	0.50
Total Gas of Region 6	0.50
Total Gas of Region 7	0.50

| 21,865.57 | 141,066.14 | 260,266.72 | 379,467.29 | 498,667.87 |
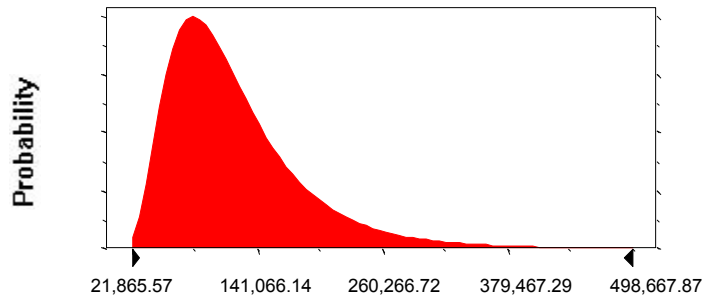
Assumption: Total NGL of Region 1 (in MMBNGL)

Lognormal distribution with parameters:
Mean	54,806.00
Standard Deviation	32,315.13

Selected range is from 0.00 to +Infinity
Mean value in simulation was 54,940.96

Correlated with:	Correlation Coefficient
Total NGL of Region 2	0.50
Total NGL of Region 3	0.50
Total NGL of Region 4	0.50
Total NGL of Region 5	0.50
Total NGL of Region 6	0.50
Total NGL of Region 7	0.50
Total NGL of Region 8	0.50

| 9,169.81 | 67,642.64 | 126,115.46 | 184,588.29 | 243,061.12 |
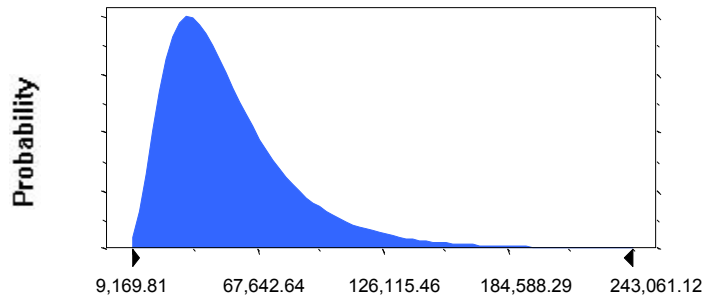
Assumption: Total NGL of Region 2 (in MMBNGL)
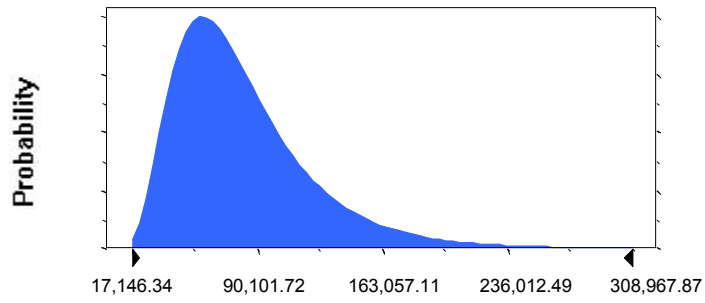
Lognormal distribution with parameters:
Mean   81,747.00
Standard Deviation   41,796.42

Selected range is from 0.00 to +Infinity
Mean value in simulation was 81,817.09

Correlated with: Correlation Coefficient
    Total NGL of Region 1   0.50
    Total NGL of Region 3   0.50
    Total NGL of Region 4   0.50
    Total NGL of Region 5   0.50
    Total NGL of Region 6   0.50
    Total NGL of Region 7   0.50
    Total NGL of Region 8   0.50

| 17,146.34 | 90,101.72 | 163,057.11 | 236,012.49 | 308,967.87 |

Assumption: Total NGL of Region 3 (in MMBNGL)
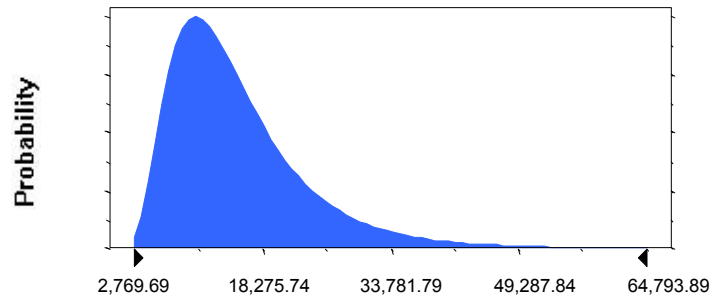
Lognormal distribution with parameters:
    Mean   15,379.00
    Standard Deviation   8,671.42

Selected range is from 0.00 to +Infinity
Mean value in simulation was 15,468.17

Correlated with:	Correlation Coefficient
Total NGL of Region 1	0.50
Total NGL of Region 2	0.50
Total NGL of Region 4	0.50
Total NGL of Region 5	0.50
Total NGL of Region 6	0.50
Total NGL of Region 7	0.50
Total NGL of Region 8	0.50

| 2,769.69 | 18,275.74 | 33,781.79 | 49,287.84 | 64,793.89 |

Assumption: Total NGL of Region 4 (in MMBNGL)
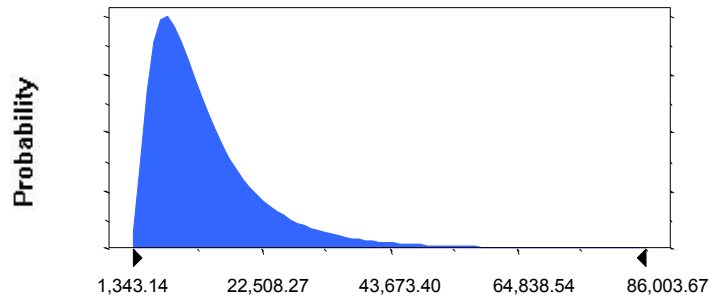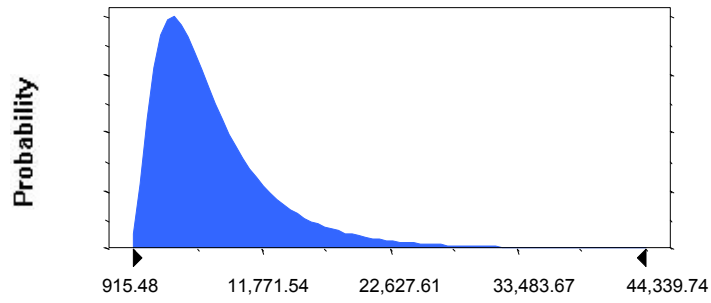
Lognormal distribution with parameters:
    Mean   13,667.00
    Standard Deviation   10,735.27

Selected range is from 0.00 to +Infinity
Mean value in simulation was 13,695.85

Correlated with:	Correlation Coefficient
Total NGL of Region 1	0.50
Total NGL of Region 2	0.50
Total NGL of Region 3	0.50
Total NGL of Region 5	0.50
Total NGL of Region 6	0.50
Total NGL of Region 7	0.50
Total NGL of Region 8	0.50

| 1,343.14 | 22,508.27 | 43,673.40 | 64,838.54 | 86,003.67 |

Assumption: Total NGL of Region 5 (in MMBNGL)

Lognormal distribution with parameters:
Mean	7,853.00
Standard Deviation	5,658.81

Selected range is from 0.00 to +Infinity
Mean value in simulation was 7,834.09

Correlated with:	Correlation Coefficient
Total NGL of Region 1	0.50
Total NGL of Region 2	0.50
Total NGL of Region 3	0.50
Total NGL of Region 4	0.50
Total NGL of Region 6	0.50
Total NGL of Region 7	0.50
Total NGL of Region 8	0.50

| 915.48 | 11,771.54 | 22,627.61 | 33,483.67 | 44,339.74 |

Assumption: Total NGL of Region 6 (in MMBNGL)
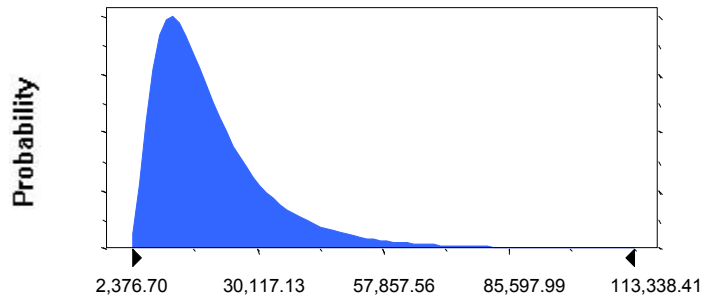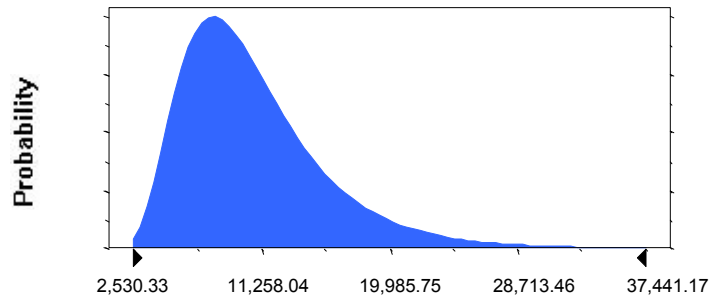
Lognormal distribution with parameters:
    Mean   20,196.00
    Standard Deviation   14,481.92

Selected range is from 0.00 to +Infinity
Mean value in simulation was 20,145.81

Correlated with:	Correlation Coefficient
Total NGL of Region 1	0.50
Total NGL of Region 2	0.50
Total NGL of Region 3	0.50
Total NGL of Region 4	0.50
Total NGL of Region 5	0.50
Total NGL of Region 7	0.50
Total NGL of Region 8	0.50

2,376.70   30,117.13   57,857.56   85,597.99   113,338.41

Assumption: Total NGL of Region 7 (in MMBNGL)

Lognormal distribution with parameters:
Mean	10,766.00
Standard Deviation	5,088.99

Selected range is from 0.00 to +Infinity
Mean value in simulation was 10,767.00

Correlated with:	Correlation Coefficient
Total NGL of Region 1	0.50
Total NGL of Region 2	0.50
Total NGL of Region 3	0.50
Total NGL of Region 4	0.50
Total NGL of Region 5	0.50
Total NGL of Region 6	0.50
Total NGL of Region 8	0.50

| 2,530.33 | 11,258.04 | 19,985.75 | 28,713.46 | 37,441.17 |

Assumption: Total NGL of Region 8 (in MMBNGL)

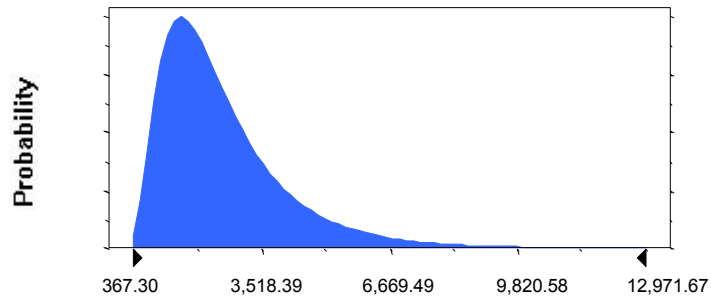Lognormal distribution with parameters:
    Mean   2,604.00
    Standard Deviation   1,693.99

Selected range is from 0.00 to +Infinity
Mean value in simulation was 2,603.70

Correlated with:	Correlation Coefficient
Total NGL of Region 1	0.50
Total NGL of Region 2	0.50
Total NGL of Region 3	0.50
Total NGL of Region 4	0.50
Total NGL of Region 5	0.50
Total NGL of Region 6	0.50
Total NGL of Region 7	0.50

367.30   3,518.39   6,669.49   9,820.58   12,971.67
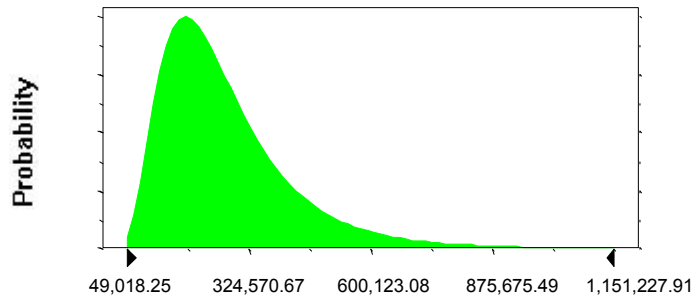
Assumption: Gas in Oil Fields of Region 1 (in BCFG)

Lognormal distribution with parameters:
Mean   272,806.00
Standard Deviation   154,039.90

Selected range is from 0.00 to +Infinity
Mean value in simulation was 271,543.82

Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 2	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 4	0.50
Gas in Oil Fields of Region 5	0.50
Gas in Oil Fields of Region 6	0.50
Gas in Oil Fields of Region 7	0.50
Gas in Oil Fields of Region 8	0.50

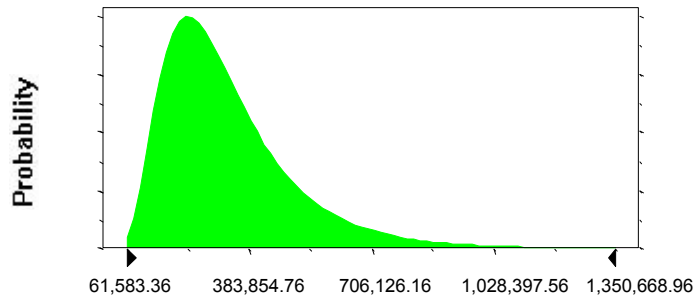| 49,018.25 | 324,570.67 | 600,123.08 | 875,675.49 | 1,151,227.91 |

Assumption: Gas in Oil Fields of Region 2 (in BCFG)

Lognormal distribution with parameters:
Mean   329,248.00
Standard Deviation   181,316.35

Selected range is from 0.00 to +Infinity
Mean value in simulation was 328,675.38

Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 1	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 4	0.50
Gas in Oil Fields of Region 5	0.50
Gas in Oil Fields of Region 6	0.50
Gas in Oil Fields of Region 7	0.50
Gas in Oil Fields of Region 8	0.50

61,583.36   383,854.76   706,126.16   1,028,397.56   1,350,668.96

Assumption: Gas in Oil Fields of Region 3 (in BCFG)
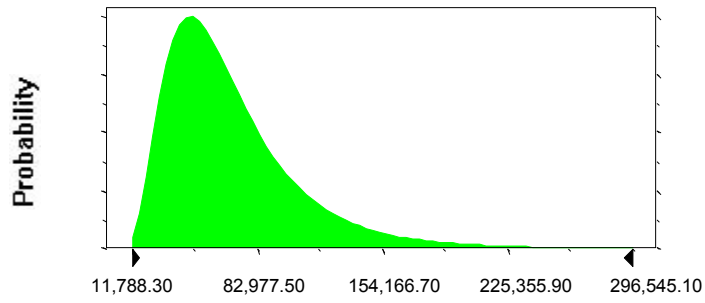
Lognormal distribution with parameters:
Mean   68,314.00
Standard Deviation   39,538.91

Selected range is from 0.00 to +Infinity
Mean value in simulation was 68,487.79

Correlated with: Correlation Coefficient
    Gas in Oil Fields of Region 1   0.50
    Gas in Oil Fields of Region 2   0.50
    Gas in Oil Fields of Region 4   0.50
    Gas in Oil Fields of Region 5   0.50
    Gas in Oil Fields of Region 6   0.50
    Gas in Oil Fields of Region 7   0.50
    Gas in Oil Fields of Region 8   0.50

| 11,788.30 | 82,977.50 | 154,166.70 | 225,355.90 | 296,545.10 |

Assumption: Gas in Oil Fields of Region 4 (in BCFG)
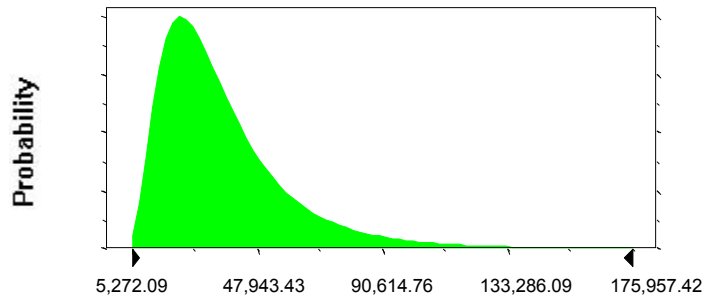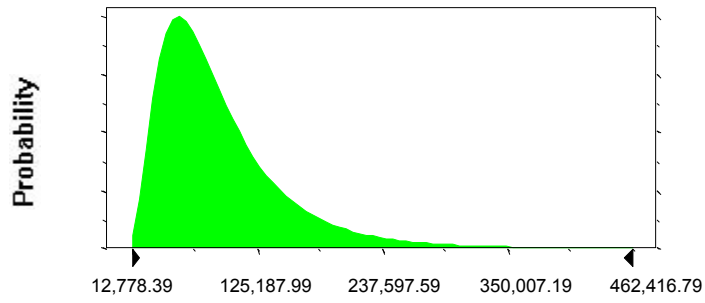
Lognormal distribution with parameters:
Mean   36,134.00
Standard Deviation   23,065.76

Selected range is from 0.00 to +Infinity
Mean value in simulation was 36,255.86

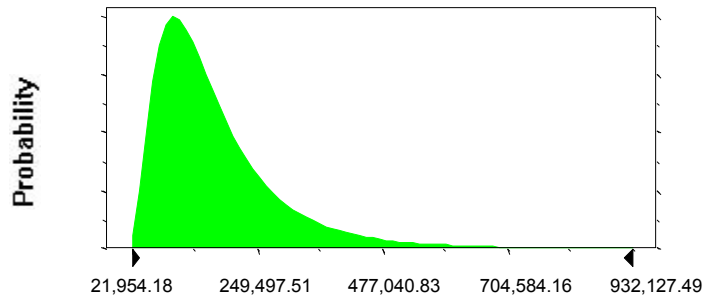| Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 1	0.50
Gas in Oil Fields of Region 2	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 5	0.50
Gas in Oil Fields of Region 6	0.50
Gas in Oil Fields of Region 7	0.50
Gas in Oil Fields of Region 8	0.50

| 5,272.09 | 47,943.43 | 90,614.76 | 133,286.09 | 175,957.42 |

Assumption: Gas in Oil Fields of Region 5 (in BCFG)

Lognormal distribution with parameters:
Mean	91,926.00
Standard Deviation	60,287.06

Selected range is from 0.00 to +Infinity
Mean value in simulation was 92,181.52

Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 1	0.50
Gas in Oil Fields of Region 2	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 4	0.50
Gas in Oil Fields of Region 6	0.50
Gas in Oil Fields of Region 7	0.50
Gas in Oil Fields of Region 8	0.50

12,778.39   125,187.99   237,597.59   350,007.19   462,416.79

Assumption: Gas in Oil Fields of Region 6 (in BCFG)

Lognormal distribution with parameters:
Mean	173,881.00
Standard Deviation	120,147.39

Selected range is from 0.00 to +Infinity
Mean value in simulation was 174,817.00

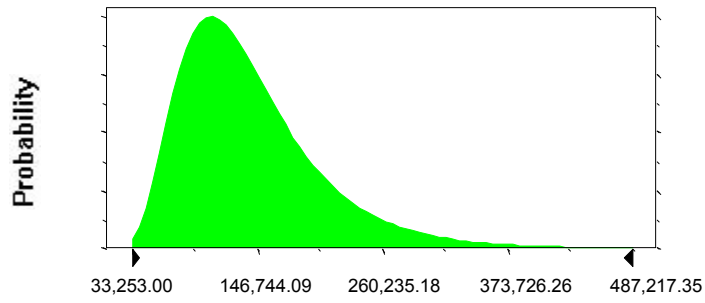| Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 1	0.50
Gas in Oil Fields of Region 2	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 4	0.50
Gas in Oil Fields of Region 5	0.50
Gas in Oil Fields of Region 7	0.50
Gas in Oil Fields of Region 8	0.50

| 21,954.18 | 249,497.51 | 477,040.83 | 704,584.16 | 932,127.49 |

Assumption: Gas in Oil Fields of Region 7 (in BCFG)

Lognormal distribution with parameters:
Mean	140,685.00
Standard Deviation	66,232.10

Selected range is from 0.00 to +Infinity
Mean value in simulation was 140,479.13

Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 1	0.50
Gas in Oil Fields of Region 2	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 4	0.50
Gas in Oil Fields of Region 5	0.50
Gas in Oil Fields of Region 6	0.50
Gas in Oil Fields of Region 8	0.50

33,253.00   146,744.09   260,235.18   373,726.26   487,217.35

Assumption: Gas in Oil Fields of Region 8 (in BCFG)

Lognormal distribution with parameters:
Mean	9,370.00
Standard Deviation	5,438.79

Selected range is from 0.00 to +Infinity
Mean value in simulation was 9,371.64

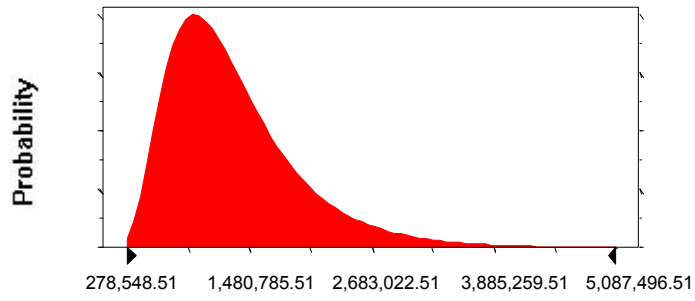| Correlated with:	Correlation Coefficient
Gas in Oil Fields of Region 1	0.50
Gas in Oil Fields of Region 2	0.50
Gas in Oil Fields of Region 3	0.50
Gas in Oil Fields of Region 4	0.50
Gas in Oil Fields of Region 5	0.50
Gas in Oil Fields of Region 6	0.50
Gas in Oil Fields of Region 7	0.50
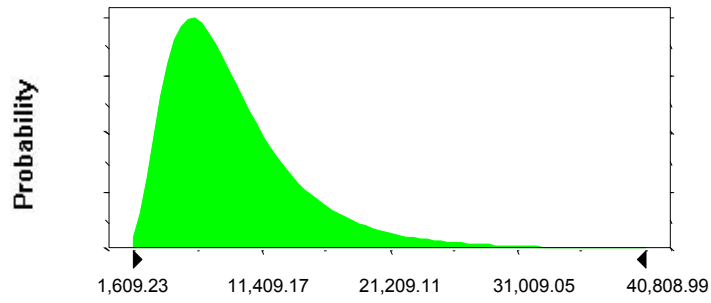
Assumption: Gas in Gas Fields of Region 1 (in BCFG)

Lognormal distribution with parameters:
Mean	1,338,455.00
Standard Deviation	687,921.05

Selected range is from 0.00 to +Infinity
Mean value in simulation was 1,342,199.74

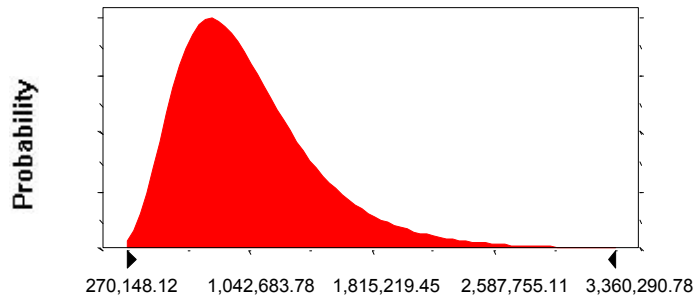| Correlated with:	Correlation Coefficient
Gas in Gas Fields of Region 2	0.50
Gas in Gas Fields of Region 3	0.50
Gas in Gas Fields of Region 4	0.50
Gas in Gas Fields of Region 5	0.50
Gas in Gas Fields of Region 6	0.50
Gas in Gas Fields of Region 7	0.50
Gas in Gas Fields of Region 8	0.50

Assumption: Gas in Gas Fields of Region 2 (in BCFG)

Lognormal distribution with parameters:
Mean   1,040,684.00
Standard Deviation   457,251.06

Selected range is from 0.00 to +Infinity
Mean value in simulation was 1,042,127.21

Correlated with: Correlation Coefficient
    Gas in Gas Fields of Region 1   0.50
    Gas in Gas Fields of Region 3   0.50
    Gas in Gas Fields of Region 4   0.50
    Gas in Gas Fields of Region 5   0.50
    Gas in Gas Fields of Region 6   0.50
    Gas in Gas Fields of Region 7   0.50
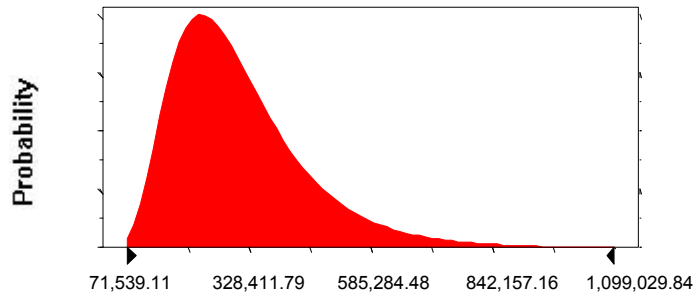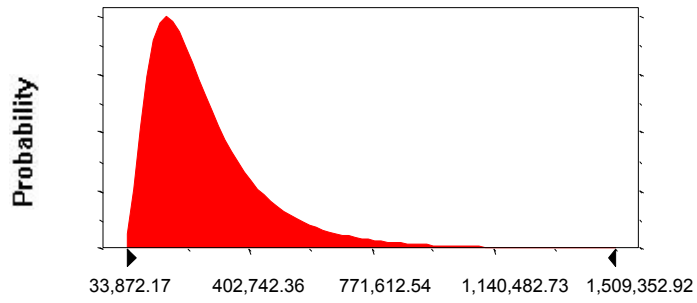   Gas in Gas Fields of Region 8   0.50

270,148.12   1,042,683.78   1,815,219.45   2,587,755.11   3,360,290.78

Assumption: Gas in Gas Fields of Region 3 (in BCFG)

Lognormal distribution with parameters:
Mean	311,025.00
Standard Deviation	149,283.96

Selected range is from 0.00 to +Infinity
Mean value in simulation was 310,125.46

Correlated with:	Correlation Coefficient
Gas in Gas Fields of Region 1	0.50
Gas in Gas Fields of Region 2	0.50
Gas in Gas Fields of Region 4	0.50
Gas in Gas Fields of Region 5	0.50
Gas in Gas Fields of Region 6	0.50
Gas in Gas Fields of Region 7	0.50
Gas in Gas Fields of Region 8	0.50

| 71,539.11 | 328,411.79 | 585,284.48 | 842,157.16 | 1,099,029.84 |

Assumption: Gas in Gas Fields of Region 4 (in BCFG)

Lognormal distribution with parameters:
Mean	276,231.00
Standard Deviation	193,852.06

Selected range is from 0.00 to +Infinity
Mean value in simulation was 276,117.46

Correlated with:	Correlation Coefficient
Gas in Gas Fields of Region 1	0.50
Gas in Gas Fields of Region 2	0.50
Gas in Gas Fields of Region 3	0.50
Gas in Gas Fields of Region 5	0.50
Gas in Gas Fields of Region 6	0.50
Gas in Gas Fields of Region 7	0.50
Gas in Gas Fields of Region 8	0.50

33,872.17	402,742.36	771,612.54	1,140,482.73	1,509,352.92

Assumption: Gas in Gas Fields of Region 5 (in BCFG)

Lognormal distribution with parameters:
Mean	62,574.00
Standard Deviation	37,371.50

Selected range is from 0.00 to +Infinity
Mean value in simulation was 62,519.50

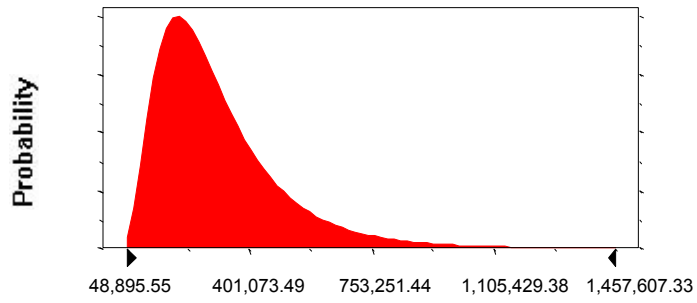| Correlated with:	Correlation Coefficient
Gas in Gas Fields of Region 1	0.50
Gas in Gas Fields of Region 2	0.50
Gas in Gas Fields of Region 3	0.50
Gas in Gas Fields of Region 4	0.50
Gas in Gas Fields of Region 6	0.50
Gas in Gas Fields of Region 7	0.50
Gas in Gas Fields of Region 8	0.50

| 10,246.00 | 78,103.90 | 145,961.81 | 213,819.72 | 281,677.63 |
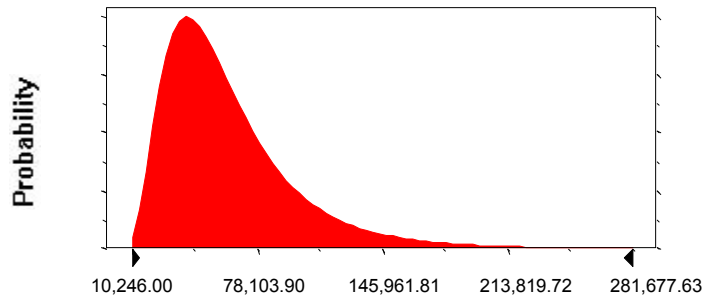
Assumption: Gas in Gas Fields of Region 6 (in BCFG)

Lognormal distribution with parameters:
Mean	313,309.00
Standard Deviation	192,455.20

Selected range is from 0.00 to +Infinity
Mean value in simulation was 314,110.42

Correlated with: Correlation Coefficient
Gas in Gas Fields of Region 1	0.50
Gas in Gas Fields of Region 2	0.50
Gas in Gas Fields of Region 3	0.50
Gas in Gas Fields of Region 4	0.50
Gas in Gas Fields of Region 5	0.50
Gas in Gas Fields of Region 7	0.50
Gas in Gas Fields of Region 8	0.50

48,895.55   401,073.49   753,251.44   1,105,429.38   1,457,607.33

Assumption: Gas in Gas Fields of Region 7 (in BCFG)

Lognormal distribution with parameters:
Mean	94,604.00
Standard Deviation	39,435.38

Selected range is from 0.00 to +Infinity
Mean value in simulation was 94,764.38

Correlated with:	Correlation Coefficient
Gas in Gas Fields of Region 1	0.50
Gas in Gas Fields of Region 2	0.50
Gas in Gas Fields of Region 3	0.50
Gas in Gas Fields of Region 4	0.50
Gas in Gas Fields of Region 5	0.50
Gas in Gas Fields of Region 6	0.50
Gas in Gas Fields of Region 8	0.50

| 26,279.60 | 92,246.84 | 158,214.07 | 224,181.30 | 290,148.53 |
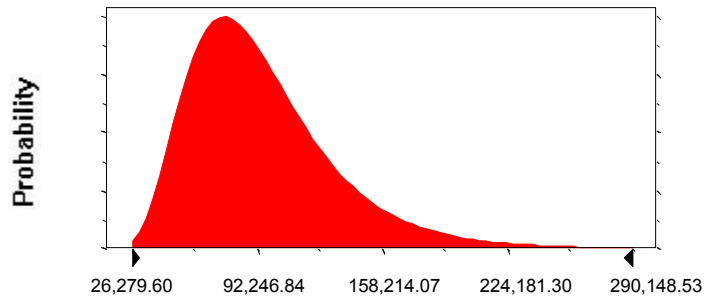
Assumption: Gas in Gas Fields of Region 8 (in BCFG)
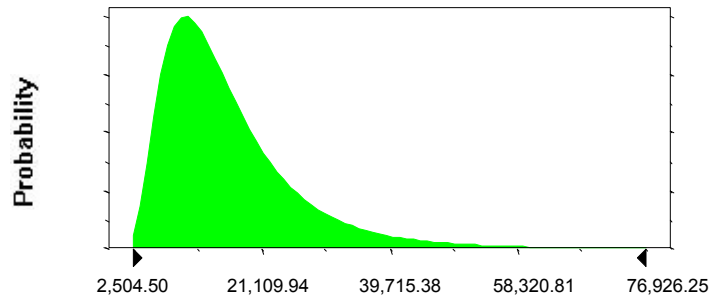
Lognormal distribution with parameters:
Mean   110,240.00
Standard Deviation   61,381.67

Selected range is from 0.00 to +Infinity
Mean value in simulation was 110,223.95

Correlated with: Correlation Coefficient
    Gas in Gas Fields of Region 1   0.50
    Gas in Gas Fields of Region 2   0.50
    Gas in Gas Fields of Region 3   0.50
    Gas in Gas Fields of Region 4   0.50
    Gas in Gas Fields of Region 5   0.50
    Gas in Gas Fields of Region 6   0.50
    Gas in Gas Fields of Region 7   0.50

| 20,260.10 | 129,666.41 | 239,072.72 | 348,479.03 | 457,885.34 |
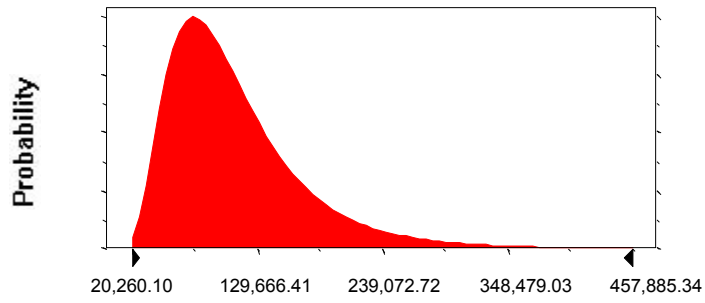
Assumption: NGL in Oil Fields of Region 1 (in MMBNGL)

Lognormal distribution with parameters:
Mean	16,336.00
Standard Deviation	10,138.12

Selected range is from 0.00 to +Infinity
Mean value in simulation was 16,286.17

Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 7	0.50
NGL in Oil Fields of Region 8	0.50

| 2,504.50 | 21,109.94 | 39,715.38 | 58,320.81 | 76,926.25 |

Assumption: NGL in Oil Fields of Region 2 (in MMBNGL)

Lognormal distribution with parameters:
Mean	15,595.00
Standard Deviation	9,565.79

Selected range is from 0.00 to +Infinity
Mean value in simulation was 15,604.49

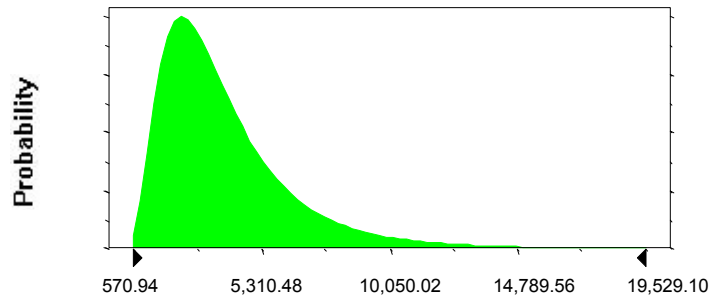| Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 7	0.50
NGL in Oil Fields of Region 8	0.50
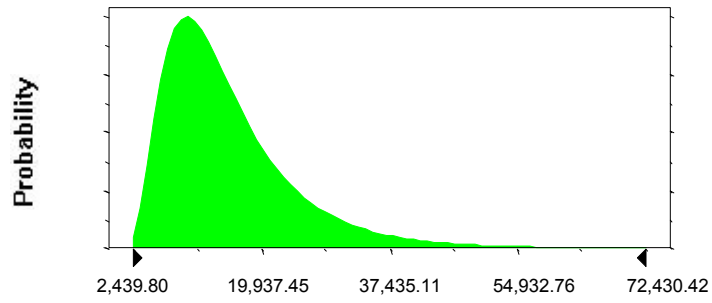
Assumption: NGL in Oil Fields of Region 3 (in MMBNGL)

Lognormal distribution with parameters:
Mean	3,971.00
Standard Deviation	2,555.84

Selected range is from 0.00 to +Infinity
Mean value in simulation was 3,983.56

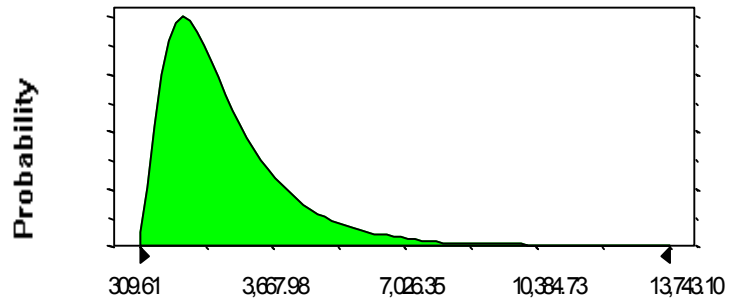| Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 7	0.50
NGL in Oil Fields of Region 8	0.50

Assumption: NGL in Oil Fields of Region 4 (in MMBNGL)

Lognormal distribution with parameters:
Mean	2,519.00
Standard Deviation	1,765.59

Selected range is from 0.00 to +Infinity
Mean value in simulation was 2,508.61

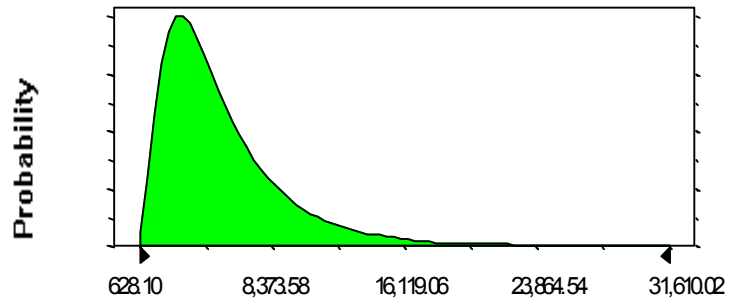| Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 7	0.50
NGL in Oil Fields of Region 8	0.50

Assumption: NGL in Oil Fields of Region 5 (in MMBNGL)

Lognormal distribution with parameters:
Mean	5,515.00
Standard Deviation	4,022.26

Selected range is from 0.00 to +Infinity
Mean value in simulation was 5,485.86

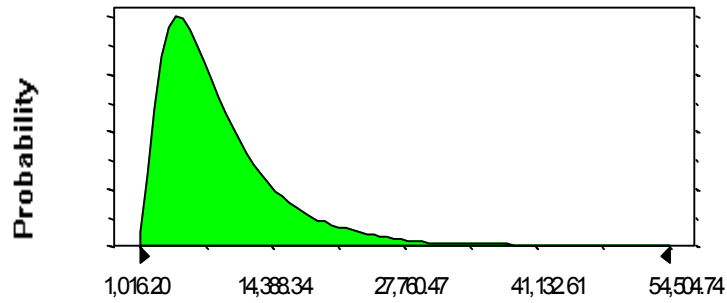| Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 7	0.50
NGL in Oil Fields of Region 8	0.50

Assumption: NGL in Oil Fields of Region 6 (in MMBNGL)

Lognormal distribution with parameters:
Mean	9,276.00
Standard Deviation	6,901.03

Selected range is from 0.00 to +Infinity
Mean value in simulation was 9,328.25

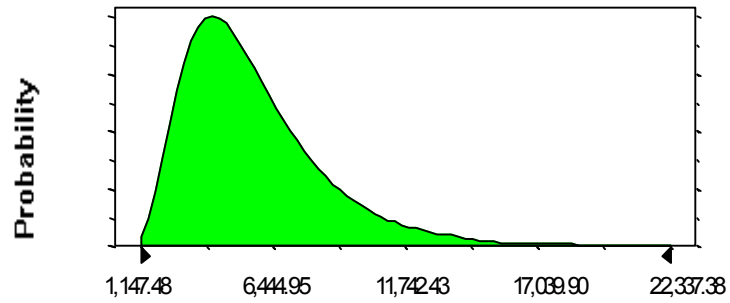| Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 7	0.50
NGL in Oil Fields of Region 8	0.50

Assumption: NGL in Oil Fields of Region 7 (in MMBNGL)

Lognormal distribution with parameters:
Mean	5,722.00
Standard Deviation	3,013.59

Selected range is from 0.00 to +Infinity
Mean value in simulation was 5,706.51

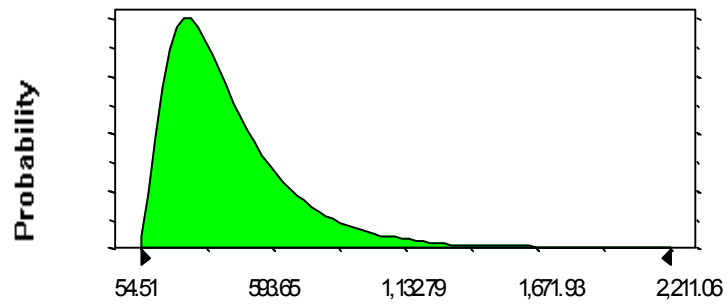| Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 8	0.50

Assumption: NGL in Oil Fields of Region 8 (in MMBNGL)

Lognormal distribution with parameters:
Mean	420.00
Standard Deviation	285.95

Selected range is from 0.00 to +Infinity
Mean value in simulation was 419.87

Correlated with:	Correlation Coefficient
NGL in Oil Fields of Region 1	0.50
NGL in Oil Fields of Region 2	0.50
NGL in Oil Fields of Region 3	0.50
NGL in Oil Fields of Region 4	0.50
NGL in Oil Fields of Region 5	0.50
NGL in Oil Fields of Region 6	0.50
NGL in Oil Fields of Region 7	0.50

Assumption: NGL in Gas Fields of Region 1 (in MMBNGL)
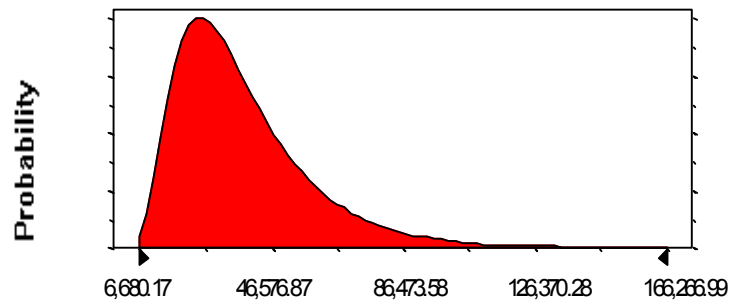
Lognormal distribution with parameters:
Mean   38,470.00
Standard Deviation   22,181.22

Selected range is from 0.00 to +Infinity
Mean value in simulation was 38,352.12

Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 7	0.50
NGL in Gas Fields of Region 8	0.50

| 6,680.17 | 46,576.87 | 86,473.58 | 126,370.28 | 166,266.99 |

Assumption: NGL in Gas Fields of Region 2 (in MMBNGL)

Lognormal distribution with parameters:
Mean	66,152.00
Standard Deviation	32,253.54

Selected range is from 0.00 to +Infinity
Mean value in simulation was 66,005.19

Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 7	0.50
NGL in Gas Fields of Region 8	0.50

14,877.89   70,568.69   126,259.49   181,950.29   237,641.09
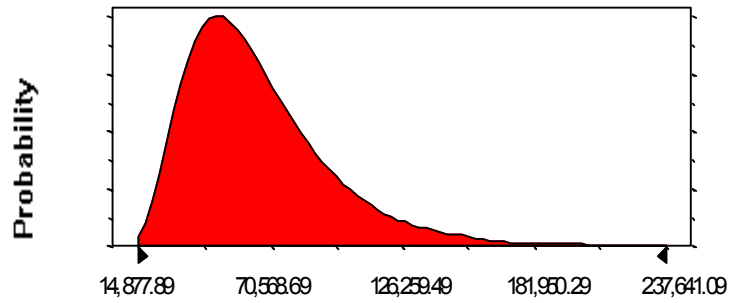
Assumption: NGL in Gas Fields of Region 3 (in MMBNGL)

Lognormal distribution with parameters:
Mean	11,407.00
Standard Deviation	6,121.00

Selected range is from 0.00 to +Infinity
Mean value in simulation was 11,441.65

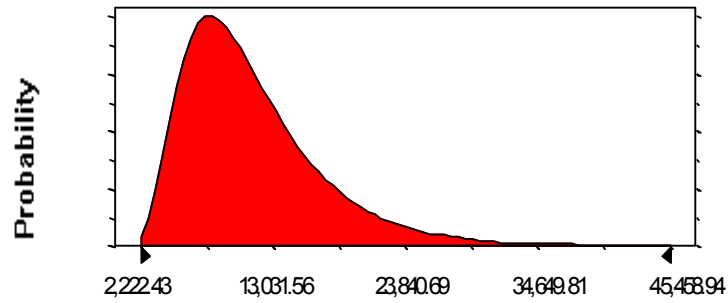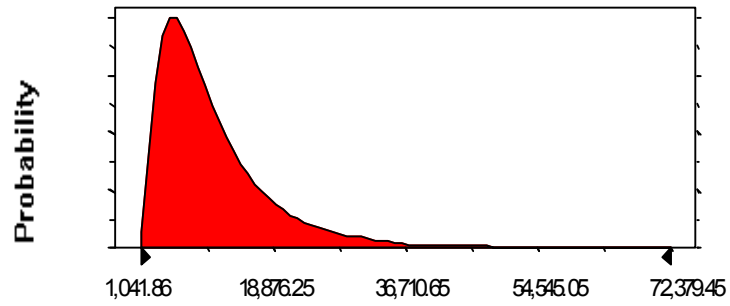| Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 7	0.50
NGL in Gas Fields of Region 8	0.50

Assumption: NGL in Gas Fields of Region 4 (in MMBNGL)

Lognormal distribution with parameters:
Mean	11,148.00
Standard Deviation	8,974.33

Selected range is from 0.00 to +Infinity
Mean value in simulation was 11,166.19

Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 7	0.50
NGL in Gas Fields of Region 8	0.50

Assumption: NGL in Gas Fields of Region 5 (in MMBNGL)

Lognormal distribution with parameters:
Mean	2,338.00
Standard Deviation	1,637.20

Selected range is from 0.00 to +Infinity
Mean value in simulation was 2,341.74

Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 7	0.50
NGL in Gas Fields of Region 8	0.50

| 287.87 | 3,401.14 | 6,514.41 | 9,627.68 | 12,740.96 |

Assumption: NGL in Gas Fields of Region 6 (in MMBNGL)
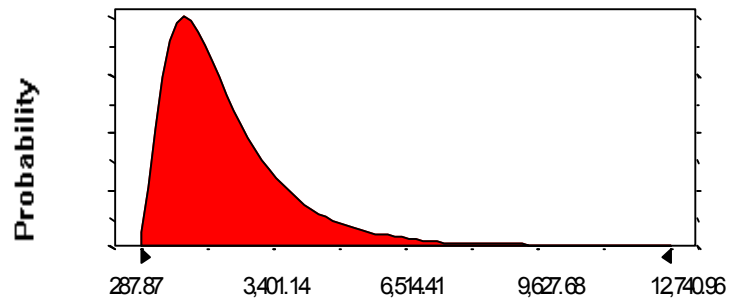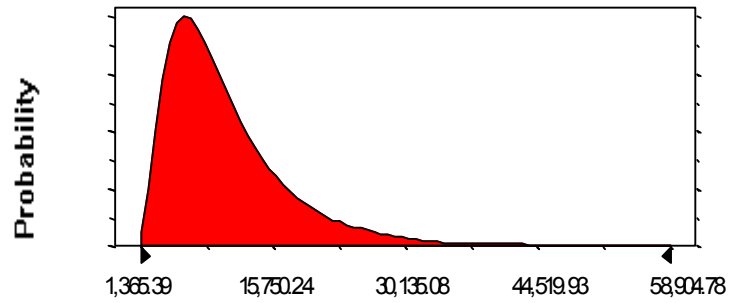
  Lognormal distribution with parameters:
     Mean   10,919.00
     Standard Deviation   7,583.63

Selected range is from 0.00 to +Infinity
Mean value in simulation was 10,884.69

Correlated with: Correlation Coefficient

Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 7	0.50
NGL in Gas Fields of Region 8	0.50

Assumption: NGL in Gas Fields of Region 7 (in MMBNGL)

Lognormal distribution with parameters:
Mean	5,044.00
Standard Deviation	2,076.49

Selected range is from 0.00 to +Infinity
Mean value in simulation was 5,031.21

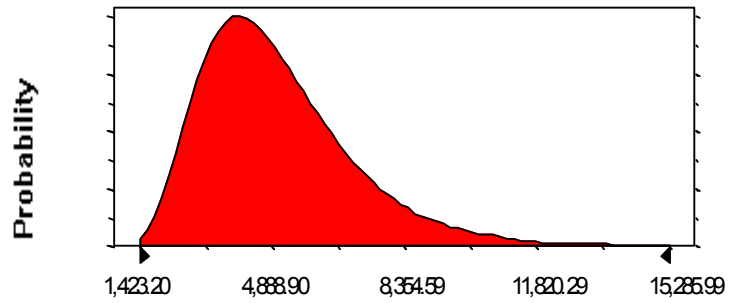| Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 8	0.50

Assumption: NGL in Gas Fields of Region 8 (in MMBNGL)

Lognormal distribution with parameters:
Mean	2,184.00
Standard Deviation	1,408.13

Selected range is from 0.00 to +Infinity
Mean value in simulation was 2,181.30

Correlated with:	Correlation Coefficient
NGL in Gas Fields of Region 1	0.50
NGL in Gas Fields of Region 2	0.50
NGL in Gas Fields of Region 3	0.50
NGL in Gas Fields of Region 4	0.50
NGL in Gas Fields of Region 5	0.50
NGL in Gas Fields of Region 6	0.50
NGL in Gas Fields of Region 7	0.50
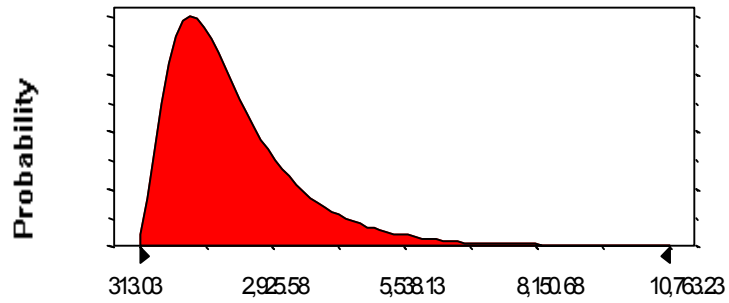
End of Assumptions

Simulation started on 2/9/00 at 11:41:24
Simulation stopped on 2/9/00 at 11:50:52

SEVENTH APPROXIMATION--BASIC INPUT DATA FORM

IDENTIFICATION INFORMATION

Date:…………………………..

Assessment Geologist:……..

Region:……………………….. Number:

Province:……………………… Number:

Total Petroleum System:…… Number:

Assessment Unit:…………… Number:

Notes from Assessor:………

CHARACTERISTICS OF ASSESSMENT UNIT

What is the minimum field size?………. mmboe grown (6000 cfg = 1 bo)

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):…

Number of discovered fields exceeding minimum size:………… Oil: Gas:

Established (>13 fields)	Frontier (1-13 fields)	Hypothetical (no fields)

Median size (grown) of discovered oil fields (mmbo):

1st 3rd discovered	2nd 3rd	3rd 3rd

Median size (grown) of discovered gas fields (bcfg):

1st 3rd discovered	2nd 3rd	3rd 3rd

Assessment-Unit Probabilities:

Attribute	Probability of occurrence (0-1.0)
1. **CHARGE:** Adequate petroleum charge for an undiscovered field ≥ minimum size…………….	
2. **ROCKS:** Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size..…	
3. **TIMING:** Favorable geologic timing for an undiscovered field ≥ minimum size………………..	

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):……….............……

4. **ACCESS:** Adequate location for necessary petroleum-related activities……..………………..

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:

(uncertainty of estimating fixed but unknown values)

Oil fields:………………….…………min. no. (>0) median no. max no.

Gas fields:…………………………..min. no. (>0) median no. max no.

Sizes of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:

(inherent natural variability in the sizes of undiscovered fields)

Oil in oil fields (mmbo)………………..…… min. size median size max. size

Gas in gas fields (bcfg):……………….….. min. size median size max. size

Figure AA-1.   Basic input data form for the Seventh Approximation.

			Assessment Unit (name, no.)				

AVERAGE COPRODUCT RATIOS FOR UNDISCOVERED FIELDS
(uncertainty of estimating fixed but unknown values)

Oil fields:		minimum	median	maximum
Gas/oil ratio (cfg/bo)…………………..……….				
NGL/gas ratio (bngl/mmcfg)…………………..……				
Gas fields:				
Liquids/gas ratio (bliq/mmcfg)………………..……..				
OR				
NGL/gas ratio (bngl/mmcfg)………………..……..				
Oil/gas ratio (bo/mmcfg)…………………………..				

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS
(inherent natural variability in the properties of undiscovered fields)

Oil fields:		minimum	median	maximum
API gravity of oil (degrees)……………………….				
Sulfur content of oil (%)……………………..…….				
Drilling depth (m) …………………..…………………..				
Depth (m) of water (if applicable)………………..…..				
Gas fields:				
Inert-gas content (%)………………………..……				
CO_2 content (%)……………………………..…...				
Hydrogen-sulfide content (%)……………………..				
Drilling depth (m)…………………………………….				
Depth (m) of water (if applicable)………………….				

ALLOCATION OF UNDISCOVERED RESOURCES TO LAND ENTITIES
(uncertainty of estimating fixed but unknown values)

1. _____ represents _____ areal % of the assessment unit

Oil in oil fields:		minimum	median	maximum
Volume % in entity………………………………..				
Portion of volume % that is offshore (0-100%)……				
Gas in gas fields:				
Volume % in entity………………………………..				
Portion of volume % that is offshore (0-100%)……				

(repeat above sequence as necessary to include all land entities of interest)

Figure AA-1. continued