Final Report

DEVELOPMENT OF 2012 OIL AND GAS EMISSIONS PROJECTIONS FOR THE UINTA BASIN

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INTRODUCTION

This document outlines the projection methodologies used in generating the 2012 emissions projections from oil and gas sources in the Uinta Basin. These methodologies use as a starting point the 2006 baseline Uinta Basin oil and gas emissions inventory, described in the baseline emissions report entitled "Development of Baseline 2006 Emissions from Oil and Gas Activity in the Uinta Basin".

This methodology description is broken down into subsections which describe:

- Geographic grouping of data
- Description of the projected parameters
- Scaling factors and developing uncontrolled emissions projections
- Application of "on-the-books" regulations and control measures

Projections for years beyond 2012 (not addressed in this methodology) will likely include additional parameters and will be based on these 2012 projections as the start year. The methodology for developing far future year projections will be detailed in a separate analysis.

Following the discussion of the methodology, the results of the 2012 emissions projections for the North San Juan Basin are presented in graphical and tabular formats.

Geographic Grouping

All oil and gas production in the North San Juan Basin is concentrated in one geographic region, with activity both on SUIT tribal land and in adjacent state land. Therefore for purposes of the 2012 midterm projections, only two geographic regions were considered:

- SUIT tribal airshed – 2012 midterm emissions projections within the bounds of the SUIT tribal airshed are derived from the SUIT PEA inventory considering the No Action Alternative
- State land in Archuleta and La Plata Counties – 2012 midterm emissions projections on state land adjacent to the SUIT tribal airshed rely on activity projections developed from the SUIT PEA inventory but are applied to the activity statistics and baseline emissions for state land only

The methodologies for generating the 2012 midterm emissions were different for the tribal airshed as opposed to state land, and both methodologies are presented below.

Parameters Projected

GEOGRAPHIC GROUPING

The projections for 2012 have been conducted separately for 5 geographic groupings in the Uinta Basin which are essentially the 5 counties of significant oil and gas activity:

1. Carbon County
2. Duchesne County
3. Emery County
4. Grand County
5. Uintah County

This represents the region where significant oil and gas exploration and production are occurring, and projections are made for each of these counties separately. However, it should be noted that the boundaries of the Uinta Basin as defined in this project also include Wasatch County in the northwestern corner of the basin. Wasatch County does not have any significant oil and gas activity and thus no projections are made for this county, nor is Wasatch County included in any further analysis for the Uinta Basin.

Unlike the Denver-Julesburg and Piceance Basins, counties were not grouped together in the Uinta Basin for purposes of conducting the mid-term projections. There are several reasons for this. The number of whole counties in the Uinta Basin is small, thus allowing for projections to be made for each county separately in a tractable way, which was considered the most accurate methodology for projecting activity. The oil and gas activity differs from county to county, thus single-county projections were most appropriate to accurately assess the productions trends for each specific county. For example, all CBM activity in the basin is confined to Carbon and Emery Counties, with Carbon County representing approximately 80% of the total CBM gas production in the Uinta Basin. The majority of oil production occurs in Duchesne County – approximately 56% of the total oil production in the Uinta Basin, with much of the remainder occurring in Uintah County. Uintah County alone represents roughly 60% of all gas production (conventional and unconventional) in the Uinta Basin. Given these wide variations in production and production types occurring in these counties, it was decided to treat each of these 5 major production counties in the basin separately.

PARAMETERS PROJECTED

The 2012 projections for oil and gas emissions in the Uinta Basin rely on scaling 7 parameters:

- Total well counts
- Conventional gas well counts (Carbon and Emery Counties only)
- CBM well counts (Carbon and Emery Counties only)
- Spud counts
- Total gas production
- Oil production
- Condensate production

These seven parameters are considered because each parameter applies to the emissions projections of one or more source categories. Note that the analysis uses data from the IHS database, which defines condensate production as liquid hydrocarbon production from wells which are classified as gas wells. Similarly, oil production is defined as liquid hydrocarbon production from wells which are classified as oil wells. The classification of gas vs. oil wells in the IHS database is based on the gas-oil ratio (GOR) of the well, using a cutoff GOR defined by the Utah Division of Oil, Gas and Mining. This is the only distinction made between condensate and oil production. It should also be noted that while CBM well counts are not used explicitly as a projection parameter, they are distinguished from conventional well counts for purposes of projecting some source categories' emissions. This is only the case for Carbon and Emery Counties which have mixed well populations including both CBM and conventional gas wells. This distinction was made in an effort to better characterize the differences in VOC content of gas from CBM wells relative to conventional gas wells. For all other counties, only the total well count is considered.

The mapping of source category to projection parameter is shown below in Table 1.

Table 1. Scaling parameter for each oil and gas source category considered in this inventory.

Source	SCC	Description	Projection Parameter
Unpermitted	2310000100	Heaters	total well count
Unpermitted	2310000220	Drill rigs	spud count
Unpermitted	2310000230	Workover rigs	total well count
Unpermitted	2310000300	Pneumatic devices	total well count
Unpermitted	2310000700	Fugitives	total well count
Unpermitted	2310000801	Truck loading of condensate liquid	condensate production
Unpermitted	2310000802	Truck loading of oil	oil production
Unpermitted	2310000820	Gas plant truck loading	condensate production
Unpermitted	2310001610	Venting - initial completions	spud count
Unpermitted	2310001611	Initial completion flaring	spud count
Unpermitted	2310001620	Venting - recompletions	spud count
Unpermitted	2310001630	Venting - blowdowns	total gas production
Unpermitted	2310001640	Venting – compressor startups	total gas production
Unpermitted	2310001650	Venting – compressor shutdowns	total gas production
Unpermitted	2310002230	Condensate tanks	condensate production
Unpermitted	2310002240	Oil tanks	oil production
Unpermitted	2310003100	Miscellaneous engines	total well count
Unpermitted	2310003200	Pneumatic pumps	total well count
Unpermitted	2310003500	Initial completion flaring	spud count
Unpermitted	2310020600	Compressor Engines	total gas production
Unpermitted	2310021410	Dehydrators	total gas production
Unpermitted	2310021411	Dehydrator flaring	total gas production
Unpermitted	2310000330	Artificial lift engines	oil production
Permitted	31000000	Permitted sources	total gas production

PROJECTION METHODOLOGIES FOR GEOGRAPHIC GROUPINGS

For each geographic grouping, the methodology for obtaining the 2012 value of each projection parameter (total well counts, conventional gas well counts, CBM well counts, spud counts, condensate production, oil production and gas production) is described below. In general, spud count projections for the 5 counties in the Uinta Basin were developed by obtaining the historical spud count data for each county from the IHS database, and projecting a trend line forward from 2007 to 2012 with modifications due to specific information provided by participating companies. Well count projections for the Uinta Basin counties were developed by deriving an average ratio of annual spud counts to well counts for a number of historical years, and then applying this ratio to the projected spud counts to estimate annual well counts for future years. It should be noted that in the Piceance Basin projections, the well counts were projected from historical data and spud counts were derived from the well counts. This is reversed for the Uinta Basin since it was determined that spud count projections more accurately predicted future year well counts.

Conventional gas production projections for Uintah and Carbon Counties only were developed by using typical well decline data for the Uinta Basin (Buys & Associates, 2009) to predict the added annual gas production from the well count projections for each of these two counties. For other counties and for CBM gas production, the gas production projections were developed by projecting a trend line forward from 2007 to 2012 based on historical data. Operator provided production data describing typical well decline rates were determined to be reasonably applicable only to conventional gas production, and only to production in Uintah and Carbon Counties. For other counties, the provided decline data did not show good agreement with historical production data, or were difficult to obtain as representative curves given the variability in production within a county. In particular, restimulation and recompletion activities conducted on oil wells in Duchesne County made decline curve correlation very difficult. For Uintah and Carbon Counties only, condensate production projections were developed by scaling the future year condensate production to the previous year condensate production using the same growth or decline rates as developed for gas production, which therefore accounts for well decline using the typical well decline data. For other counties, condensate production was projected forward from 2007 to 2012 using a trend line based on historic data. Finally oil production projections were developed by obtaining the historical oil production data for the geographic grouping using the IHS database, and projecting a trend line forward from 2007 to 2012. The IHS database is a tool to query oil and gas statistical well and production data, and uses as its reference data the databases maintained by various state OGCC’s (or equivalent).

Activity projections used to generate the IPAMS WRAP Phase III 2012 air emissions projections for the exploration and production of oil and natural gas in the Uinta Basin were originally completed in August 2008. Due to low commodity prices, the severe economic downturn afflicting the entire American economy, the associated lack of capital to sustain the previous level of drilling and production activity, constrained take-away capacity, and the difficulty obtaining permits to drill, IPAMS determined that the emissions projections overstated what could be expected through 2012. Therefore, a decision was made to revise the original projections downward by the 25% factor described above.

IPAMS believes this is a conservative downward revision. A slowdown in activity over 40% was already evident in December 2008. Production can drop off very quickly because of the combined factors of well decline and reduced drilling during the downturn. The volatility of commodity prices and uncertainties about when the economy may recover mean that we cannot predict with accuracy when activity will pick up to the levels originally projected. Once the economy does recover, it takes considerable time to bring production levels back up to the projected levels due to the time to remobilize and increase drilling efforts.

Carbon County

Spud Counts – Spud counts in Carbon County have been plotted for the years 1970 – 2007 below in Figure 1, including projections to 2012.

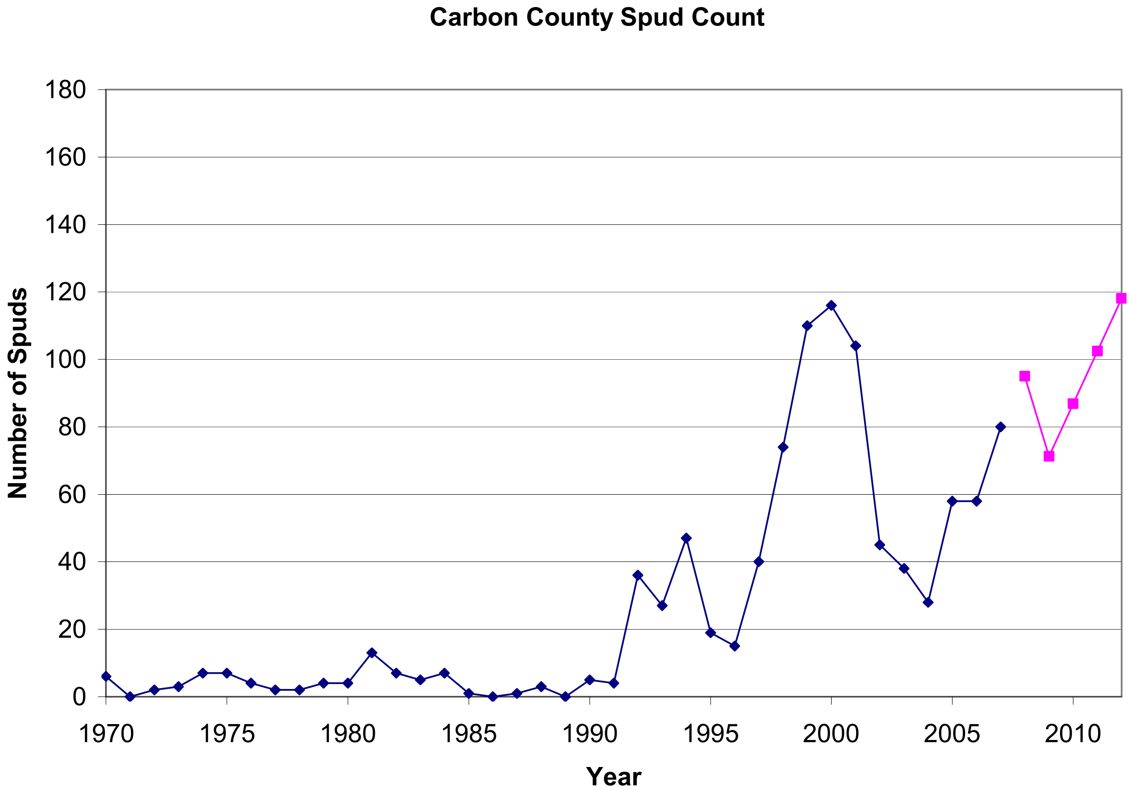

Figure 1. Spud count historical data (from the IHS database) for Carbon County and projections to 2012.[1]

Spud counts in Carbon County were linearly projected for the years 2007 – 2008 based on historical data from 2004 – 2006, since this period was considered representative of the recent significant increase in activity in the Uinta Basin. In 2009 a 25% decrease in the number of spuds was predicted, given specific information from the participating companies indicating that a decline in activity was expected for the Uinta Basin as a whole, as described above. Following this, spuds were projected to continue to increase for 2010 – 2012 using a linear extrapolation with the same slope as the original 2007 – 2008 linear extrapolation.

[1] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Conventional Well Counts – Conventional gas well counts in Carbon County have been plotted for the years 1970 – 2007 below in Figure 2, including projections to 2012.

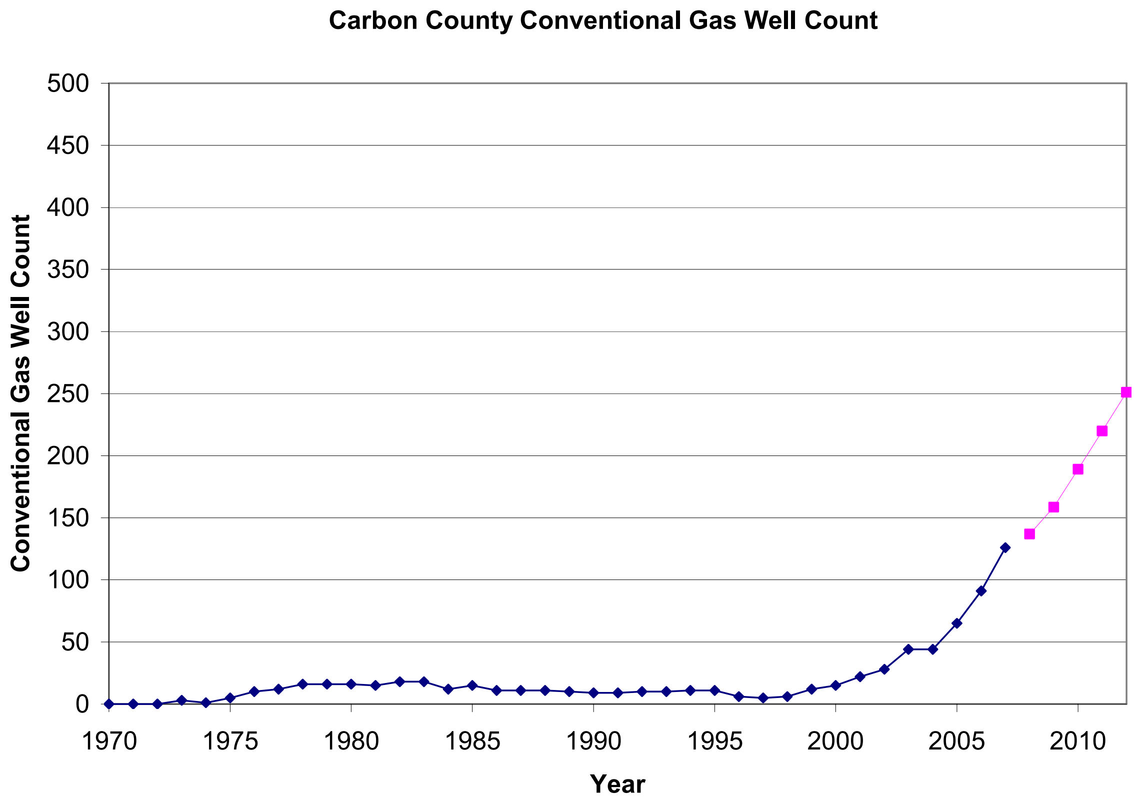

Figure 2. Conventional gas well count historical data (from the IHS database) for Carbon County and projections to 2012.[2]

Conventional gas well count projections were developed for the period 2007 – 2012 by first developing a ratio of the number of spuds in each year from 2001 – 2007 to the number of new wells added in each of those years. This represented the historic rate of drilling as compared to the rate of new well addition, accounting for factors such as unsuccessful drilling and wells which were plugged and abandoned. This data for the years 2001 – 2007 was averaged to develop a single historical drilling rate estimate of 1.42. This drilling rate estimate was then applied to the spud count as predicted by the spud count projection in Figure 1 in order to determine the total number of new wells added in each year from 2007 – 2012, which was added to the base year 2006 to arrive at the total number of active wells in Carbon County for each of the projection years. Finally the total number of active wells in each year of the projection was multiplied by the ratio of the number of conventional gas wells to the number of CBM wells in Carbon County in 2006 to determine the number of active conventional gas wells.

It should be noted that this process inherently assumes that conventional and CBM wells will be added in proportion to their existing split in Carbon County – i.e. that there will not be a significant increase in only conventional gas exploration and production, or only CBM exploration and production. This assumption should be reconsidered if specific information is available on planned conventional vs. CBM activity in Carbon County.

[2] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

CBM Well Counts – CBM well counts in Carbon County have been plotted for the years 1970 – 2007 below in Figure 3, including projections to 2012.

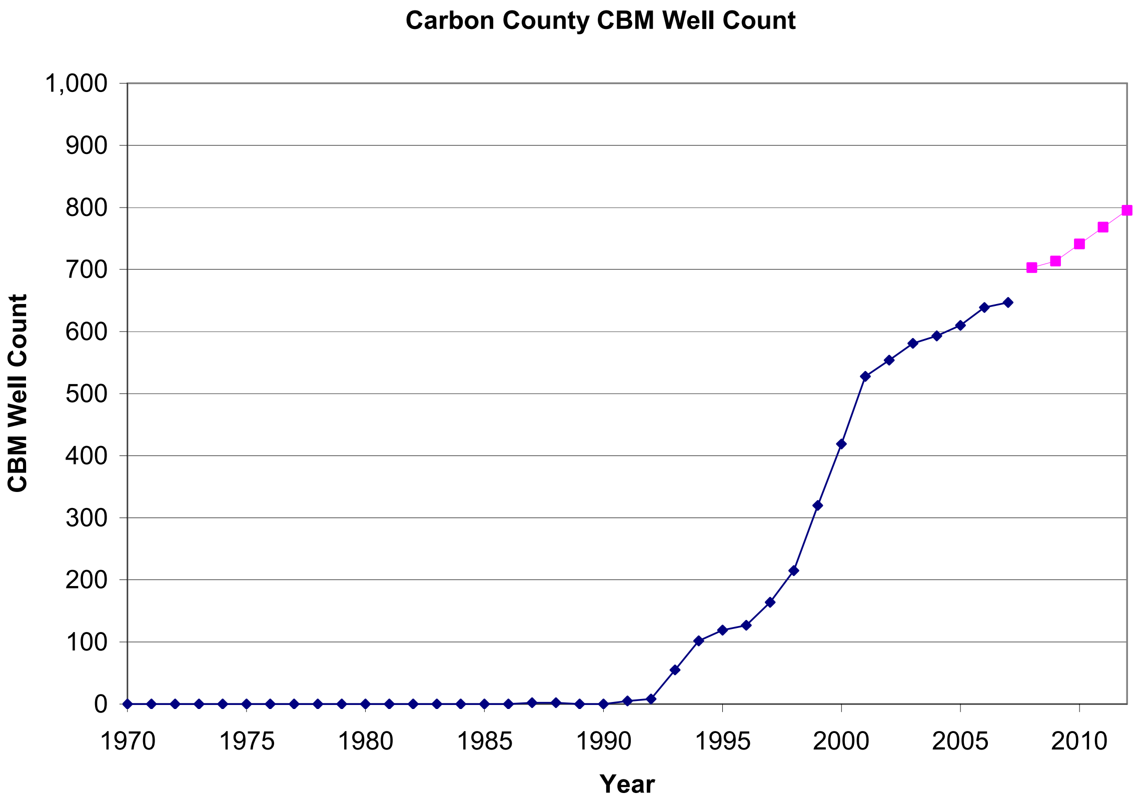

Figure 3. CBM well count historical data (from the IHS database) for Carbon County and projections to 2012. [3]

Total CBM well counts for Carbon County were projected using the methodology described above in the section on conventional well counts. The CBM well count projections were developed by applying the fraction of 2006 well counts in Carbon County that were CBM wells to the total projected active wells in the county for each year of the projection.

[3] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Total Gas Production – Gas production in Carbon County was analyzed and projected separately for conventional gas production and for CBM gas production. The projections of each of these two types of gas production were summed to obtain total gas production in the county for future years.

Conventional gas production in Carbon County has been plotted for the years 1970 – 2007 below in Figure 4, including projections to 2012.

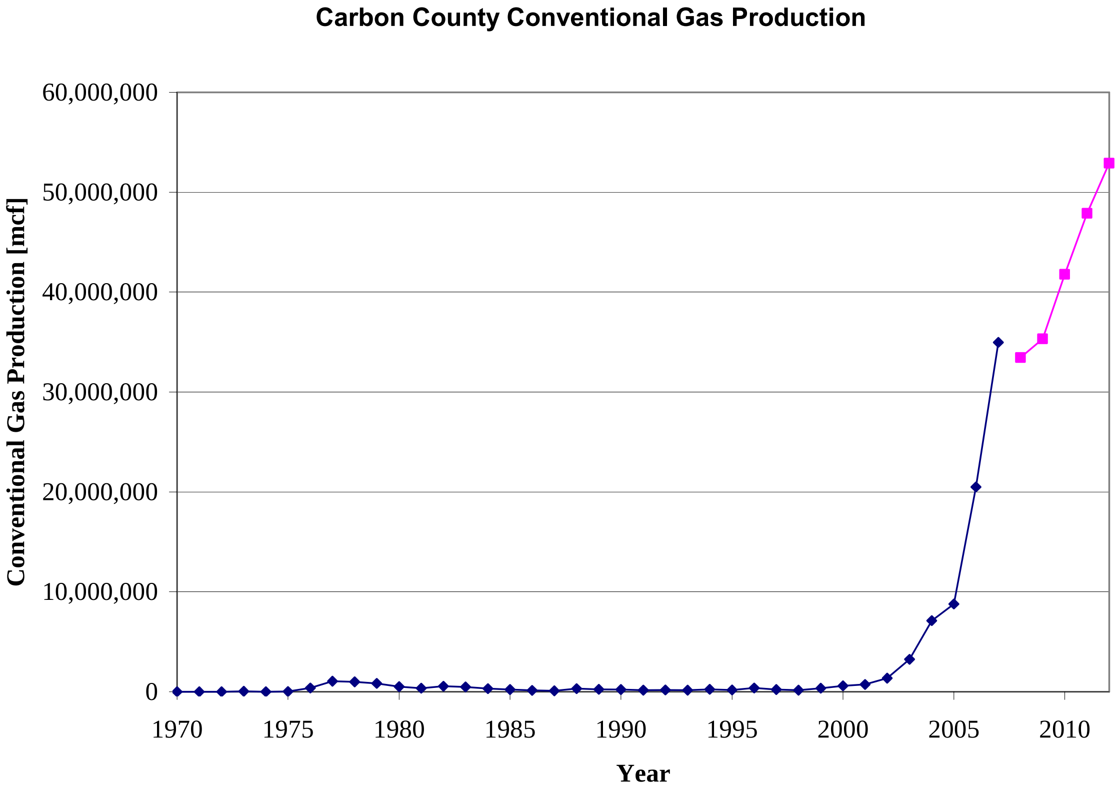

Figure 4. Conventional gas production historical data (from the IHS database) for Carbon County and projections to 2012. [4]

The analysis to determine conventional gas production projections in Carbon County relied on geologic reservoir data provided by the companies which was used to develop a production decline curve for typical gas wells in this county specifically (Buys & Associates, 2009). This is referred to as a decline curve and is shown below in Figure 5. As seen in Figure 5 the conventional gas production of a new well brought on-line peaks in the first year of operation of the well and then declines following an approximately exponential decline curve. The methodology used to determine future year conventional gas production in the county incorporated this decline data, as shown below in Equation (1):

[4] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Equation (1) $$P_i = \left[\left(N_{wells,i} - N_{wells,i-1} \right) \times 0.5 \times V_{Decline,0} + \sum_{j=0}^{20} \left(N_{wells,j} - N_{wells,j-1} \right) \times V_{Decline,j} \right] \times f$$

where:

P_i is the conventional gas production in the county in future year i [mscf]
$N_{wells,i}$ is the number of conventional gas wells in the county in future year i [# of wells]
$V_{Decline,0}$ is the first-year predicted production per well following a decline curve [mscf/well]
$V_{Decline,j}$ is the predicted production per well following a decline curve for year j [mscf/well]
j tracks the years of life of a conventional gas well in the county, assumed to be a maximum of 20
f is a correlation factor for wells that are plugged and abandoned and producing well fields that differ from the typical decline curve (assumed to be 1.50 for Carbon County)

Equation (1) essentially uses the conventional well count predictions of Figure 2 for a period of 20 previous years, assuming the same decline profile for all new wells added, and provides a prediction of the total production in Carbon County in a future year as the sum of these decline production values for each of the previous 20 years. The factor of 0.5 in Equation (1) is to account for the fact that in any current year new wells are added throughout the year. The correlation factor f was introduced to account for wells that are no longer active (e.g. plugged and abandoned) throughout the 20-year past calculation for each future year and also to account for production variances between well fields and the typical decline curve.

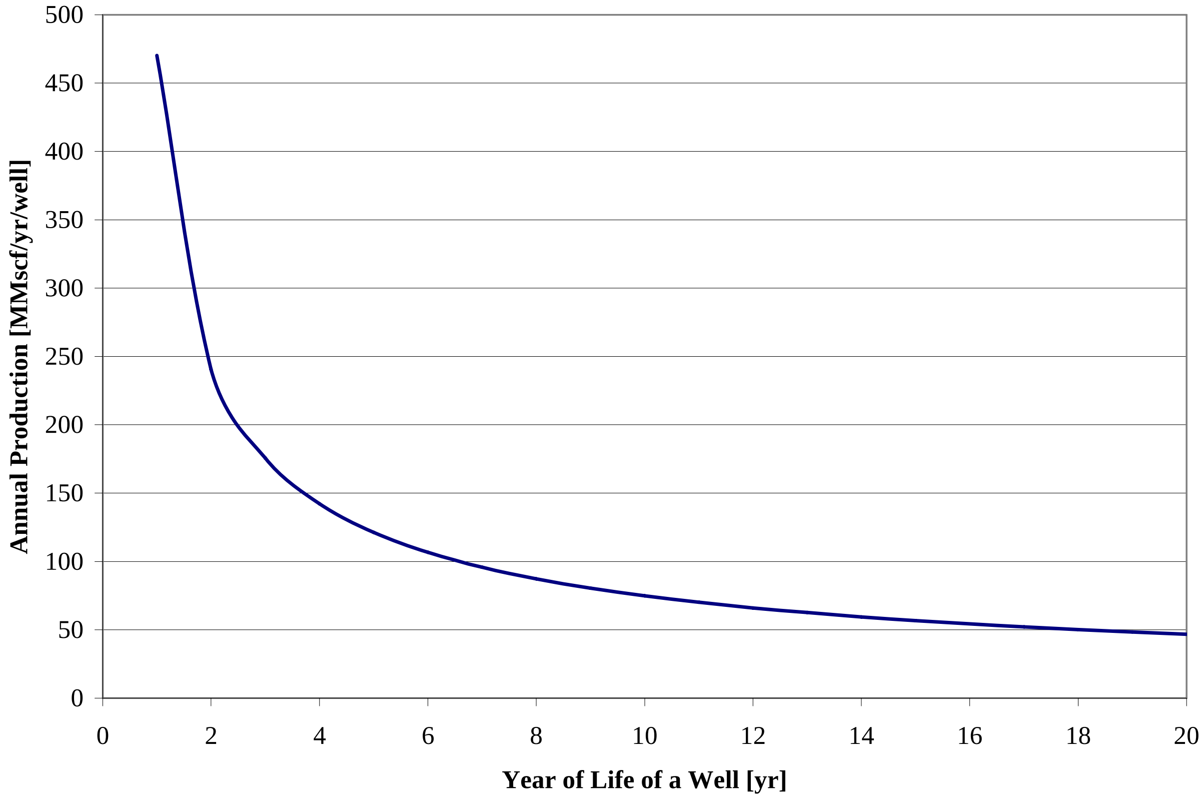

Figure 5. A typical decline curve showing well decline for an individual typical conventional gas well in Carbon County.

An analysis was conducted to justify the use of the typical decline curve and to determine whether the particular curve shown in Figure 5 was sufficiently accurate to be representative of conventional gas wells in Carbon County specifically. The analysis was conducted by using Equation (1) to predict Carbon County conventional gas production for years prior to 2007, for which IHS data was already available and could be used to compare the accuracy of this method. The results are shown below in Table 2 for calendar years 2000 – 2007 and show that this method, with the specific correlation factor selected, is reasonably accurate in predicting past county-level gas production volumes.

Table 2. Comparison of actual and predicted conventional gas production volumes for Carbon County for the years 2000– 2007 using the decline projection analysis.

Year	Actual Carbon County Conventional Gas Production [MCF]	Predicted Carbon County Conventional Gas Production [MCF]	Percentage Difference
2000	595,000	4,212,000	608%
2001	731,000	6,033,000	726%
2002	1,353,000	7,345,000	443%
2003	3,237,000	11,971,000	270%
2004	7,122,000	10,905,000	53%
2005	8,773,000	15,835,000	81%
2006	20,497,000	23,885,000	17%
2007	34,975,000	33,530,000	-4%

As Table 2 shows, the predicted conventional gas production in Carbon County using the decline curve method of Equation (1) and the actual conventional gas production in the County as obtained from the IHS database do not closely agree for the beginning portion of this period 2000 – 2005. However the agreement is reasonably accurate for the most recent years of activity, 2006-2007 in which there has been a significant growth in conventional gas production in the county. Differences between operator provided well decline data and actual formation performance, pipeline take-away constraints, and temporarily shut-in wells are potential contributing causes for the variation between actual and predicted gas production rates.

CBM gas production in Carbon County has been plotted for the years 1970 – 2007 below in Figure 6, including projections to 2012. CBM gas production has been in decline in the period 2002 – 2007, and no information obtained from participating companies would indicate that there would be any expected change to this decline through the mid-term projection year of 2012. However, for purposes of this analysis it was conservatively estimated that CBM gas production in Carbon County would continue at 2007 levels through the period 2007 – 2012.

Conventional and CBM gas production were summed to obtain projections of total gas production in Carbon County. Total gas production has been plotted for the years 1970 – 2007 below in Figure 7, including projections to 2012.

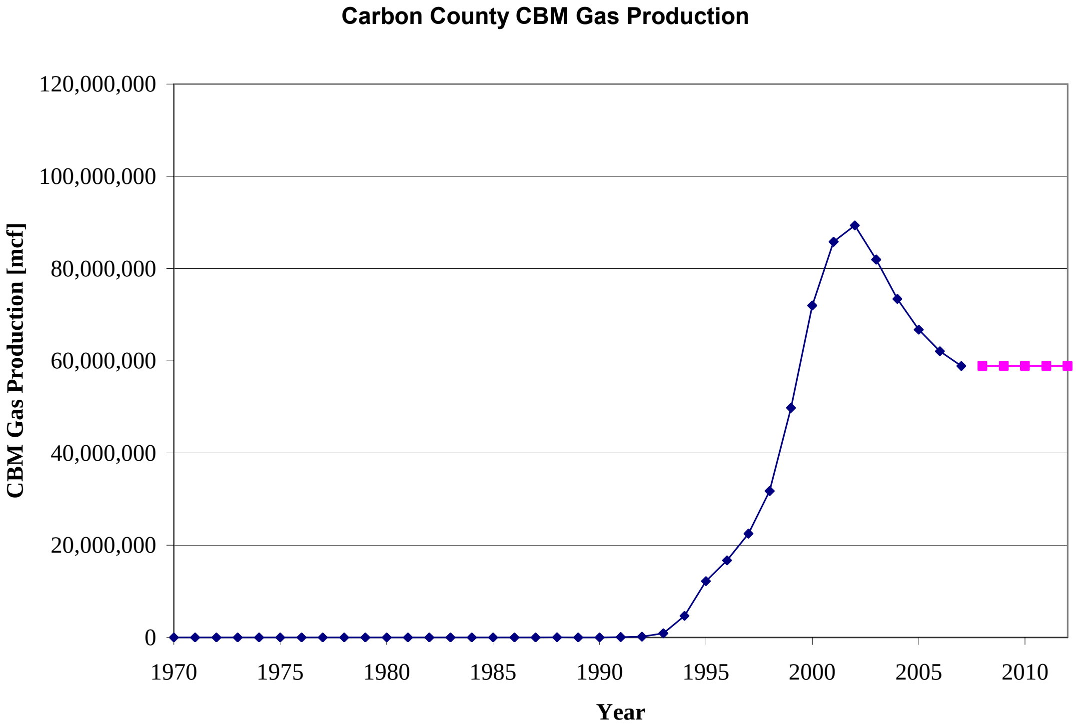

Figure 6. CBM gas production historical data (from the IHS database) for Carbon County and projections to 2012.[5]

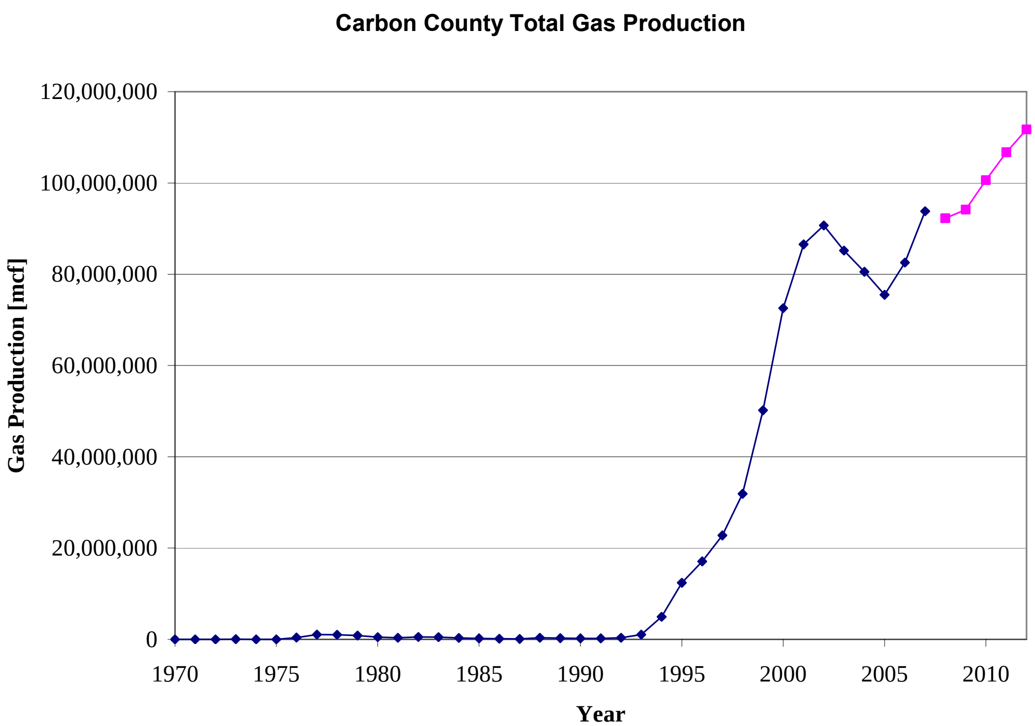

Figure 7. Total gas production historical data (from the IHS database) for Carbon County and projections to 2012.[6]

[5] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.
[6] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Condensate Production – Condensate production in Carbon County has been plotted for the years 1970 – 2007 below in Figure 8, including projections to 2012.

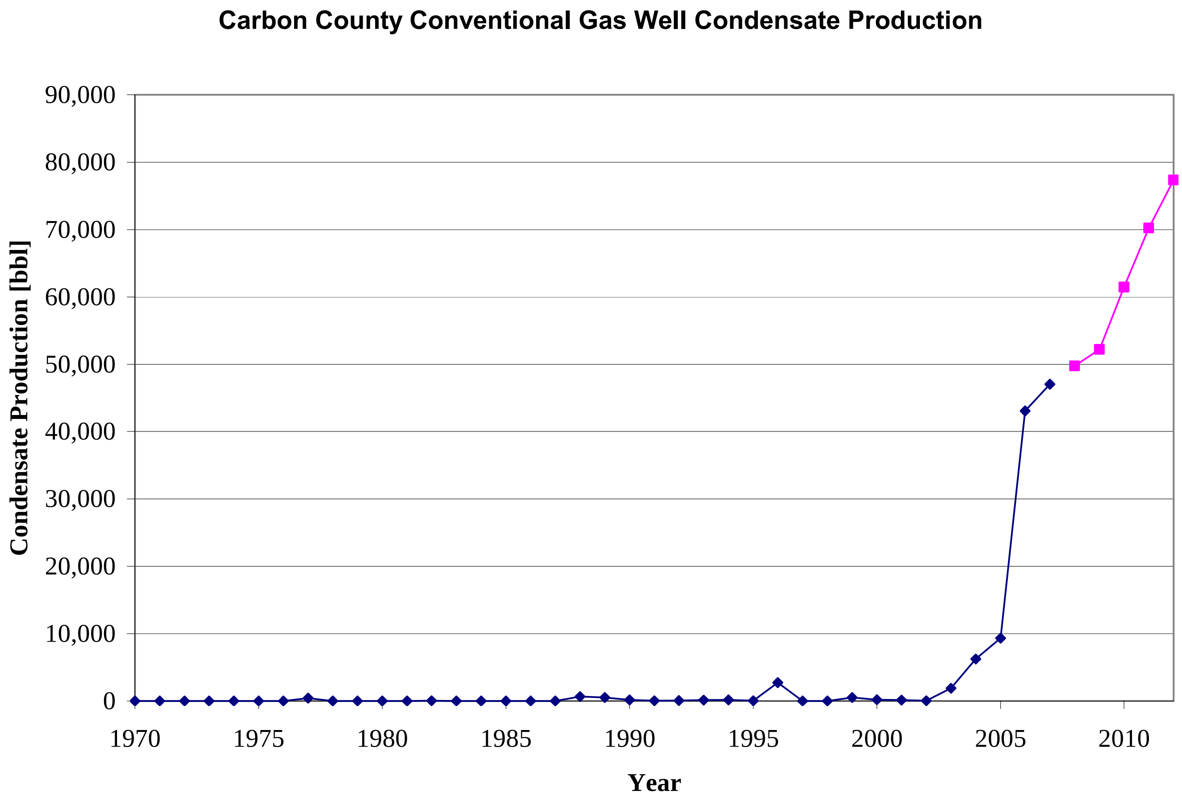

Figure 8. Condensate production historical data (from the IHS database) for Carbon County and projections to 2012. [7]

It was assumed that condensate production is a direct function of conventional gas production, since "condensate" in this analysis refers to liquid hydrocarbon production that is an associated product of natural gas at conventional gas wells. Therefore scaling factors were developed for each year from 2008 – 2012 that were the ratio of conventional gas production in that year to conventional gas production in the previous year. These scaling factors were then applied to the condensate production for each year from 2008 – 2012, and form the projections shown in Figure 8. It should be noted that this methodology is expected to result in a projection trend identical in form to that of the conventional gas production projections, as shown in a comparison of Figures 4 and 8. It should also be noted that CBM wells are assumed not to produce any condensate, as verified by gas composition analyses, IHS database analysis, and information provided by participating companies.

[7] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Oil Production – Oil production in Carbon County has been plotted for the years 1970 – 2007 below in Figure 9, including projections to 2012.

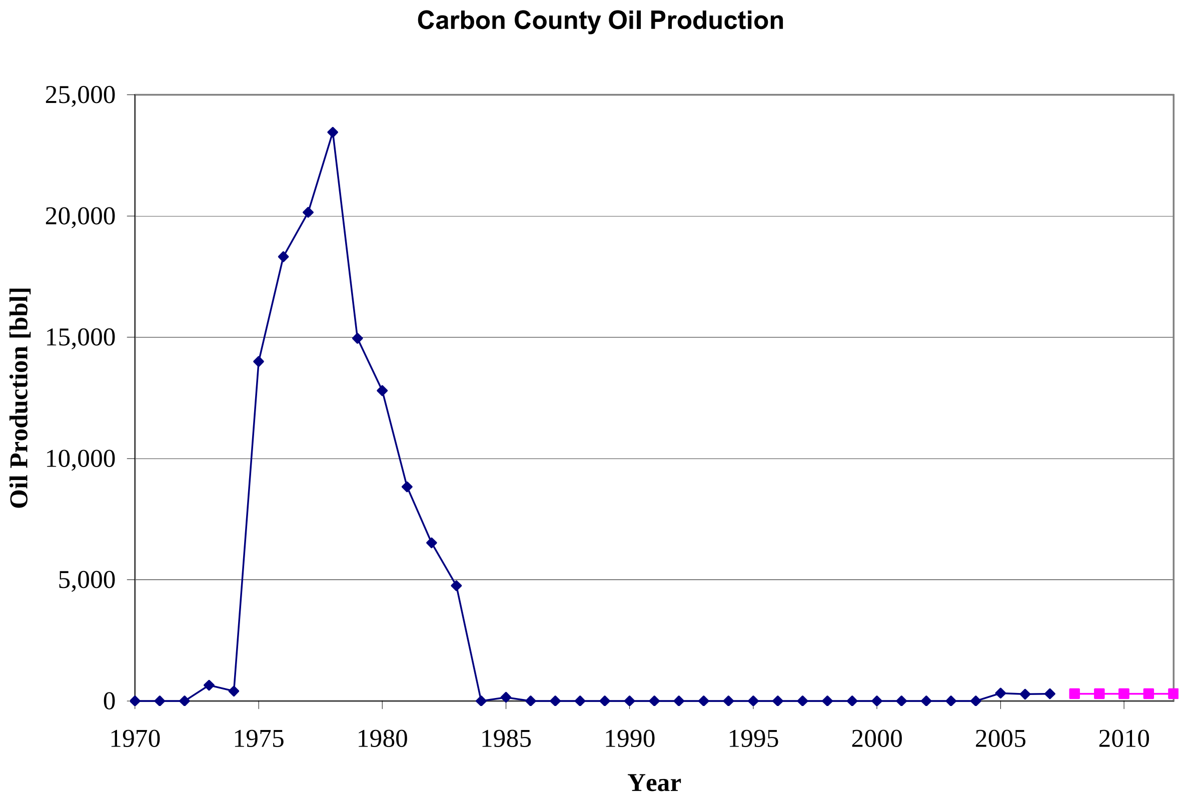

Figure 9. Oil production historical data (from the IHS database) for Carbon County and projections to 2012. [8]

Carbon County does not have a significant amount of oil production. No data indicated that there would be any likely growth in oil production, and so oil production was projected to be negligible in the years 2008 – 2012.

[8] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Duchesne County

Spud Counts – Spud counts in Duchesne County have been plotted for the years 1970 – 2007 below in Figure 10, including projections to 2012.

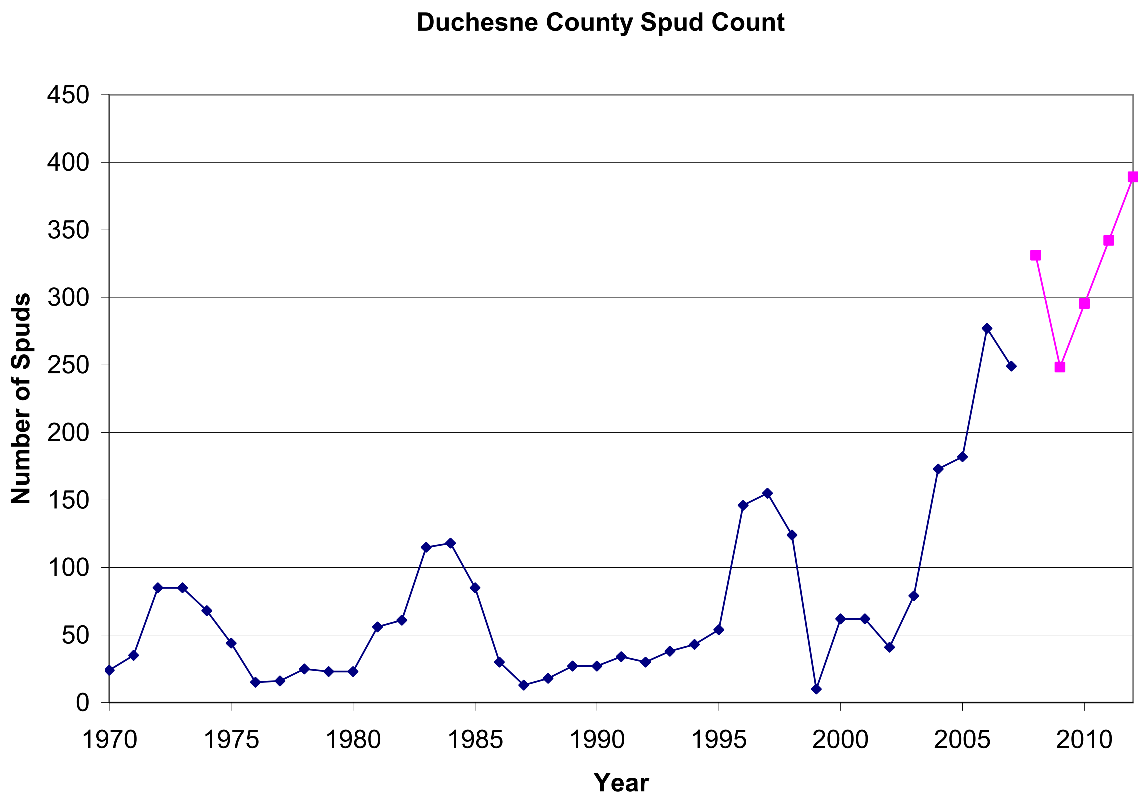

Figure 10. Spud count historical data (from the IHS database) for Duchesne County and projections to 2012.[9]

Similar to the methodology for spud count projections for Carbon County, spud counts were linearly projected for Duchesne County based on data from 2002 – 2007. A best-fit linear projection was used for projecting spud counts in 2007 – 2008, and then the spud count for 2009 was reduced by 25% and a second linear projection, with the same slope as the 2007 – 2008 projection was used for 2009 – 2012. The spud count projections were reduced in 2009 to account for an anticipated decline in activity in the Uinta Basin as described above.

[9] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Total Well Counts – Total well counts in Duchesne County have been plotted for the years 1970 – 2007 below in Figure 11, including projections to 2012.

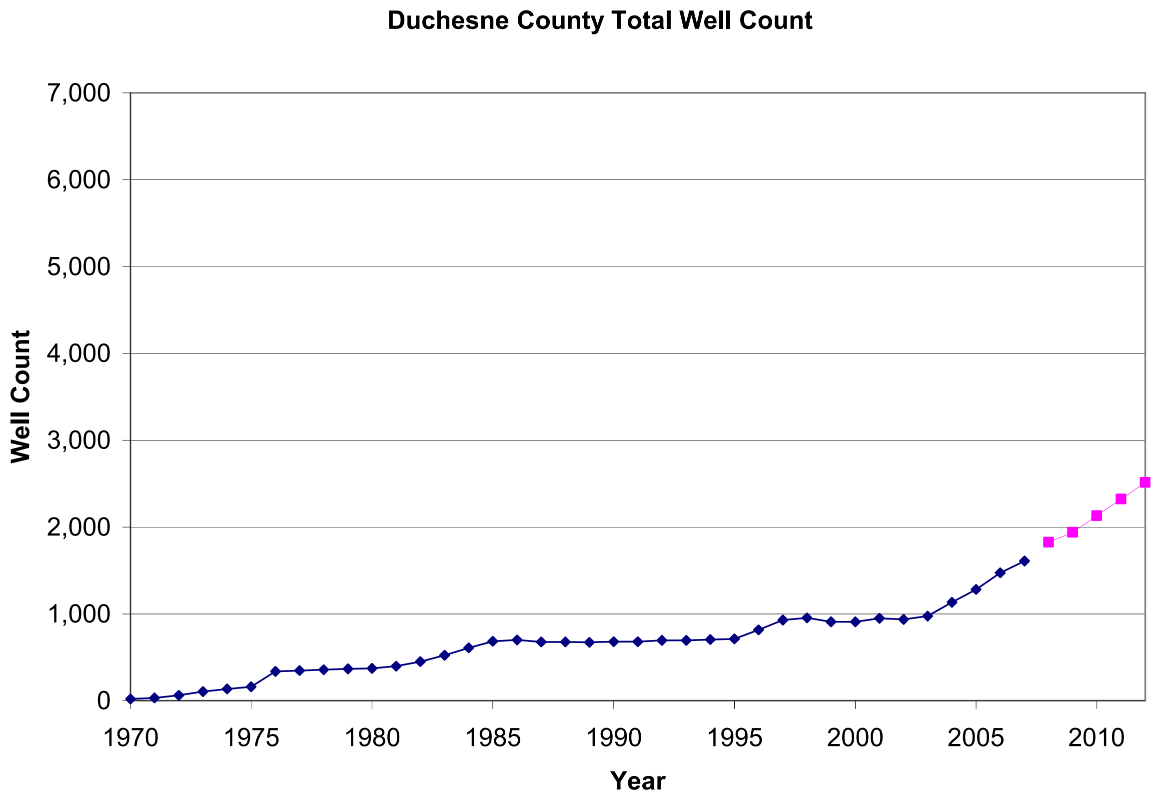

Figure 11. Total well count historical data (from the IHS database) for Duchesne County and projections to 2012. [10]

Total well count projections were developed for the period 2007 – 2012 by first developing a ratio of the number of spuds in each year from 2001 – 2007 to the number of new wells added in each of those years, similar to the methodology for Carbon County. This data for the years 2001 – 2007 was averaged to develop a single historical drilling rate estimate of 1.52. This drilling rate estimate was then applied to the spud count as predicted by the spud count projection in Figure 10 in order to determine the total number of new wells added in each year from 2007 – 2012, which was added to the base year 2006 to arrive at the total number of active wells in Duchesne County for each of the projection years. It should be noted that Duchesne County does not have any CBM activity, and thus no effort was made to distinguish well types in Duchesne County.

[10] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Gas Production – Gas production in Duchesne County has been plotted for the years 1970 – 2007 below in Figure 12, including projections to 2012.

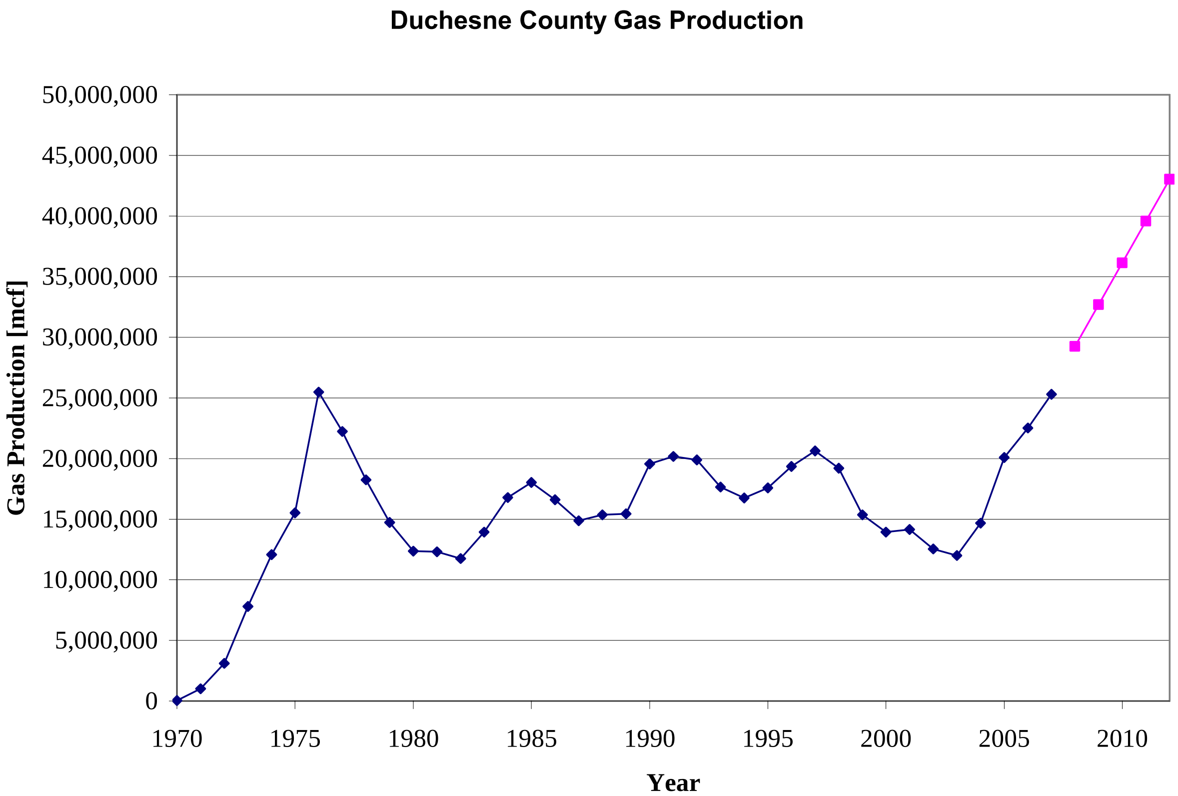

Figure 12. Gas production historical data (from the IHS database) for Duchesne County and projections to 2012. [11]

Gas production in Duchesne County was projected for the period 2008 – 2012 based on the historical data in Figure 12. A linear curve was best fit to the 2003 – 2007 gas production data, and this curve was extrapolated to 2012.

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Condensate Production – Condensate production in Duchesne County has been plotted for the years 1970 – 2007 below in Figure 13, including projections to 2012.

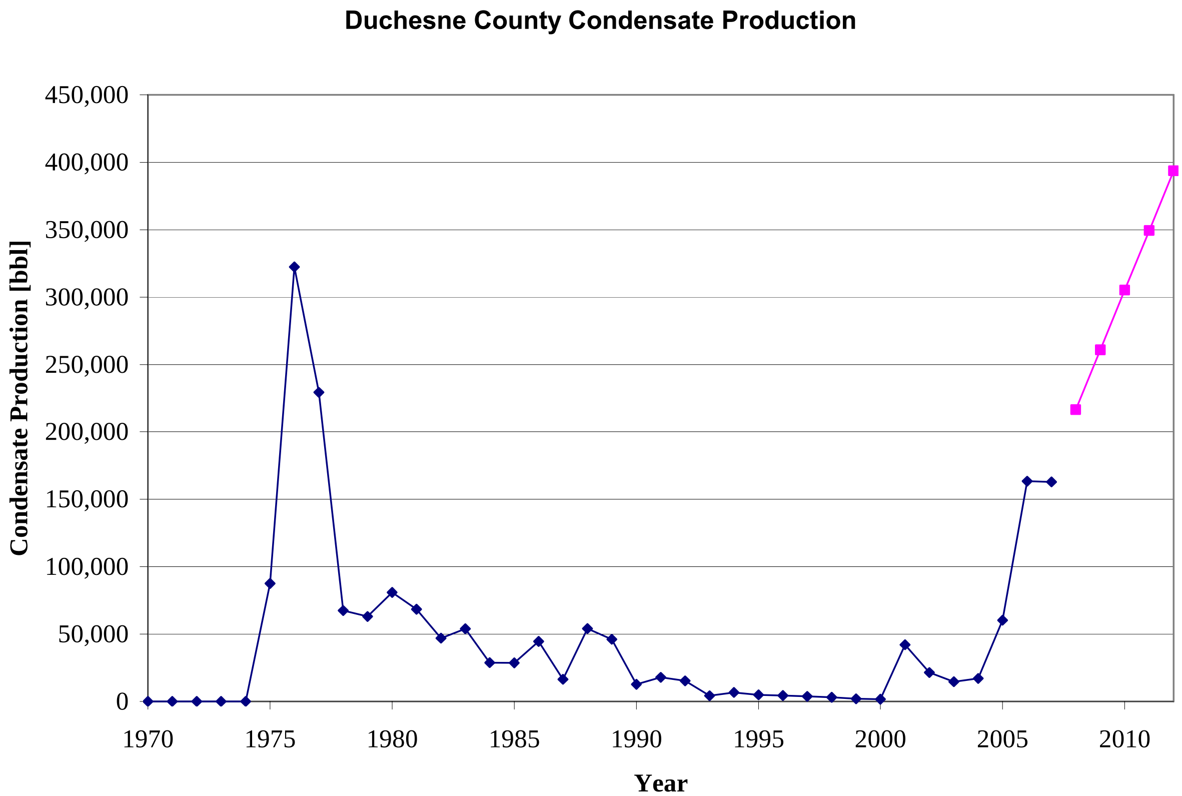

Figure 13. Condensate production historical data (from the IHS database) for Duchesne County and projections to 2012. [12]

Similar to the methodology used for Duchesne County gas production, the condensate production for the period 2007 – 2012 was projected based on the historical data shown in Figure 13. A linear curve was best fit to the 2004 – 2007 condensate production data, and this curve was extrapolated to 2012.

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Oil Production – Oil production in Duchesne County has been plotted for the years 1970 – 2007 below in Figure 14 including projections to 2012.

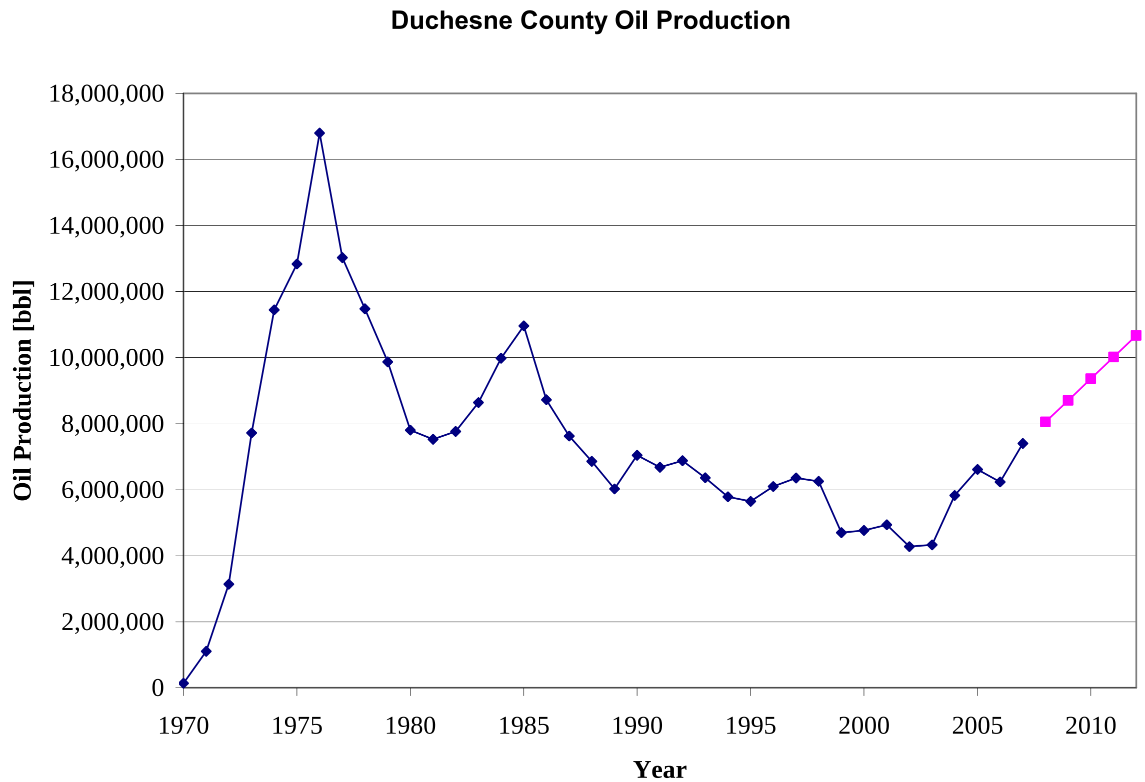

Figure 14. Oil production historical data (from the IHS database) for Duchesne County and projections to 2012. [13]

Similar to the methodology used for Duchesne County gas and condensate production, the oil production for the period 2007 – 2012 was projected based on the historical data shown in Figure 14. A linear curve was best fit to the 2003 – 2007 oil production data, and this curve was extrapolated to 2012.

[13] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Emery County

Spud Counts – Spud counts in Emery County have been plotted for the years 1970 – 2007 below in Figure 15, including projections to 2012.

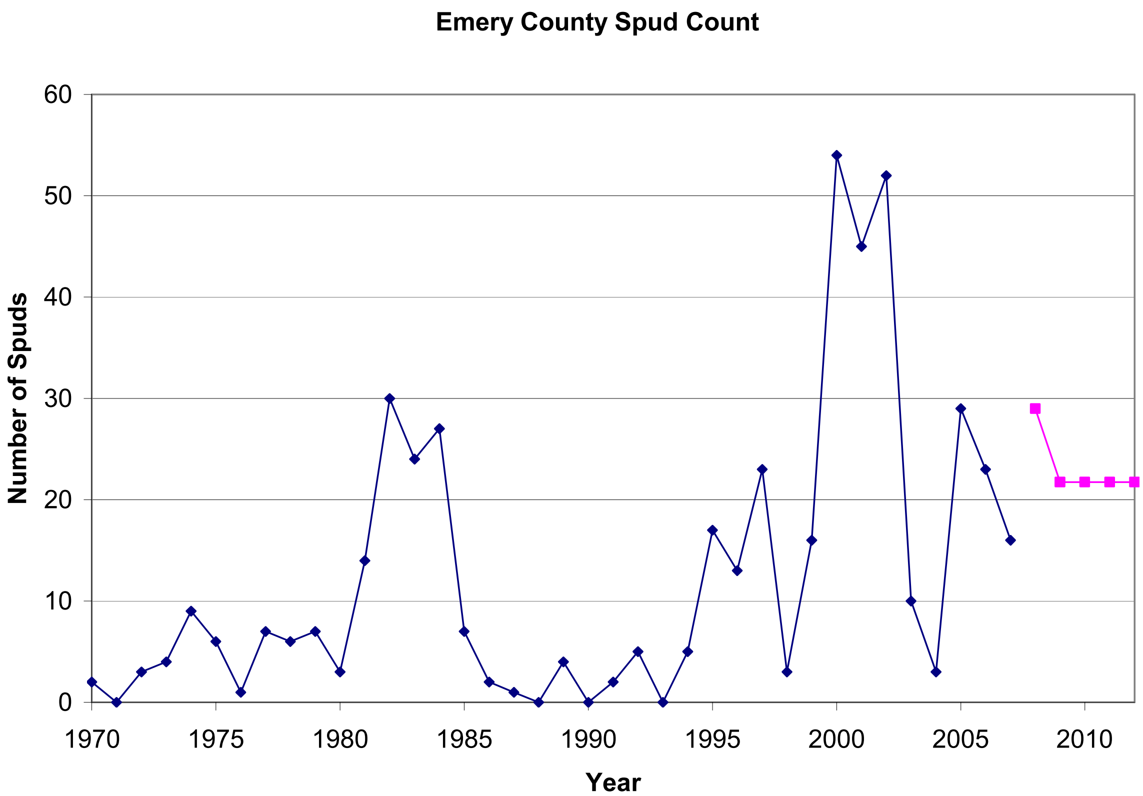

Figure 15. Spud count historical data (from the IHS database) for Emery County and projections to 2012.[14]

Spud counts in Emery County were developed based on the recent historical trends in drilling in the county shown in Figure 15, however it should be noted that drilling in Emery County has historically been sporadic and therefore difficult to characterize for purposes of projections. Therefore it was determined that the only reasonable approach to characterize spud counts for 2008 was to take a simple average of the annual spud counts in the period 2000 – 2007 since this is roughly indicative of the period of recent activity in the Uinta Basin. The 2009 spud counts were reduced from the 2008 levels by 25% to account for a decline in activity in the Uinta basin as described above, and then for the period 2010 – 2012 it was assumed that annual spud counts would remain at the 2009 levels.

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Conventional Well Counts – Conventional well counts in Emery County have been plotted for the years 1970 – 2007 below in Figure 16, including projections to 2012.

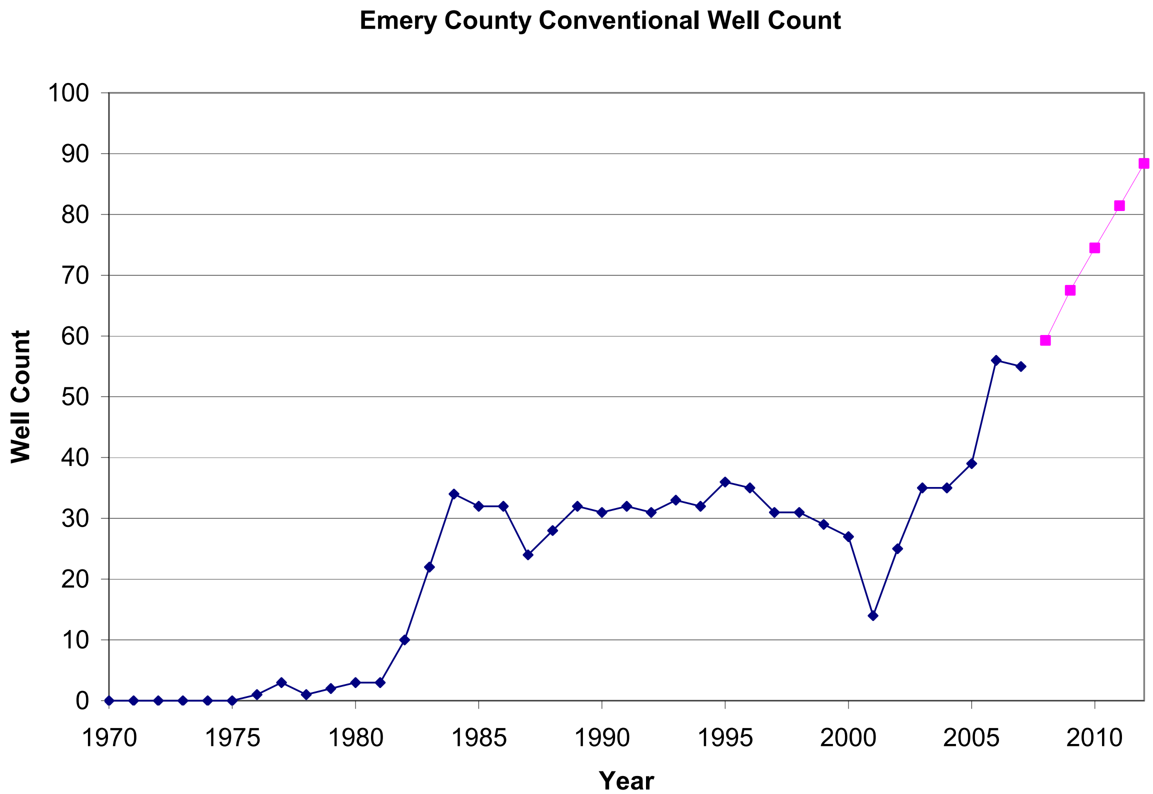

Figure 16. Conventional well count historical data (from the IHS database) for Emery County and projections to 2012. [15]

Similar to the methodology used to develop conventional well count projections for Carbon County, conventional gas well count projections were developed for the period 2007 – 2012 by first developing a ratio of the number of spuds to the number of new wells added for Emery County. However, because of the erratic historical drilling rates in Emery County it was impossible to determine an average drilling rate from this data. So for Emery County, the historic average drilling rate of the entire Uinta Basin was used, and estimated to be 1.40. This drilling rate estimate was then applied to the spud count as predicted by the spud count projection in Figure 15 in order to determine the total number of new wells added in each year from 2007 – 2012, which was added to the base year 2006 to arrive at the total number of active wells in Emery County for each of the projection years. Finally the total number of active wells in each year of the projection was multiplied by the ratio of the number of conventional gas wells to the number of CBM wells in Emery County in 2006 to determine the number of active conventional gas wells.

[15] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

CBM Well Counts – CBM well counts in Emery County have been plotted for the years 1970 – 2007 below in Figure 17, including projections to 2012.

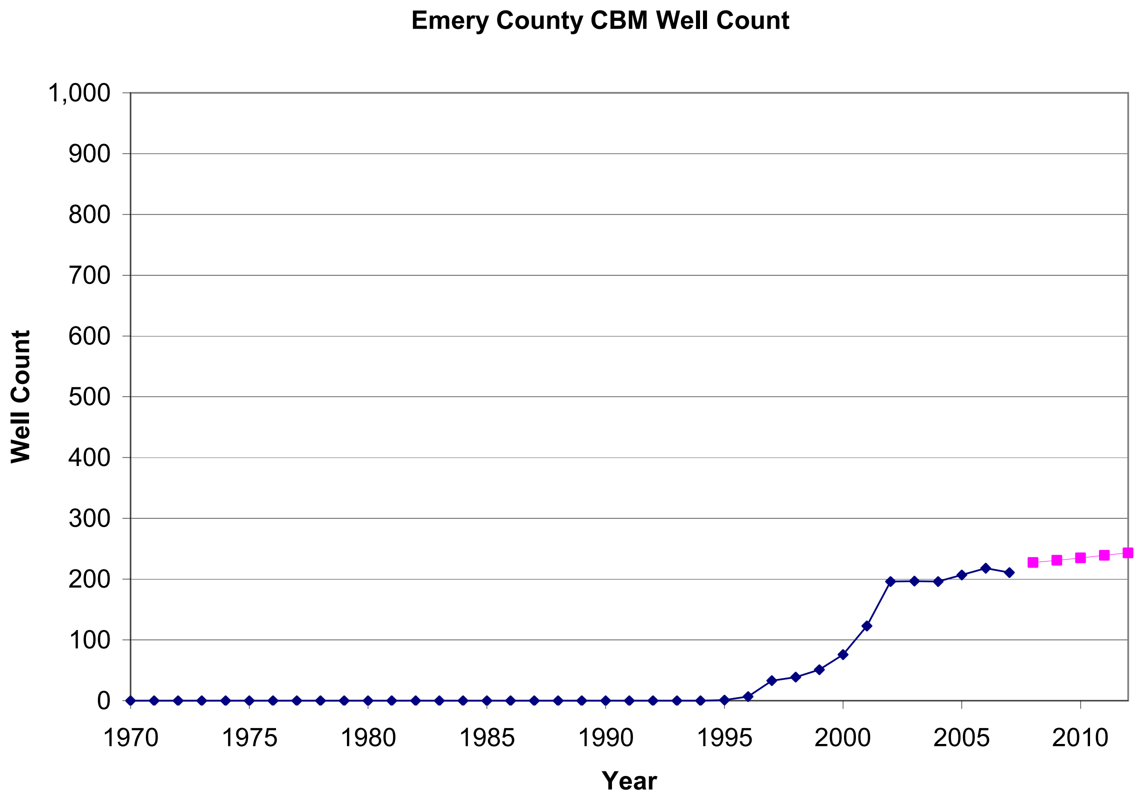

Figure 17. CBM well count historical data (from the IHS database) for Emery County and projections to 2012. [16]

Total CBM well counts for Emery County were projected using the methodology described above in the section on conventional well counts. The CBM well count projections were developed by applying the fraction of 2006 well counts in Emery County that were CBM wells to the total projected active wells in the county for each year of the projection.

[16] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Total Gas Production – Gas production in Emery County was analyzed and projected separately for conventional gas production and for CBM gas production. The projections of each of these two types of gas production were summed to obtain total gas production in the county for future years.

Conventional gas production in Emery County has been plotted for the years 1970 – 2007 below in Figure 18, including projections to 2012.

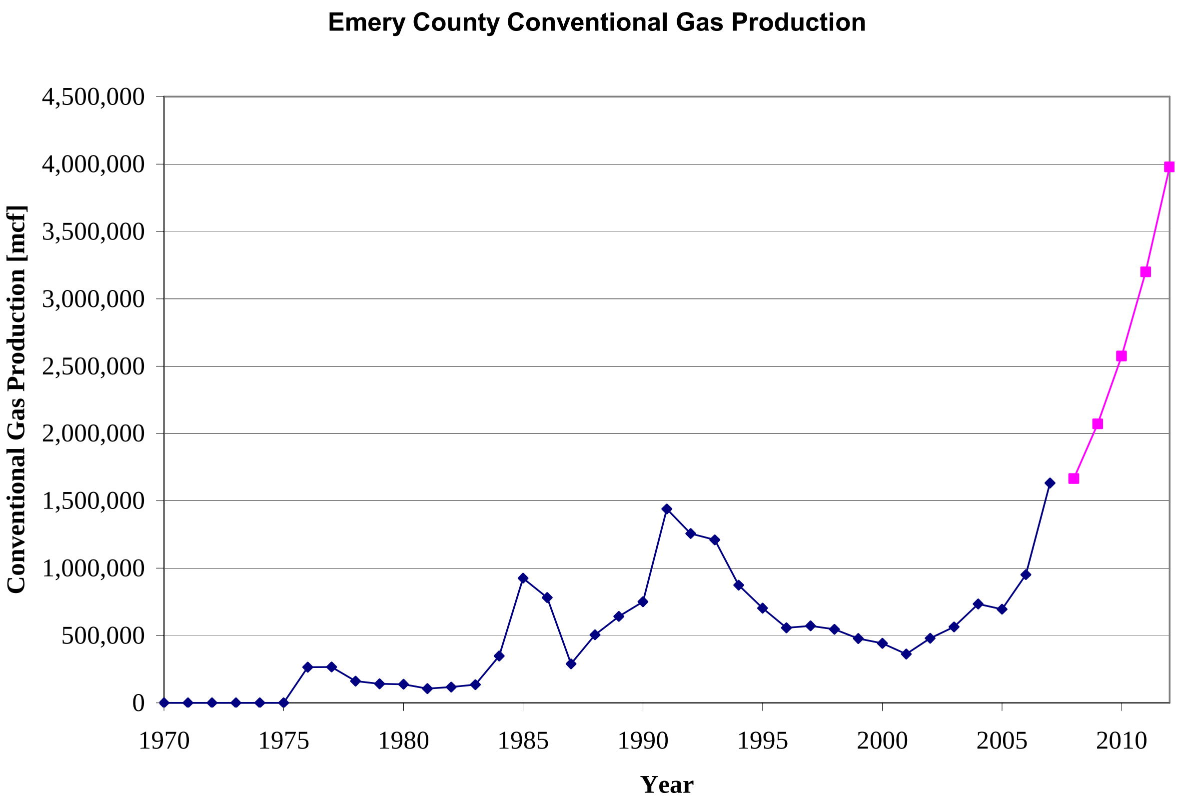

Figure 18. Conventional gas production historical data (from the IHS database) for Emery County and projections to 2012. [17]

The conventional gas production in Emery County for the period 2007 – 2012 was projected based on the historical data shown in Figure 18. An exponential curve was best fit to the 2001 – 2007 conventional gas production data, and this curve was extrapolated to 2012.

CBM gas production in Emery County has been plotted for the years 1970 – 2007 below in Figure 19, including projections to 2012.

[17] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

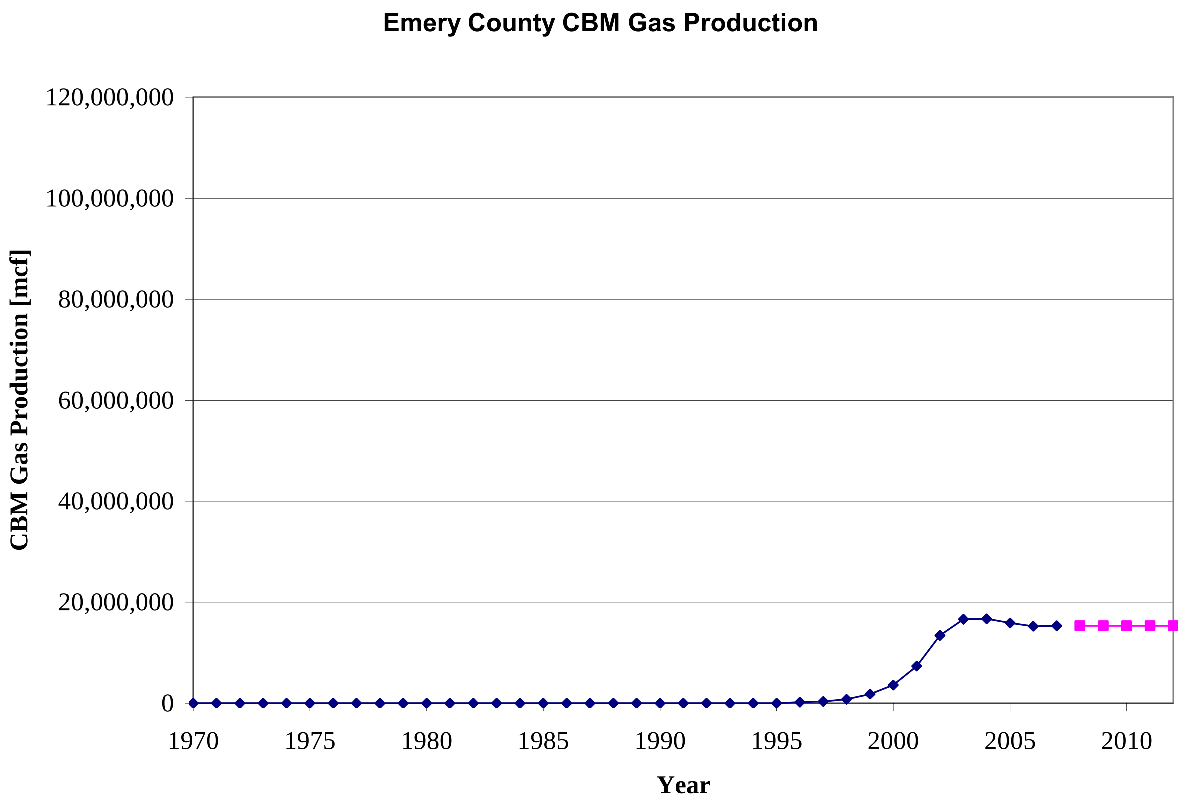

Figure 19. CBM gas production historical data (from the IHS database) for Emery County and projections to 2012.[18]

CBM gas production in Emery County has been slowly declining from a peak in the 2003 – 2004 time period, but was conservatively estimated to remain at 2007 levels for the projected period 2007 – 2012.

Conventional and CBM gas production were summed to obtain projections of total gas production in Emery County. Total gas production has been plotted for the years 1970 – 2007 below in Figure 20, including projections to 2012.

[18] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

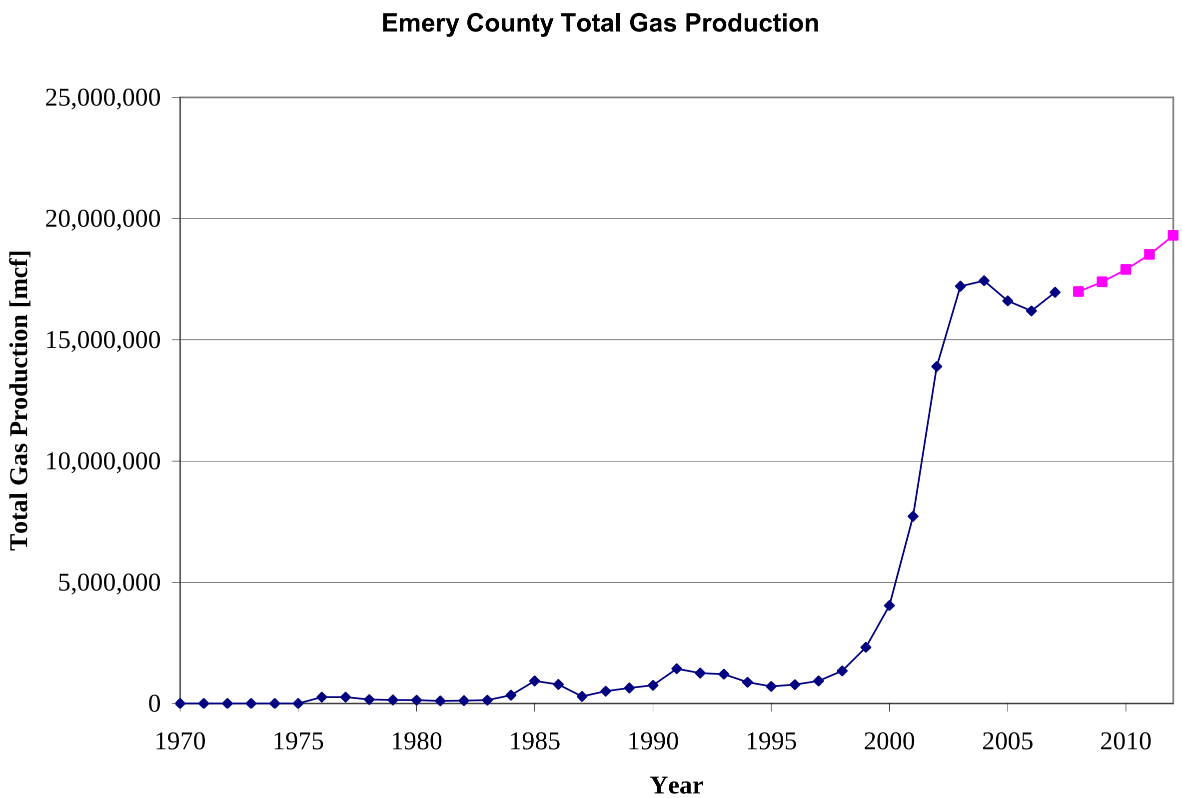

Figure 20. Total gas production historical data (from the IHS database) for Emery County and projections to 2012. [19]

[19] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Condensate Production – Condensate production in Emery County has been plotted for the years 1970 – 2006 below in Figure 21, including projections to 2012.

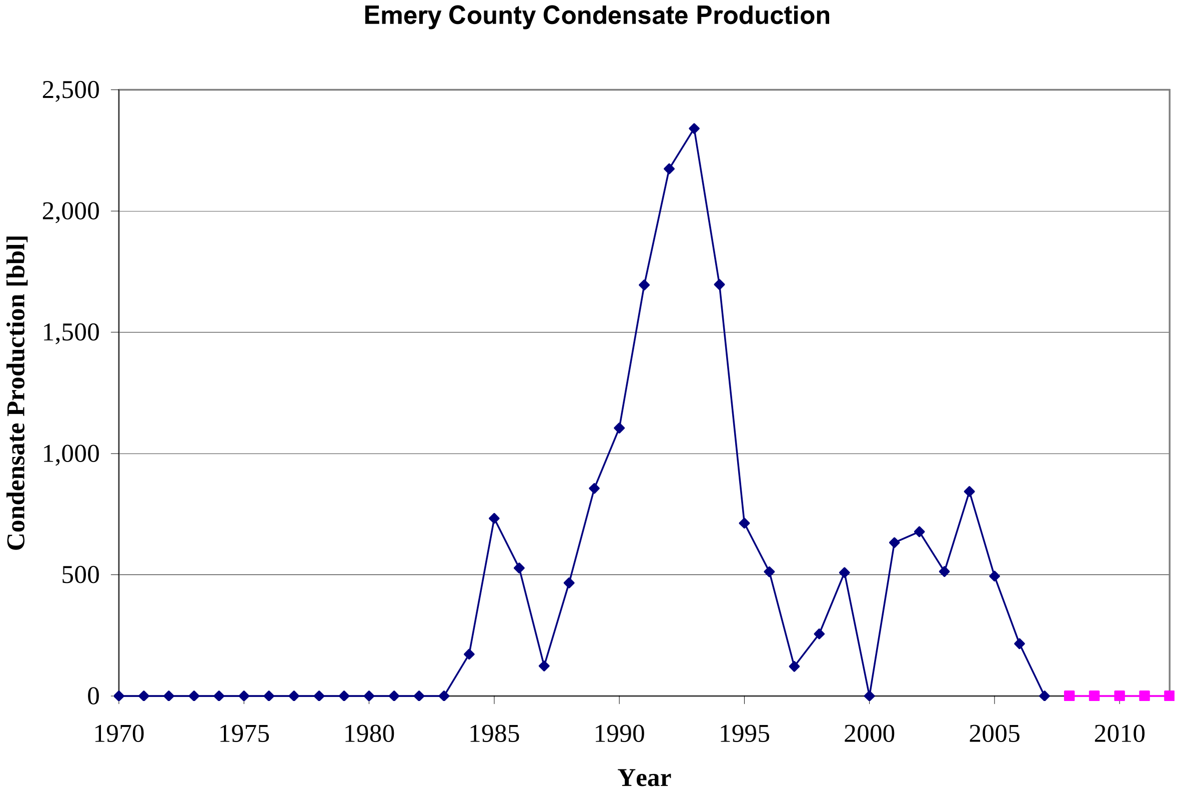

Figure 21. Condensate production historical data (from the IHS database) for Emery County and projections to 2012. [20]

Condensate production in Emery County peaked in 1993 at approximately 2,400 bbl/yr and declined substantially from this peak by the year 2000. During the period 2000 – 2004 there was again an increase in condensate production, peaking at less than 1,000 bbl/yr in 2004 and then declining sharply. In 2007 no condensate was produced in Emery County. Given the erratic nature of condensate production in Emery County and the decline from 2004 – 2007 it was projected that there would be no additional condensate production in Emery County in the period 2007 – 2012.

[20] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Oil Production – Oil production in Emery County has been plotted for the years 1970 – 2006 below in Figure 22, including projections to 2012.

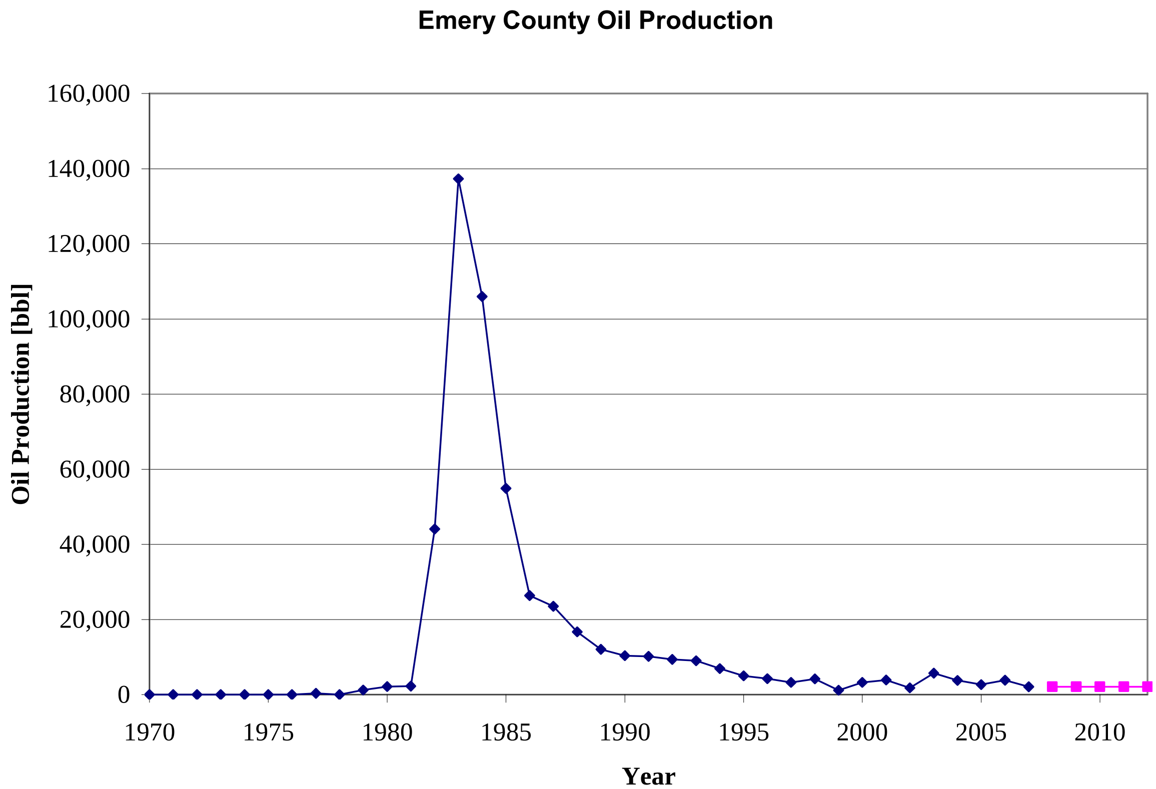

Figure 22. Oil production historical data (from the IHS database) for Emery County and projections to 2012.[21]

Oil production in Emery County peaked in the mid-1980's and has steadily declined since that time. There is some small and erratic oil production during the period 2000 – 2007, and so it was conservatively estimated that oil production would continue at 2007 levels for the period 2007 – 2012.

[21] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Grand County

Spud Counts – Spud counts in Grand County have been plotted for the years 1970 – 2006 below in Figure 23, including projections to 2012.

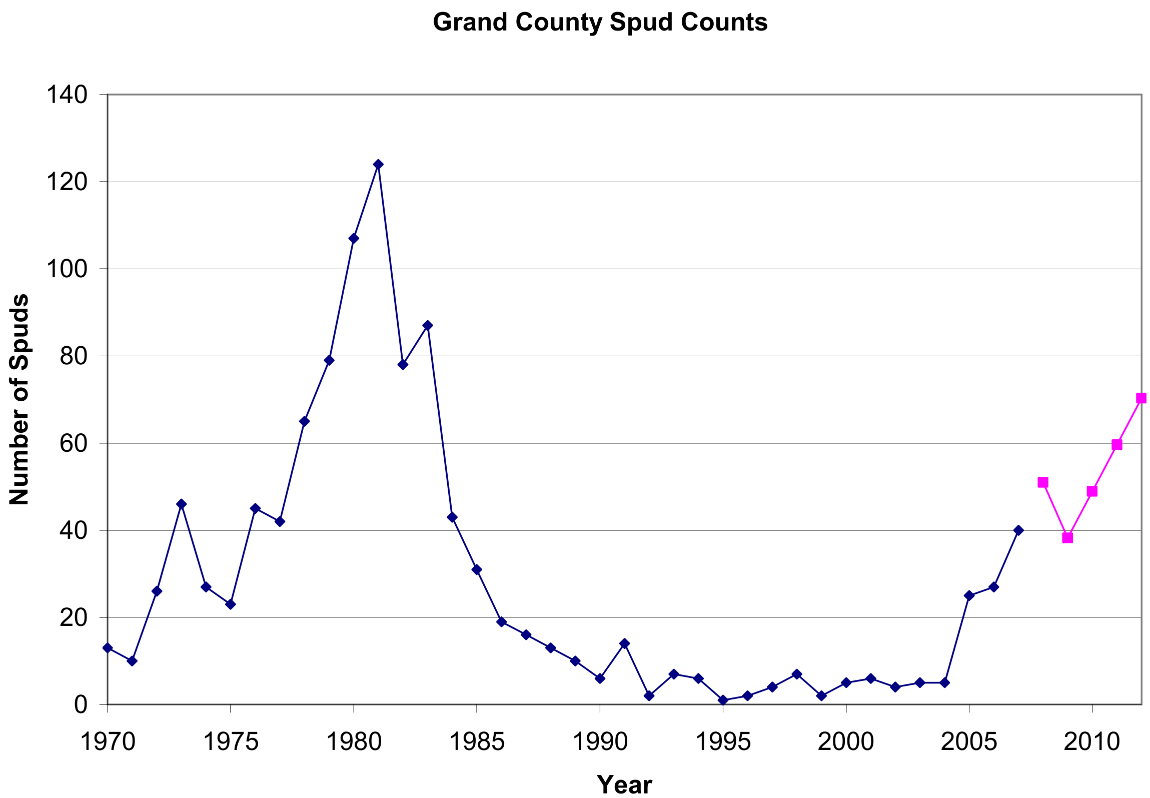

Figure 23. Spud count historical data (from the IHS database) for Grand County and projections to 2012. [22]

Similar to the methodology for spud count projections for Carbon and Duchesne Counties, spud counts were linearly projected for Grand County based on data from 2004 – 2007. A best-fit linear projection was used for projecting spud counts in 2007 – 2008, and then the spud count for 2009 was reduced by 25% and a second linear projection, with the same slope as the 2007 – 2008 projection was used for 2009 – 2012. The spud count projections were reduced in 2009 to account for an anticipated decline in activity in the Uinta Basin as described above.

[22] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Total Well Counts – Total well counts in Grand County have been plotted for the years 1970 – 2006 below in Figure 24, including projections to 2012.

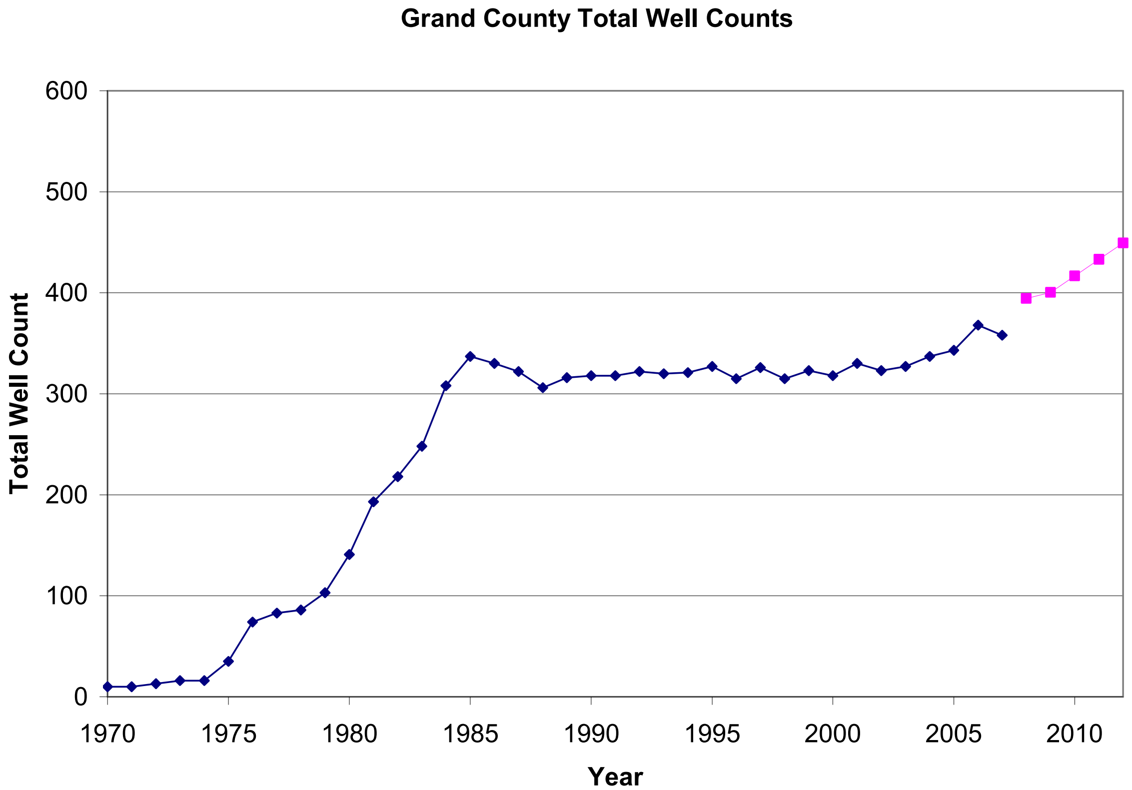

Figure 24. Total well count historical data (from the IHS database) for Grand County and projections to 2012.[23]

Total well count projections were developed for the period 2007 – 2012 by first developing a ratio of the number of spuds to the number of new wells added. Similar to Emery County, this ratio was highly variable for Grand County and thus the historic average drilling rate for the entire Uinta Basin was used, estimated to be 1.40. This drilling rate estimate was then applied to the spud count as predicted by the spud count projection in Figure 23 in order to determine the total number of new wells added in each year from 2007 – 2012, which was added to the base year 2006 to arrive at the total number of active wells in Grand County for each of the projection years. It should be noted that Grand County does not have any CBM activity, and thus no effort was made to distinguish well types in Grand County.

[23] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Gas Production – Gas production in Grand County has been plotted for the years 1970 – 2006 below in Figure 25, including projections to 2012.

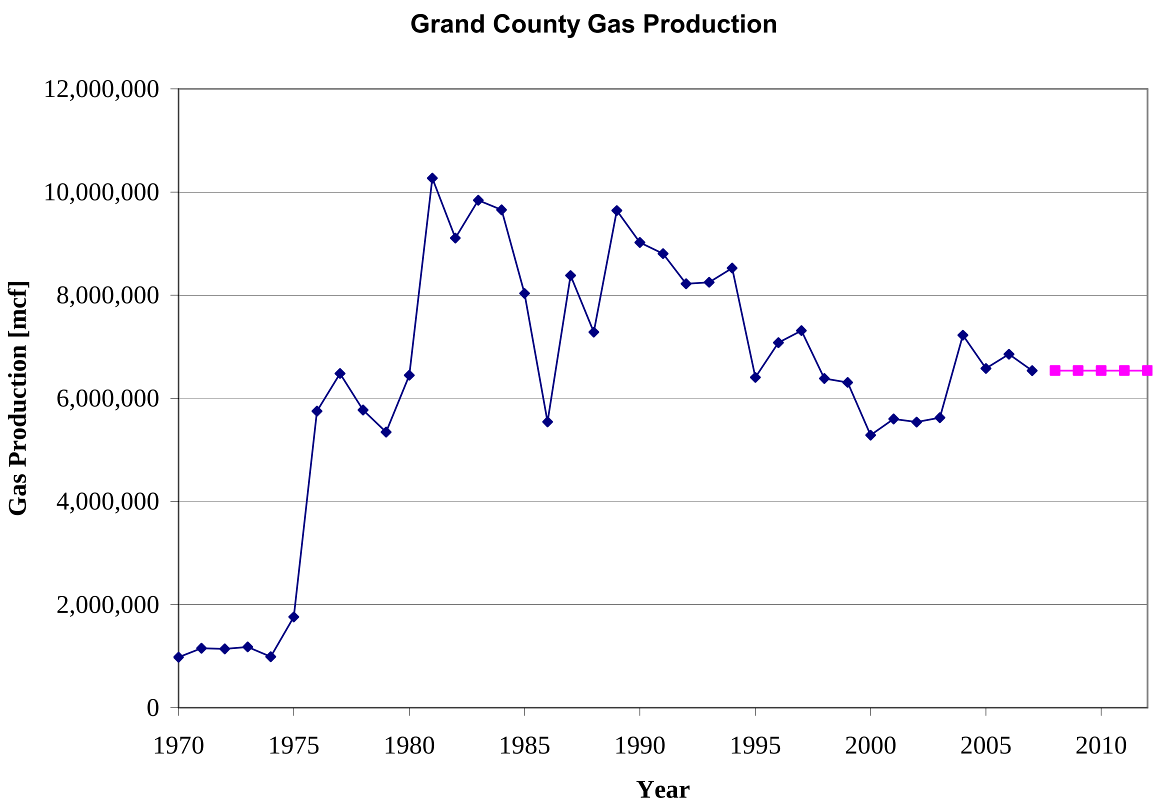

Figure 25. Gas production historical data (from the IHS database) for Grand County and projections to 2012. [24]

Historic gas production in Grand County was determined to be too variable to predict future year production levels with any reasonable accuracy. Therefore gas production was projected to remain at 2007 levels for the period 2007 – 2012.

[24] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Condensate Production – Condensate production in Grand County has been plotted for the years 1970 – 2006 below in Figure 26, including projections to 2012.

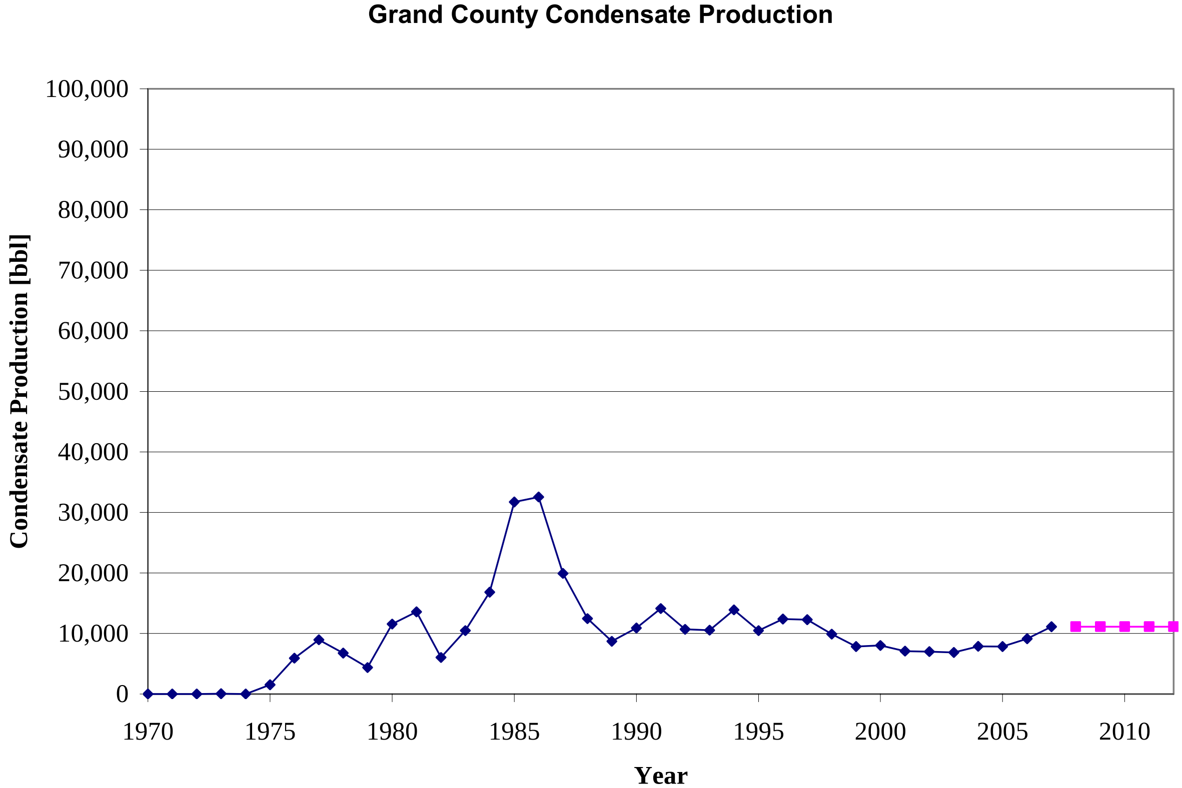

Figure 26. Condensate production historical data (from the IHS database) for Grand County and projections to 2012.[25]

Condensate production has been relatively steady in Grand County at 10,000 bbl/yr for the period 1977 – 2007, with a brief peak in the mid-1980's. Therefore it was conservatively assumed that condensate production would remain at 2007 levels for the period 2007 – 2012.

[25] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Oil Production – Oil production in Grand County has been plotted for the years 1970 – 2006 below in Figure 27, including projections to 2012.

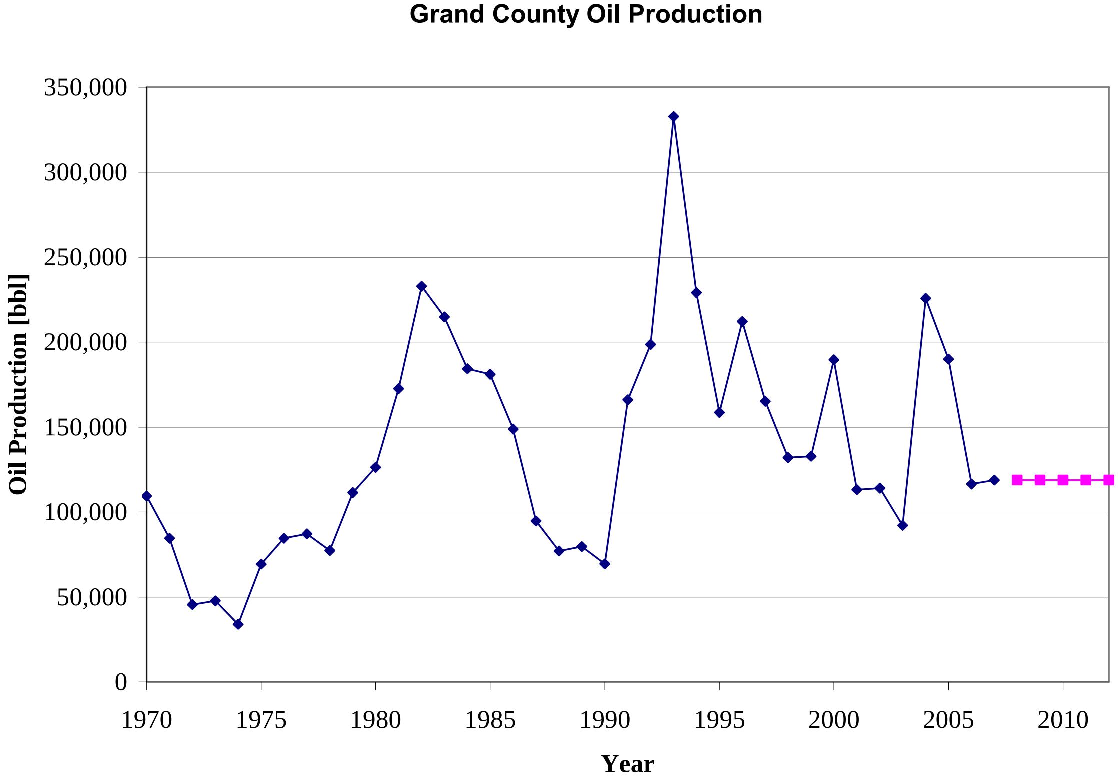

Figure 27. Oil production historical data (from the IHS database) for Grand County and projections to 2012. [26]

Oil production in Grand County peaked in 1993 at approximately 340,000 bbl/yr and has been generally declining since. However there is significant year-to-year variability in the oil production in this county, therefore it was conservatively projected that oil production would continue to remain at the annual production level in 2006 for the projection period of 2007 – 2012.

[26] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Uintah County

Spud Counts – Spud counts in Uintah County have been plotted for the years 1970 – 2006 below in Figure 28, including projections to 2012.

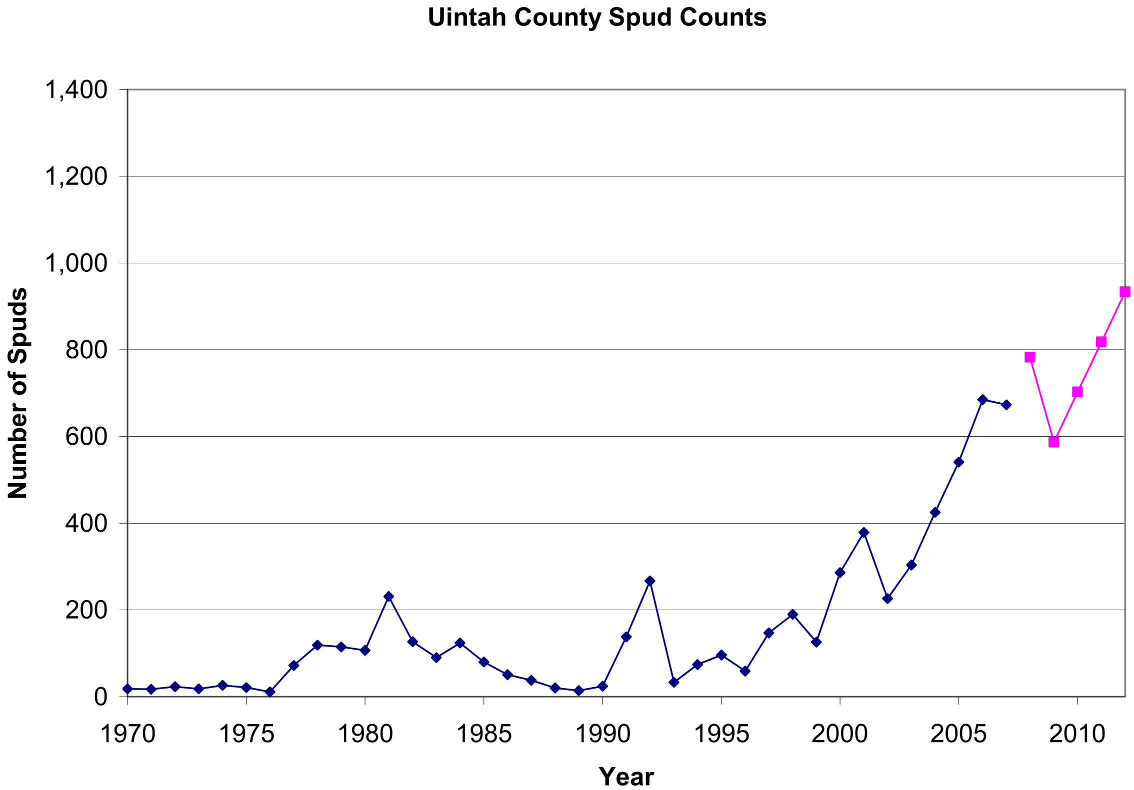

Figure 28. Spud count historical data (from the IHS database) for Uintah County and projections to 2012.[27]

Similar to the methodology for spud count projections for Carbon, Duchesne and Grand Counties, spud counts were linearly projected for Uintah County based on data from 2002 – 2007. A best-fit linear projection was used for projecting spud counts in 2007 – 2008, and then the spud count for 2009 was reduced by 25% and a second linear projection, with the same slope as the 2007 – 2008 projection was used for 2009 – 2012. The spud count projections were reduced in 2009 to account for an anticipated decline in activity in the Uinta Basin as described above.

[27] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Total Well Counts – Total well counts in Uintah County have been plotted for the years 1970 – 2006 below in Figure 29, including projections to 2012.

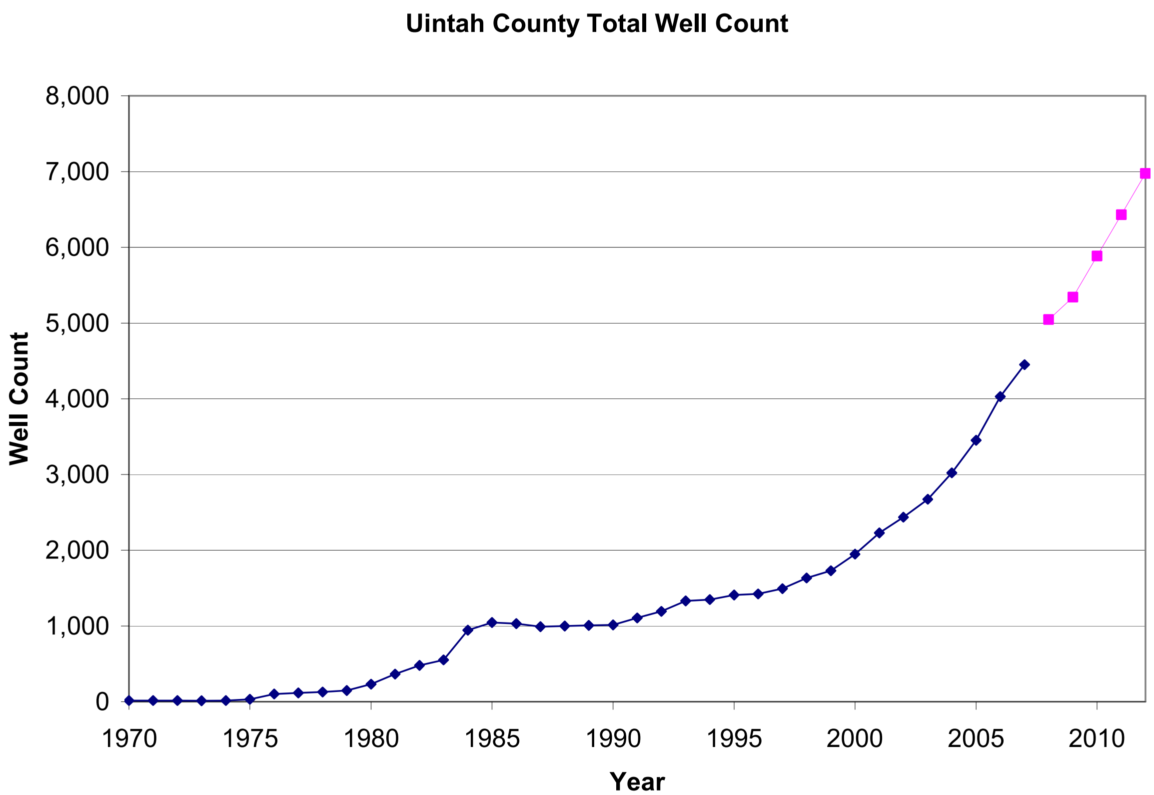

Figure 29. Total well count historical data (from the IHS database) for Uintah County and projections to 2012.[28]

Total well count projections were developed for the period 2007 – 2012 by first developing a ratio of the number of spuds in each year from 2003 – 2007 to the number of new wells added in each of those years, similar to the methodology for other Uinta Basin counties. This data for the years 2003 – 2007 was averaged to develop a single historical drilling rate estimate of 1.31. This drilling rate estimate was then applied to the spud count as predicted by the spud count projection in Figure 28 in order to determine the total number of new wells added in each year from 2007 – 2012, which was added to the base year 2006 to arrive at the total number of active wells in Uintah County for each of the projection years. There are a very small number of CBM wells in Uintah County but these were considered negligible relative to the number of conventional wells and were therefore conservatively considered added to the conventional well totals. No other CBM activity was separately analyzed for Uintah County.

[28] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Total Gas Production – Conventional gas production in Uintah County has been plotted for the years 1970 – 2007 below in Figure 30, including projections to 2012. As noted above, CBM gas production in Uintah County is negligible and was assumed to be conventional gas production for purposes of this analysis.

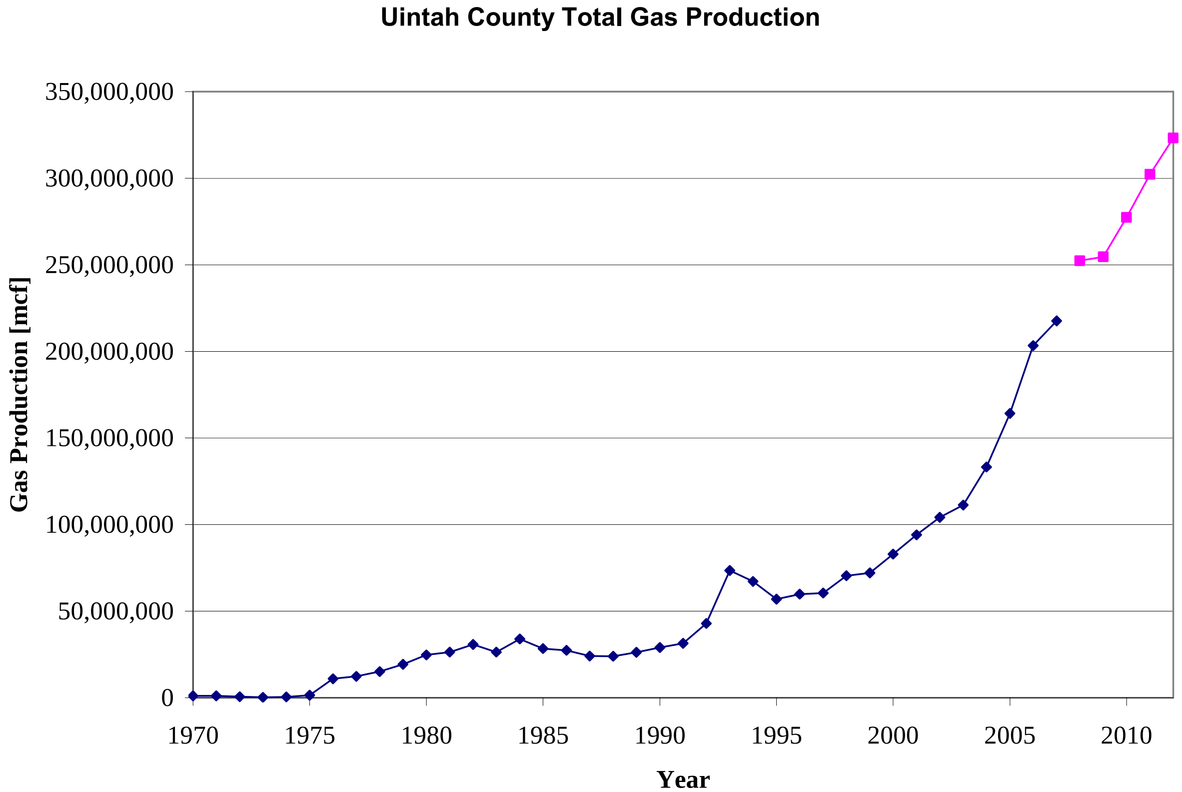

Figure 30. Total gas production historical data (from the IHS database) for Uintah County and projections to 2012. [29]

The analysis to determine total gas production projections in Uintah County was similar to that for Carbon County, and relied on geologic reservoir data provided by the companies for this county specifically (Buys & Associates, 2009). The decline curve for Uintah County is shown below in Figure 31. The methodology used to determine future year conventional gas production in the county was similar to that used for Carbon County as described by Equation (1) above. The correlation factor used in Equation (1) for Uintah County was 0.83. Wells in Uintah County were also assumed to have a 20-year life span, similar to wells in Carbon County.

[29] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

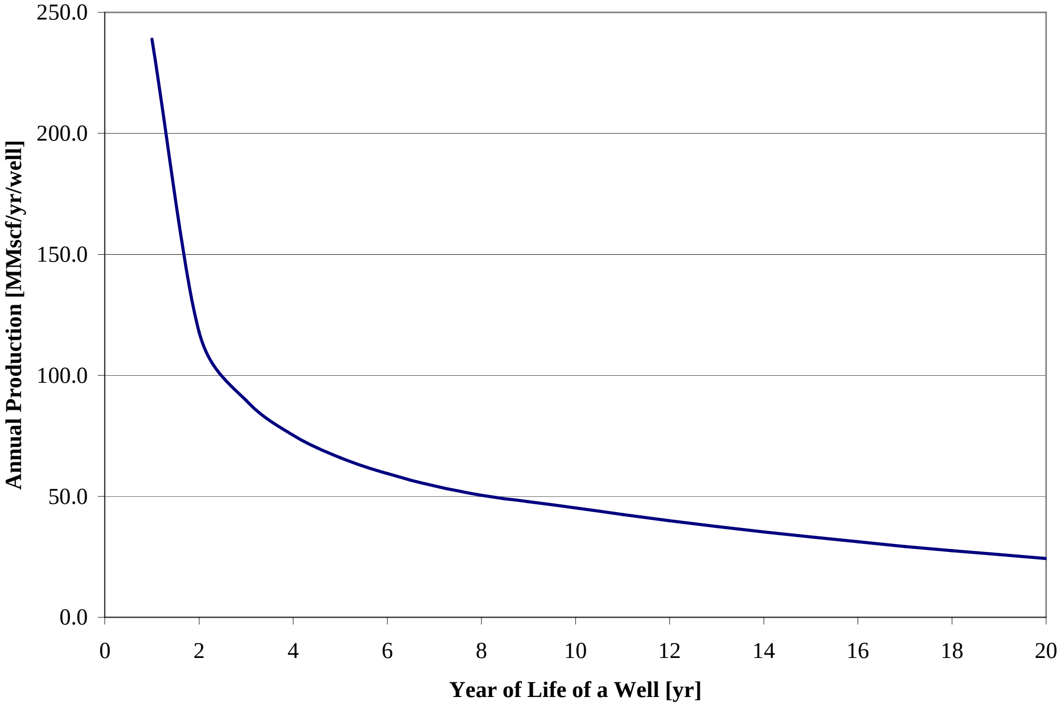

Figure 31. A typical decline curve showing well decline for an individual typical conventional gas well in Uintah County.

An analysis was conducted to justify the use of the decline curve and to determine whether the particular curve shown in Figure 31 was sufficiently accurate to be representative of gas wells in Uintah County specifically. The analysis was conducted by using Equation (1) to predict Uintah County gas production for years prior to 2007, for which IHS data was already available and could be used to compare the accuracy of this method. The results are shown below in Table 3 for calendar years 2000 – 2007 and show that this method, with the specific correlation factor selected, is reasonably accurate in predicting past county-level gas production volumes.

Table 3. Comparison of actual and predicted gas production volumes for Uintah County for the years 2000– 2007 using the typical decline projection analysis.

Year	Actual Uintah County Gas Production [MCF]	Predicted Uintah County Gas Production [MCF]	Percentage Difference
2000	82,966	82,888	0%
2001	94,143	101,064	-7%
2002	104,183	109,572	-5%
2003	111,275	118,741	-7%
2004	133,298	132,789	0%
2005	164,172	159,766	3%
2006	203,391	199,808	2%
2007	217,678	220,178	-1%

As Table 2 shows, the predicted gas production in Uintah County using the decline curve method of Equation (1) and the actual gas production in the County as obtained from the IHS database agree reasonably well for the period 2000 – 2007.

Condensate Production – Condensate production in Uintah County has been plotted for the years 1970 – 2006 below in Figure 32, including projections to 2012.

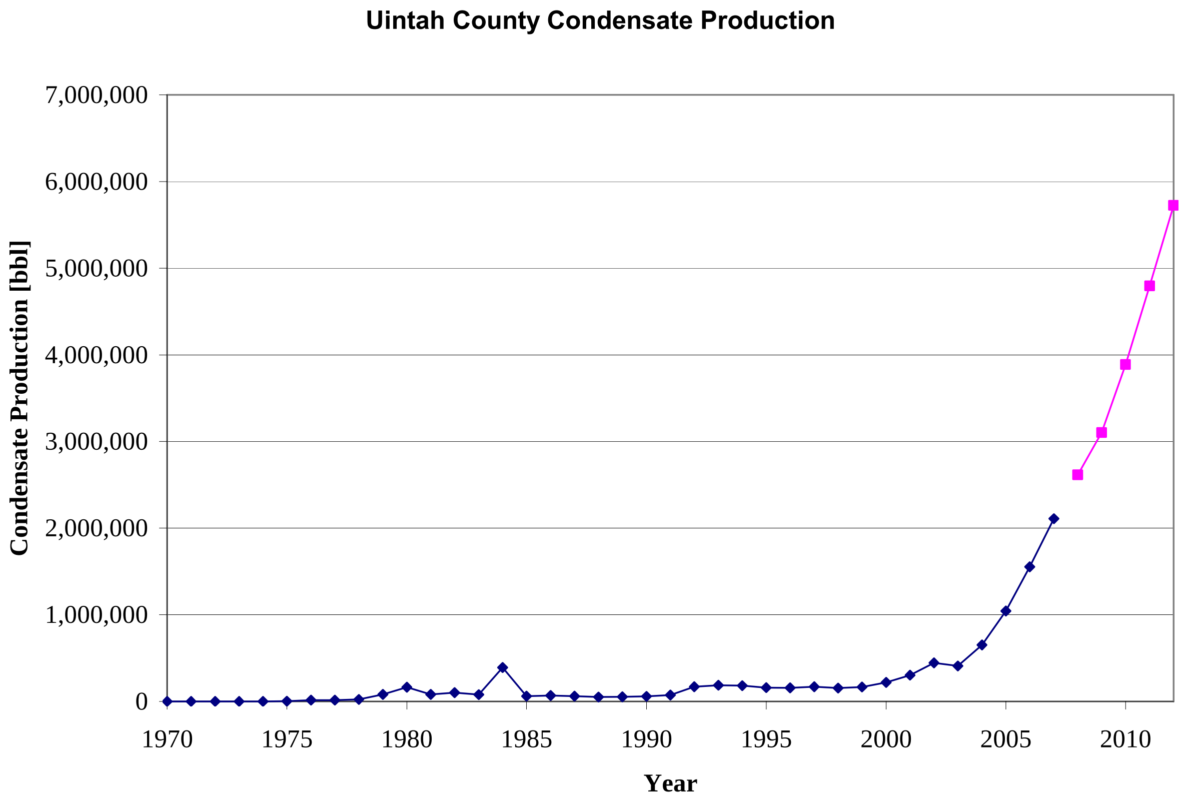

Figure 32. Condensate production historical data (from the IHS database) for Uintah County and projections to 2012. [30]

Similar to Carbon County, scaling factors were developed for each year from 2008 – 2012 that were the ratio of Uintah County total gas production in that year to total gas production in the previous year. These scaling factors were then applied to the condensate production for each year from 2008 – 2012, and form the projections shown in Figure 32.

[30] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

Oil Production – Oil production in Uintah County has been plotted for the years 1970 – 2006 below in Figure 33, including projections to 2012.

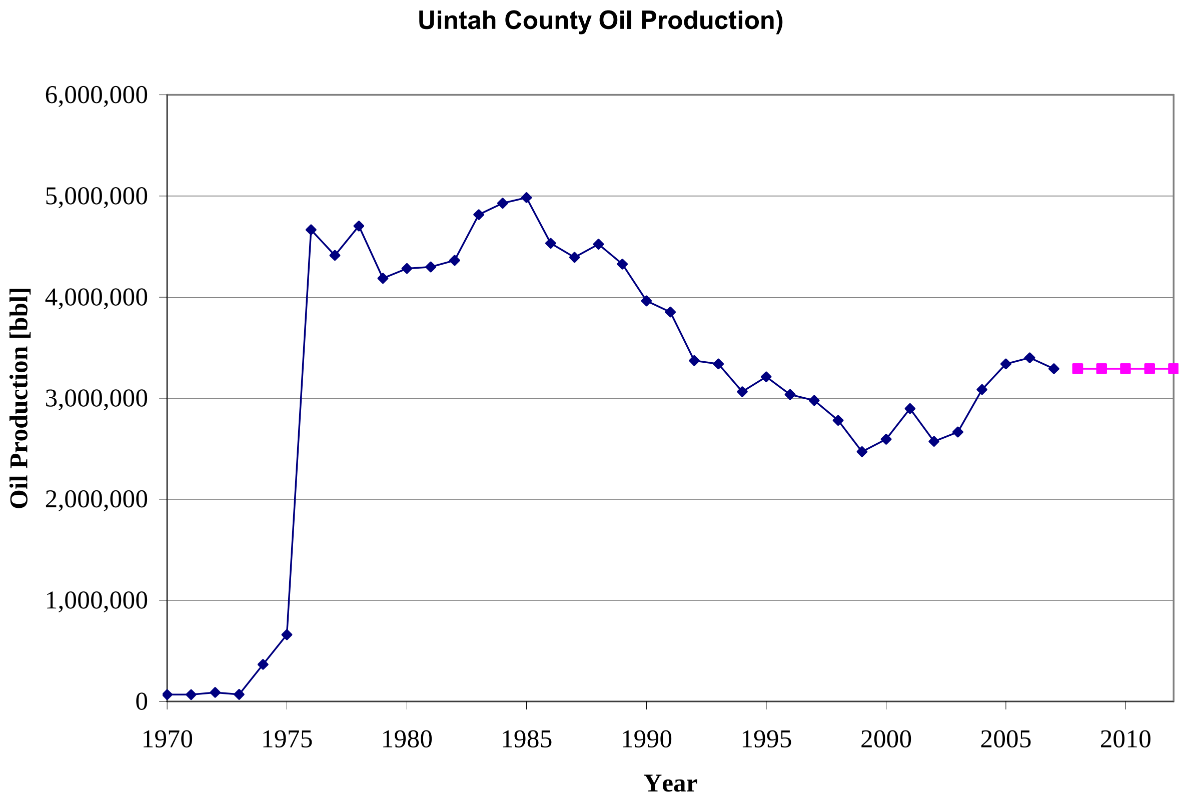

Figure 33. Oil production historical data (from the IHS database) for Uintah County and projections to 2012. [31]

Oil production in Uintah County peaked in 1985 and was generally declining from this peak in the period 1985 – 1999. Despite a small increase in oil production in the County in the period 2000 – 2006, oil production again declined in 2007. Given this variability, it was determined not to be possible to project oil production reliably from the historical data, and thus oil production in the period 2007 – 2012 was conservatively assumed to remain at 2007 levels.

[31] Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright 2009. All rights reserved.

SCALING FACTOR DEVELOPMENT AND UNCONTROLLED 2012 EMISSIONS

Scaling factors were generated for each county for each parameter considered here: total well count, conventional gas well counts (Carbon and Emery Counties only), CBM well counts (Carbon and Emery Counties only), spud counts, total gas production, oil production, and condensate production. The ratio of the value of each of these parameters in each county in 2012 to their values in 2006 is the scaling factor for that parameter for purposes of this projection.

The projected 2012 values of each of the seven parameters for Carbon, Duchesne, Emery, Grand and Uintah Counties were ratioed to the value of the respective parameter in 2006, following Equation (2):

Equation (2) $f_i = W_{2012} / W_{2006}$

where:

f_i is the scaling factor for Carbon, Duchesne, Emery, Grand or Uintah Counties for parameter *i* (total well count, conventional gas well count, CBM well count, spud count, total gas production, condensate production, or oil production)
W_{2006} is the value of parameter *i* in 2006
W_{2012} is the projected value of parameter *i* in 2012

The scaling factor based on the appropriate parameter is selected for each source category as described in Table 1. The scaling factors for the seven parameters used in this analysis for each of the five Uinta Basin counties are presented in Table 4 below.

Table 4. Scaling factors for the seven parameters used in the projection analysis for the five counties in the Uinta Basin.

Geographic Grouping	Total Well Count	Conv. Gas Well Count	CBM Well Count	Spud Count	Total Gas Production	Condensate Production	Oil Production
Carbon County	1.43	2.758	1.24	2.04	1.35	1.80	1.06
Duchesne County	1.71	N/A	N/A	1.41	1.91	2.41	1.71
Emery County	1.21	1.578	1.12	0.95	1.19	0.00	0.54
Grand County	1.22	N/A	N/A	2.61	0.95	1.21	1.02
Uintah County	1.73	N/A	N/A	1.36	1.59	3.68	0.97

The scaling factors described in Table 4 are used to scale total 2006 emissions for each of the Uinta Basin counties. Emissions from the tribal and non-tribal airsheds are determined after growth and control by using the tribal airshed county fractions developed as part of the 2006 Uinta Basin baseline emissions development.

CONTROLLED 2012 EMISSIONS

This methodology considered any "on-the-books" federal or state regulations that would affect the uncontrolled 2012 emissions projections described above.

Table 5 below lists the "on-the-books" federal and state regulations that affect emissions source categories in the oil and gas industry, and the action taken to adjust the 2012 emissions inventory appropriately. A more detailed description follows of the methodology used to address each of these regulations as they affected the uncontrolled 2012 Uinta Basin emissions projections.

The uncontrolled 2012 emissions were adjusted based on the proposed actions or control factors developed for each regulation described in Table 5 to account for how these regulations may affect any oil and gas source category considered in this inventory. The methodology recognizes that there are a number of voluntary and/or required control measures that have been partially implemented since 2006, and/or will be implemented completely by the calendar year 2012. However, these controls were not incorporated into this base case 2012 projection, but rather could form part of the controls to be included in a future control scenario.

Table 5. Summary of federal and state "on-the-books" regulations affecting the oil and gas source categories considered in this inventory.

Source Category	Regulation	Enforcing Agency	Effective Date	Implementation in the 2012 Piceance Basin Emissions Projections
Federal				
Drill Rigs, Workover Rigs	Nonroad engine Tier standards (1-4) (EPA, 2005)	US EPA	Phase in from 1996 - 2014	EPA NONROAD model used to create county-level control factors for the drill rig SCC to account for fleet turnover.
Drill Rigs, Workover Rigs	Nonroad diesel fuel sulfur standards (EPA, 2006)	US EPA	Phase in beginning in 2010	Assume 15 ppm sulfur in nonroad diesel fuel throughout Piceance Basin. Control factors derived from EPA NONROAD model (see above).
All New Spark-Ignited Stationary Engines	New Source Performance Stds. (NSPS) (EPA, 2008)	US EPA	Phase in from 2008 - 2011	Control factors developed considering the specific composition of engines in the inventory but determined to not be applicable to the Uinta Basin engine inventory due to gas production decline (see below).

It should be noted that no Utah state-specific regulations for oil and gas sources considered in this inventory were determined to affect the midterm emissions projections.

Multiplicative control factors, as defined for this analysis, were applied according to Equation (3) below (such as for NSPS):

Equation (3) $$E_{2012,controlled} = E_{2012,uncontrolled} \times CF_{multiplicative}$$

where:

$E_{2012,controlled}$ are the controlled 2012 Uinta Basin emissions for a particular source category
$E_{2012,uncontrolled}$ are the uncontrolled, grown 2012 Uinta Basin emissions for a particular source category

$CF_{multiplicative}$ is the multiplicative control factor for a particular source category considering a particular regulation

Percentage reduction control factors, as defined for this analysis, were applied according to Equation (4) below (such as for federal nonroad engine standards):

Equation (4) $$E_{2012,controlled} = E_{2012,uncontrolled} \times CF_{percent-reduction}$$

where:

$E_{2012,controlled}$ are the controlled 2012 Uinta Basin emissions for a particular source category
$E_{2012,uncontrolled}$ are the uncontrolled, grown 2012 Uinta Basin emissions for a particular source category
$CF_{percent-reduction}$ is the percentage reduction control factor for a particular source category considering a particular regulation

Nonroad Diesel Engine Standards and Fuel Sulfur Standards

The EPA NONROAD2005 model was run with fuel inputs based on a 2002 study entitled "WRAP Mobile Sources Emission Inventory Update" (Pollack, et al., 2006). The model outputs were used to develop county-level emissions per unit population for "other oil field equipment" (SCC 2270010010) for the calendar year 2006, and then separately for the calendar year 2012. These emissions per unit population reflect the predicted fleet mix of engines – for various tier standards from baseline uncontrolled engines through Tier IV engines – and are used as a representation of fleet turnover for drilling rigs and workover rigs. The ratios of the per unit emissions in 2012 to those in 2006 for each county of interest were used to determine the percentage reduction control factors accounting for federal non-road tier standards.

In addition, the NONROAD model runs with the fuel inputs used for developing the tier standards control factors were also used to develop the control factors for SOx emissions factors for drilling rigs and workover rigs. The model is capable of tracking the expected reduction in fuel sulfur content from the baseline 2006 year – assumed to be the same as the WRAP 2002 inventory – and the 2012 future year. A similar approach was used as for the federal tier standards to develop percentage reduction control factors. The ratio of per unit SOx emissions in 2012 to those in 2006 were used to determine a percentage reduction control factor to apply to uncontrolled 2012 SOx emissions for drilling rigs and workover rigs to account for federal non-road diesel fuel standards.

The resulting percentage reduction control factors from application of nonroad diesel engine standards and fuel sulfur standards are presented below in Table 6.

Table 6. Percentage reduction control factors for the 2012 Uinta Basin emissions projections from application of federal nonroad engine standards and fuel sulfur standards to drilling and workover rig engines.

Source Category	SCCs	Percentage Reduction Control Factors				
		NOX	VOC	CO	SOx	PM
Drill rigs	2310000220	30%	39%	42%	99%	53%
Workover rigs	2310000230	30%	39%	42%	99%	53%

New Source Performance Standards for Stationary Spark-Ignited Engines

The EPA has promulgated a new regulation covering new stationary, spark-ignited engines of various horsepower classes. The regulation is assumed to apply to central compressor engines, wellhead and lateral compressor engines, and artificial lift engines as well as any other miscellaneous APEN exempt engines that are stationary, spark-ignited natural gas engines. The regulation requires new engines of various horsepower classes to meet increasingly stringent NOx and VOC emission standards over the phase-in period of the regulation.

For engines less than 25 horsepower, Table 7 shows the requirements of the NSPS regulation.

Table 7. Federal NSPS emissions standards for engines less than 25 horsepower.

HP Range[a]	Emissions Standards Requirement in (g/hp-hr)[b]		
	HC + NOx	NMHC + NOx[c]	CO
≤ 25 Hp			
Class I	16.1 (12.0)	14.8 (11.0)	610 (455)
Class I -A	50-37	-	-
Class I -B	40 (30)	37 (27.6)	
Class II	12.1 (9.0)	11.3 (8.4)	

a – Class I-A: Engines with displacement less than 66 cubic centimeters (cc); Class 1-B: Engines with displacement greater than or equal to 66cc and less than 100cc; Class I: Engines with displacement greater than or equal to 100 cc and less than 225 cc

b – Modified and reconstructed engines manufactured prior to July 1, 2008, must meet the standards applicable to engines manufactured after July 1, 2008

c – NMHC+NOX standards are applicable only to natural gas fueled engines at the option of the manufacturer, in lieu of HC+NOX standards

For engines in the horsepower range 25 – 100 horsepower, Table 8 shows the requirements of the NSPS regulation.

Table 8. Federal NSPS emissions standards for engines greater than 25 horsepower but less than 100 horsepower.

HP Range	Manufacture Date	Emissions Standards Requirement (g/hp-hr)	
		HC + NOx	CO
25<HP<100	1-Jul-08	3.8	6.5
	1-Jul-08 (severe duty)	3.8	200

For engines in the horsepower range 100 – 1,350 horsepower, Table 9 shows the requirements of the NSPS regulation.

Table 9. Federal NSPS emissions standards for engines greater than 100 horsepower but less than 1350 horsepower.

Engine Type and Fuel	HP Range	Manufacture Date	Emissions Standards Requirement (g/hp-hr)		
			NOx	CO	VOC
Non-Emergency SI Natural Gas and Non-Emergency SI Lean Burn LPG	100≤HP<500	1-Jul-08	2	4	1
		1-Jan-11	1	2	1
Non-Emergency SI Lean Burn Natural Gas and LPG	500≥HP<1350	1-Jan-08	2	4	1
		1-Jul-10	1	2	1
Non-Emergency SI Natural Gas and Non-Emergency SI Lean Burn LPG (except lean burn 500≥HP<1350)	HP≥500	1-Jul-07	2	4	1

A detailed analysis was conducted to determine the effects of this rule on the permitted and unpermitted engine fleet in the Uinta Basin. A list of all unpermitted compressor engines, permitted engines (both state- and EPA-administered permits), unpermitted artificial lift engines, and other unpermitted miscellaneous engines was developed, including the engine sizes in horsepower. This list was developed at the basin level, and then grouped by engines falling into the various horsepower ranges described above in Tables 7-9 for the four engine types tracked in this analysis. For each year in the period 2007 – 2012, the basin total gas production, oil production and total well counts were tracked to determine the year-on-year change in these parameters for the basin. For unpermitted and permitted compressor engines, if gas production grew from one year to the next, it was assumed that the fractional increase in gas production would lead to the same fractional increase in compression horsepower. For artificial lift engines, if oil production grew from one year to the next, it was assumed that the fractional increase in oil production would lead to the same fractional increase in artificial lift engine horsepower. For miscellaneous engines, if the total well count grew from one year to the next, it was assumed that the fractional increase in well count would lead to the same fractional increase in miscellaneous engine horsepower. It was conservatively assumed that if gas production, oil production or total well counts did not change or decreased from one year to the next in the period 2007 – 2012, that no new engines would be installed (i.e. that existing engines would handle the capacity if no increase in production or well counts was projected). This analysis assumed no turnover of existing engines would occur in this period, which was determined to be a conservative assumption.

If growth in gas or oil production, or well counts did occur, and a growth in corresponding engine horsepower was projected, the phase-in dates described in Tables 7-9 were considered. New engines were added to the basin-wide inventory that would meet the various NSPS requirements and phase-in dates. The result of the analysis was a projected list of engines, by horsepower and emissions rates, for the Uinta Basin in 2012. The ratios of the average emissions rates for each of the four engine types in the 2012 projection to the average emissions rates in the 2006 baseline inventory were assumed to be the control factors for these engines for the NSPS regulation. The projected control factors are shown below in Table 10.

Table 10. Multiplicative control factors for the 2012 Uinta Basin emissions projections from application of NSPS to various engine types.

Source Category	SCC	Multiplicative Control Factors				
		NOX	VOC	CO	SOx[b]	PM[b]
Miscellaneous engines	2310003100	74%	97%	206%	-	-
Compressor engines	2310020600	95%	90%	120%	-	-
Artificial Lift	2310000330	97%	98%	955%	-	-
UTDEQ Permitted Sources	31000000	89%	450%	153%	-	-
EPA Permitted Sources[a]	31000000	84%	116%	-	-	-

a – The information requested on EPA-administered permitted sources in the Uinta Basin did not include CO emissions and thus a control factor for CO could not be estimated.

b – NSPS does not require emissions standards for SOx and PM emissions from engines subject to the standard, thus no control factors were estimated for these pollutants from application of NSPS

It should be noted that VOC and CO emissions were projected to increase using this analysis. The analysis considered that the NSPS standards were the emissions rates of the engines, and in some instances the NSPS standards' emissions rates for CO and VOC were greater than those of existing engines. However, it should be noted that none of the engine types considered in this analysis are significant sources of VOC, thus this effect was considered negligible. CO emissions were not considered significant from this industrial sector and were not a focus of the inventory effort.

SUMMARY RESULTS

The scaling factors were applied to the baseline 2006 inventory, and "on-the-books" regulations were applied to the uncontrolled 2012 emissions projections to generate the final 2012 emissions projections and results are presented below.

Figure 34 shows that Duchesne and Uintah Counties account for the majority of Uinta Basin projected NOx emissions in 2012, with minor NOx emissions contributions from Carbon and Grand Counties. This is consistent with the county-level NOx emissions fractional allocation in 2006. Figure 35 shows that only Duchesne and Uintah Counties account for the large majority of projected VOC emissions in 2012. As seen in Figures 36 and 37, a significant portion of projected 2012 NOx and VOC emissions in Duchesne and Uintah Counties occur in the tribal airshed, and these represent the majority of emissions in the Uinta Basin as a whole. NOx emissions in the tribal airshed in Duchesne County represent approximately 62% of total Duchesne County NOx, and VOC emissions in the tribal airshed in Duchesne County represent approximately 53% of total Duchesne County VOC. NOx emissions in the tribal airshed in Uintah County represent approximately 97% of total Uintah County NOx, and VOC emissions in the tribal airshed in Uintah County represent approximately 98% of total Uintah County VOC.

Figure 38 shows that drilling rigs and permitted and unpermitted compressor engines are the predominant NOx emissions source categories in 2012, accounting for approximately 67% of total basin-wide NOx emissions. Figure 39 shows that VOC emissions from glycol dehydrators and flashing emissions from condensate and oil tanks combined make up approximately 57% of total VOC emissions in the Uinta Basin in 2012.

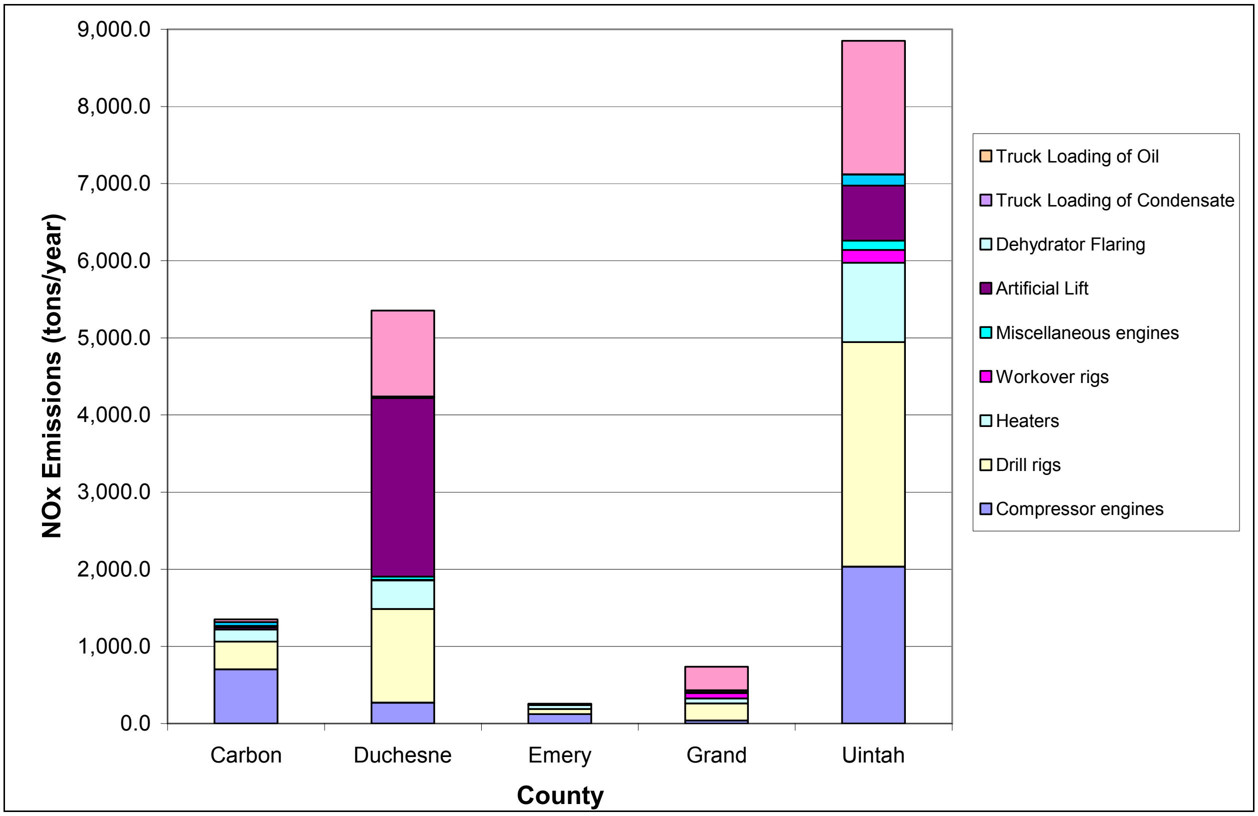

Figure 34. 2012 NOx emissions by source category and by county in the Uinta Basin.

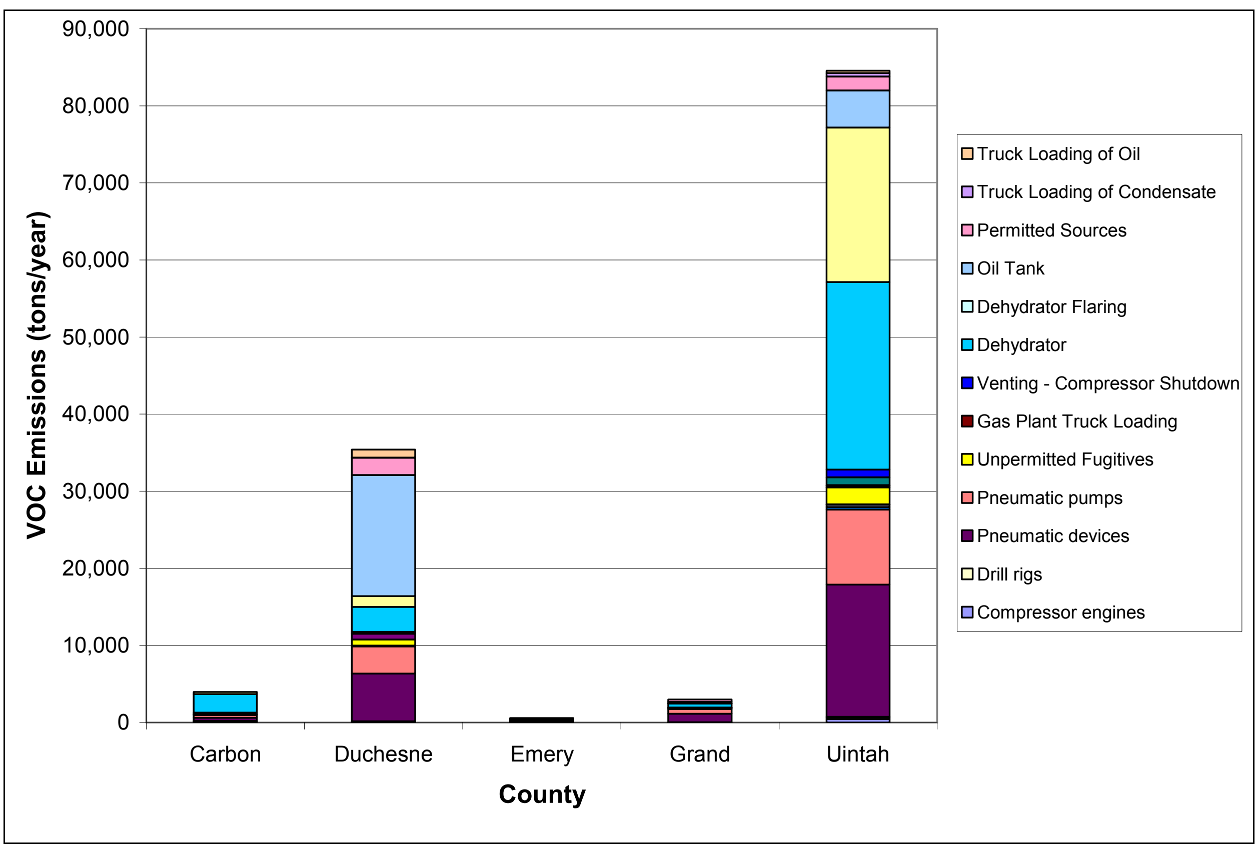

Figure 35. 2012 VOC emissions by source category and by county in the Uinta Basin.

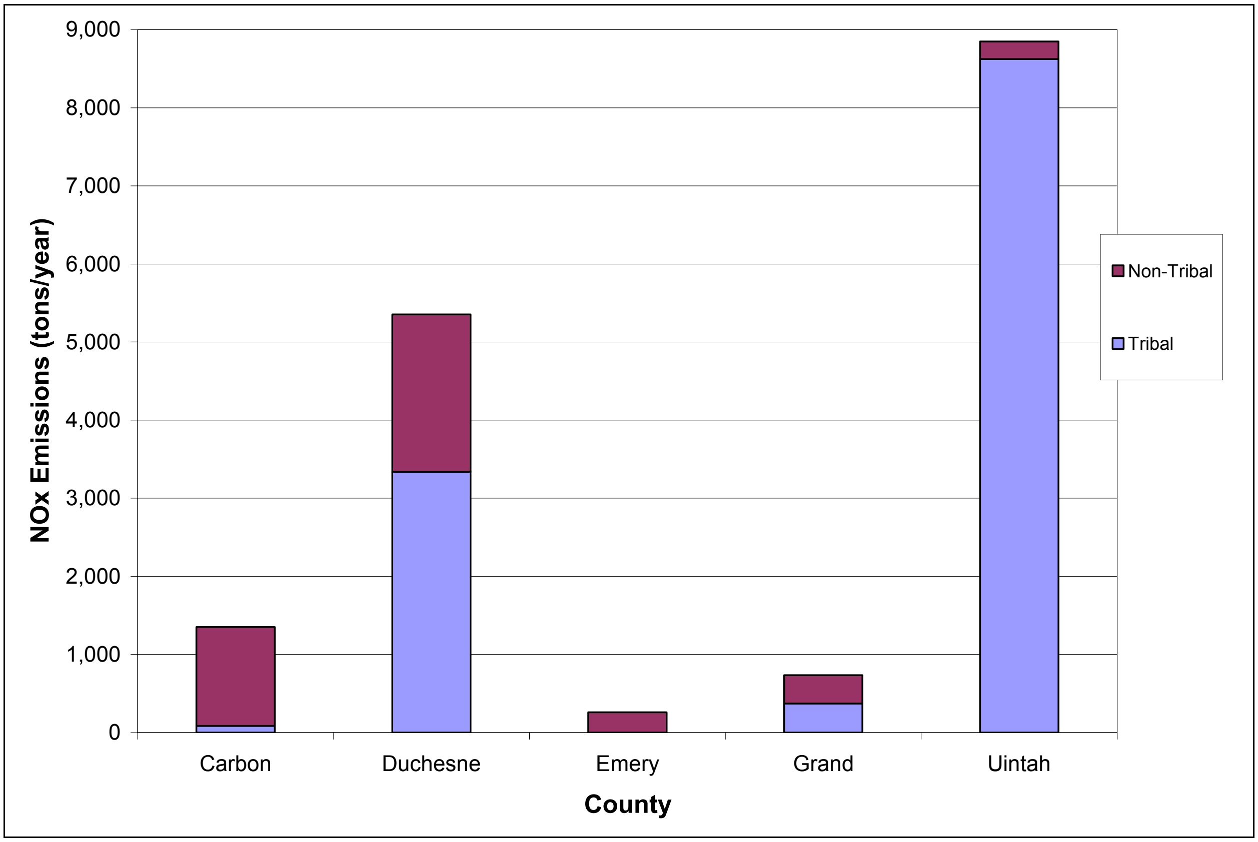

Figure 36. 2012 NOx emissions in tribal and non-tribal airsheds by county in the Uinta Basin.

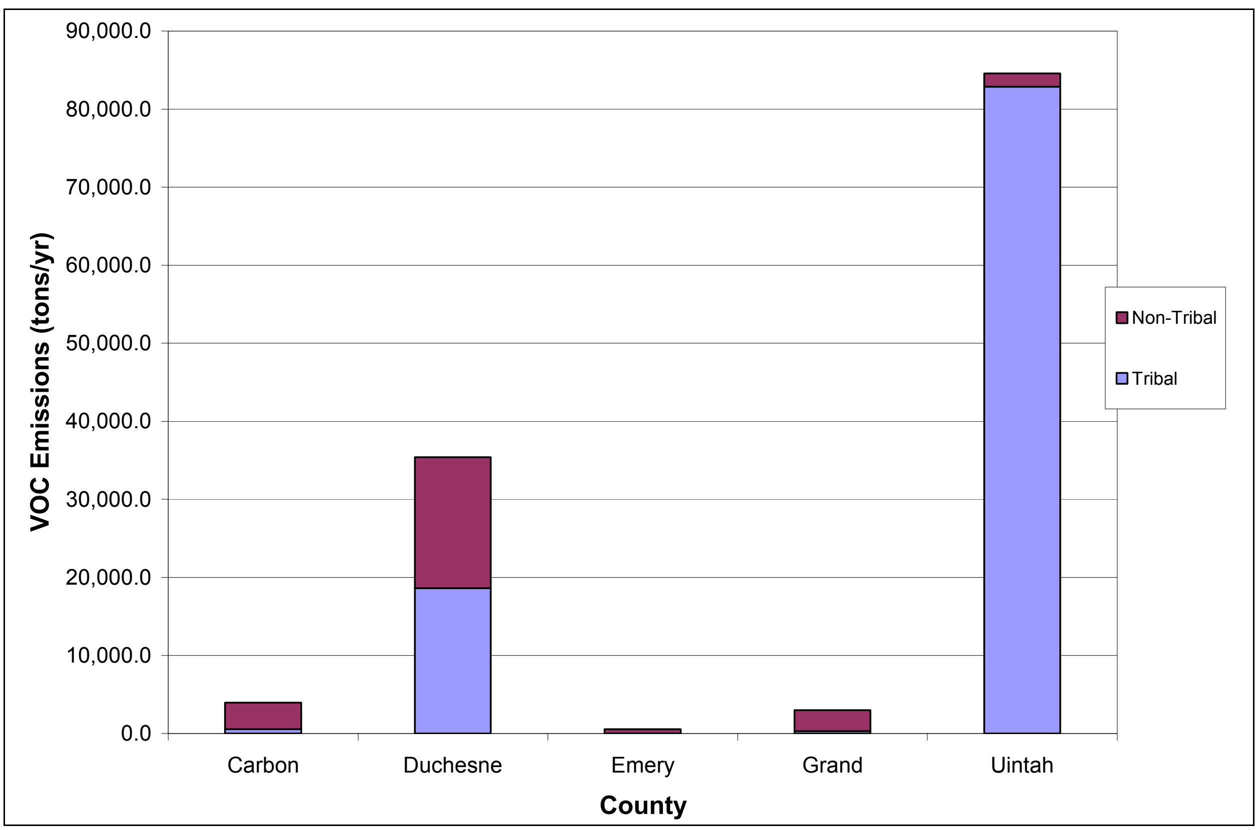

Figure 37. 2012 VOC emissions in tribal and non-tribal airsheds by county in the Uinta Basin.

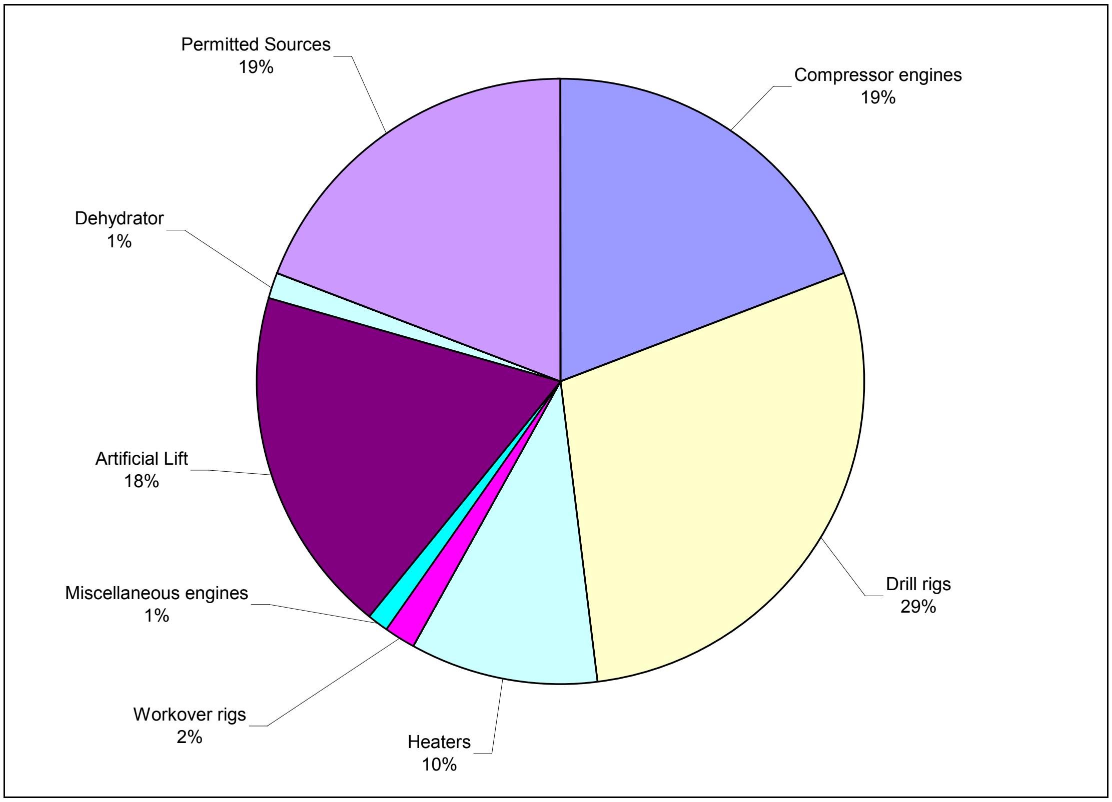

Figure 38. 2012 NOx emissions contributions by source category in the Uinta Basin.

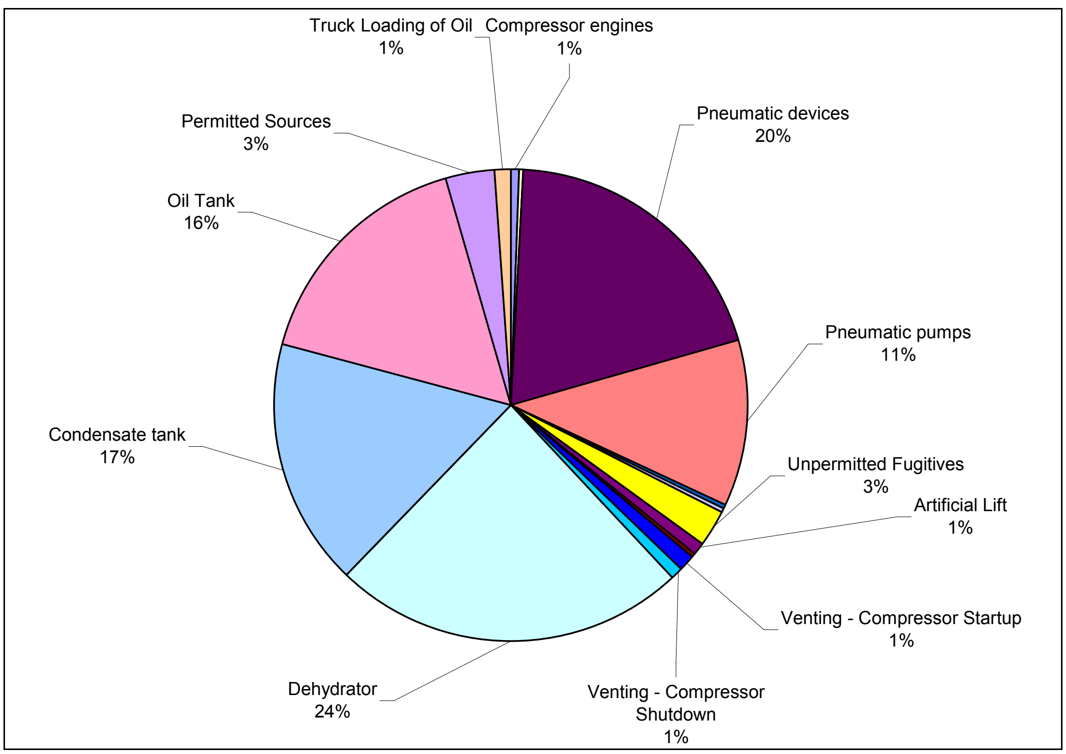

Figure 39. 2012 VOC emissions contributions by source category in the Uinta Basin.

Table 11. 2012 emissions of all criteria pollutants by county for the Uinta Basin.

County	NOx [tons/yr]	VOC [tons/yr]	CO [tons/yr]	SOx [tons/yr]	PM [tons/yr]
Carbon	1,351	3,977	1,296	2	50
Duchesne	5,352	35,410	29,756	5	208
Emery	259	559	246	0	10
Grand	736	2,984	687	1	26
Uintah	8,849	84,564	12,940	16	337
Wasatch	0	0	0	0	0
TOTAL	**16,547**	**127,495**	**44,925**	**24**	**631**

Table 12. 2012 emissions of all criteria pollutants by county and by tribal or non-tribal airshed for the Uinta Basin.

County	NOx [tons/yr]	VOC [tons/yr]	CO [tons/yr]	SOx [tons/yr]	PM [tons/yr]
Tribal Airshed					
Carbon	88	548	95	1	6
Duchesne	3,338	18,613	16,091	3	114
Emery	0	0	0	0	0
Grand	371	301	202	0	8
Uintah	8,622	82,857	11,316	16	326
Wasatch	0	0	0	0	0
Total Tribal	12,419	102,319	27,703	20	453
Non-Tribal Airshed					
Carbon	1,263	3,429	1,201	1	44
Duchesne	2,014	16,797	13,666	2	95
Emery	259	559	246	0	10
Grand	365	2,683	485	1	18
Uintah	228	1,707	1,624	0	11
Wasatch	0	0	0	0	0
Total Non-Tribal	4,128	25,175	17,222	5	178
TOTAL	**16,547**	**127,495**	**44,925**	**24**	**631**

Table 13. 2012 NOx emissions [ton/yr] by county and by source category for the Uinta Basin.

County	Compressor Engines	Drill Rigs	Permitted Sources	Artificial Lift Engines	Heaters	Workover Rigs	Glycol Dehydrators	Other Categories	Totals
Carbon	703	362	35	0	154	29	50	19	1,351
Duchesne	271	1,213	1,113	2,313	371	6	19	45	5,352
Emery	121	68	0	0	49	6	9	6	259
Grand	41	219	306	26	66	67	3	8	736
Uintah	2,034	2,911	1,731	713	1,030	162	144	124	8,849
Wasatch	0	0	0	0	0	0	0	0	0
Totals	**3,169**	**4,773**	**3,184**	**3,053**	**1,671**	**271**	**225**	**202**	**16,547**

Table 14. 2012 NOx emissions [ton/yr] by county, by tribal or non-tribal airshed and by source category for the Uinta Basin.

County	Compressor Engines	Drill Rigs	Permitted Sources	Artificial Lift Engines	Heaters	Workover Rigs	Glycol Dehydrators	Other Categories	Totals
Tribal Airshed									
Carbon	35	0	35	0	1	15	3	0	88
Duchesne	156	688	1,113	1,157	190	0	11	23	3,338
Emery	0	0	0	0	0	0	0	0	0
Grand	0	0	306	0	0	66	0	0	371
Uintah	2,027	2,902	1,731	575	1,010	111	144	122	8,622
Wasatch	0	0	0	0	0	0	0	0	0
Tribal Total	2,218	3,590	3,184	1,732	1,201	192	157	145	12,419
Non-Tribal Airshed									
Carbon	668	362	0	0	153	14	47	18	1,263
Duchesne	114	526	0	1,156	182	6	8	22	2,014
Emery	121	68	0	0	49	6	9	6	259
Grand	41	219	0	26	66	1	3	8	365
Uintah	7	9	0	138	20	51	1	3	228
Wasatch	0	0	0	0	0	0	0	0	0
Non-tribal Total	951	1,183	0	1,321	470	79	68	57	4,128
Totals	3,169	4,773	3,184	3,053	1,671	271	225	202	16,547

Table 15. 2012 VOC emissions [ton/yr] by county and by source category for the Uinta Basin.

County	Glycol Dehydrator	Pneumatic Devices	Condensate Tanks	Oil Tanks	Pneumatic Pumps	Permitted Sources	Unpermitted Fugitives	Venting – Compressor Startups/Shutdowns	Compressor Engines	Artificial Lift Engines	Other Categories	Totals
Carbon	2,430	426	271	0	350	6	53	197	154	0	90	3,977
Duchesne	3,243	6,192	1,378	15,702	3,505	2,236	794	268	59	724	1,310	35,410
Emery	159	197	0	3	123	0	25	12	27	0	13	559
Grand	492	1,106	39	175	626	296	142	41	9	8	51	2,984
Uintah	24,341	17,161	20,031	4,842	9,718	1,817	2,199	2,014	446	223	1,771	84,564
Wasatch	0	0	0	0	0	0	0	0	0	0	0	0
Totals	**30,665**	**25,083**	**21,719**	**20,722**	**14,322**	**4,355**	**3,212**	**2,533**	**695**	**955**	**3,234**	**127,495**

Table 16. 2012 VOC emissions [ton/yr] by county, by tribal or non-tribal airshed and by source category for the Uinta Basin.

County	Glycol Dehydrator	Pneumatic Devices	Condensate Tanks	Oil Tanks	Pneumatic Pumps	Permitted Sources	Unpermitted Fugitives	Venting – Compressor Startups/Shutdowns	Compressor Engines	Artificial Lift Engines	Other Categories	Totals
Tribal Airshed												
Carbon	415	18	38	0	19	6	2	34	8	0	8	548
Duchesne	1,874	3,163	82	7,855	1,790	2,236	405	155	34	362	656	18,613
Emery	0	0	0	0	0	0	0	0	0	0	0	0
Grand	0	0	0	0	0	296	0	0	0	0	5	301
Uintah	24,259	16,829	20,031	3,903	9,530	1,817	2,157	2,008	445	180	1,699	82,857
Wasatch	0	0	0	0	0	0	0	0	0	0	0	0
Tribal Total	26,548	20,010	20,151	11,758	11,339	4,355	2,564	2,197	487	542	2,369	102,319
Non-Tribal Airshed												
Carbon	2,015	408	233	0	331	0	50	163	147	0	81	3,429
Duchesne	1,369	3,029	1,296	7,847	1,714	0	388	113	25	362	654	16,797
Emery	159	197	0	3	123	0	25	12	27	0	13	559
Grand	492	1,106	39	175	626	0	142	41	9	8	45	2,683
Uintah	81	332	0	939	188	0	43	7	1	43	72	1,707
Wasatch	0	0	0	0	0	0	0	0	0	0	0	0
Non-Tribal Total	4,117	5,073	1,568	8,965	2,982	0	647	336	209	413	865	25,175
Totals	**30,665**	**25,083**	**21,719**	**20,722**	**14,322**	**4,355**	**3,212**	**2,533**	**695**	**955**	**3,234**	**127,495**

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