

This is a working document prepared by the Energy Information Administration (EIA) in order to solicit advice and comment on statistical matter from the American Statistical Association Committee on Energy Statistics. This topic will be discussed at EIA's spring 2006, meeting with the Committee to be held April 6 and 7, 2006.

## **Appendix B: EIA-914 *Monthly Natural Gas Production Report*, Data and Production Estimate Analysis, January through December 2005**

### **Introduction**

EIA currently publishes preliminary estimates of monthly natural gas production based on State data. However, these data are not considered timely or accurate enough to meet customer needs. So in 2005, the Office of Oil and Gas (OOG) implemented a new survey, Form EIA-914 *Monthly Natural Gas Production Report*, whose purpose is to improve the timeliness and accuracy of published monthly natural gas production information. The EIA-914 estimates are available two months earlier than previous estimates.

The EIA-914 survey has now collected data for report months January through December 2005 and the results have been evaluated in accordance with the analysis plan set forth in our first Category 1 clearance package in August 2005 [\*EIA-914 - Cat I Report to Administrator \(August 2005\)\*](#). As stated in that clearance package, the production estimates based on the survey data have been posted on the EIA Website [\*Form EIA-914 Monthly Natural Gas Production Report\*](#) but they are designated as “unofficial” and are physically separated from existing published natural gas production data.

EIA-914 was developed to substantially improve both the quality and timeliness of our monthly natural gas production estimates for the Lower-48 States and major producing areas. Our target has been met to have releasable gas production estimates 60 days after the close of a report month with a sampling error within 1% for the Lower- 48 States and within 1% to 5% for these large producing areas: Texas, Federal Offshore Gulf of Mexico, Wyoming, Oklahoma, New Mexico, Louisiana, and Other States (all remaining states excluding Alaska).

The purpose of this second clearance package is to show the results of the evaluation and seek final approval for using current EIA-914 production estimates as the “official” EIA natural gas production data series for the EIA-914 areas. The use of EIA-914 production estimates has already been approved as the official data series for Texas. Early approval was necessary because of the Texas Railroad Commission’s transition to a new reporting system caused misreporting by some operators and a change in the revision pattern used previously to estimate Texas production. Details are contained in the full report [\*Adjusted Estimates of Texas Natural Gas Production\*](#). With approval of this estimation process, data from the EIA-914 will be accessible via the Natural Gas Monthly (NGM) and Natural Gas Navigator, in addition to the EIA-914 website.

### **Analysis Results**

EIA-914 estimates were compared with estimates obtained from previous methods described in [How EIA Estimates Natural Gas Production](#). Month-to-month changes in State-level production obtained from the EIA-914 survey were compared to month-to-month changes obtained from the previous methods, and all results are found in the [EIA-914 Analysis Data](#) workbook, from which the following figures and tables were created. These data show that the EIA-914 production estimates are comparable to estimates made using other methods, i.e., the EIA-914 estimates are of the same level and have the same trends. Therefore, gas production estimates based on the EIA-914 are proven to be accurate and available two months earlier.

Before the EIA-914, some monthly preliminary estimates have been in error by 5, 10, 15, or 20 percent. For example, the June 2004 first preliminary estimate for New Mexico was almost 20 percent low, as compared to the “final” value. In some instances the EIA-914 estimates are believed to be more accurate than previous methods due to known shortfalls in the previous methodologies. Typically the percent differences between the EIA-914 estimates and estimates from previous methods are within the historical average errors in the previous methods. Differences of 2 to 3 percent are acceptable; our target range was 1 to 5 percent. Also, a very active quality assurance program means that the operator reported data maintains a high level of accuracy.

The table below is presented on the EIA-914 webpage. It has the latest data and revisions as of the date of this clearance package. The following figures show results for the seven areas for which data are collected on the EIA-914 Report.

- Figures 1A through 7A show estimates of natural gas production by area for EIA-914.
- Figures 1B through 7B show EIA-914 estimates compared to the previous method estimates.
- Figures 1C through 7C show EIA-914 based estimates, corrections, revisions, and resubmissions.
- Figures 1D through 7D show gross gas production estimates with error bands.

**EIA-914 Estimated Gross Withdrawals of Natural Gas by Area,  
2005 as Currently Presented on the EIA Web (Billion Cubic Feet  
per Day)**

Area	Federal Offshore Gulf of Mexico		Louisiana		New Mexico		Oklahoma	
	Report Month	Gross Withdrawals (Bcf/day)	% Change from Last Month	Gross Withdrawals (Bcf/day)	% Change from Last Month	Gross Withdrawals (Bcf/day)	% Change from Last Month	Gross Withdrawals (Bcf/day)
Jan-05	10.065		3.747		4.503		4.532	
Feb-05	10.320	2.5	3.832	2.3	4.439	-1.4	4.575	0.9
Mar-05	10.530	2.0	3.902	1.8	4.379	-1.3	4.581	0.1
Apr-05	10.369	-1.5	3.943	1.1	4.425	1.0	4.558	-0.5
May-05	10.395	0.2	3.960	0.4	4.459	0.8	4.519	-0.9
Jun-05	10.196	-1.9	3.952	-0.2	4.414	-1.0	4.613	2.1
Jul-05	9.530	-6.5	3.841	-2.8	4.416	0.1	4.632	0.4
Aug-05	8.899	-6.6	3.722	-3.1	4.423	0.1	4.628	-0.1
Sep-05	4.591	-48.4	2.952	-20.7	4.438	0.4	4.670	0.9
Oct-05	4.519	-1.6	3.145	6.5	4.497	1.3	R4.707	0.8
Nov-05	R 6.555	45.1	R 3.512	11.7	R 4.399	-2.2	R4.663	-1.1
Dec-05	7.563	15.4	3.580	1.9	4.226	-3.9	4.580	-1.6

Area	Texas		Wyoming		Other States (Excluding Alaska)		Lower 48 States	
	Report Month	Gross Withdrawals (Bcf/day)	% Change from Last Month	Gross Withdrawals (Bcf/day)	% Change from Last Month	Gross Withdrawals (Bcf/day)	% Change from Last Month	Gross Withdrawals (Bcf/day)
Jan-05	15.755		5.417		10.699		54.718	
Feb-05	15.960	1.3	5.570	2.8	10.770	0.7	55.466	1.4
Mar-05	16.149	1.2	5.523	-0.8	10.751	-0.2	55.815	0.6
Apr-05	16.289	0.9	5.437	-1.6	10.605	-1.4	55.626	-0.3
May-05	16.208	-0.5	5.533	1.8	10.819	2.0	55.891	0.5
Jun-05	16.286	0.5	5.546	0.3	10.827	0.1	55.833	-0.1
Jul-05	16.224	-0.4	5.578	0.6	10.677	-1.4	54.898	-1.7
Aug-05	16.452	1.4	5.673	1.7	10.816	1.3	54.612	-0.5
Sep-05	15.796	-4.0	5.723	0.9	10.908	0.9	49.077	-10.1
Oct-05	16.531	4.7	5.827	1.8	11.010	0.9	50.235	2.4
Nov-05	R 16.769	1.4	R 5.976	2.6	R 11.185	1.6	R 53.049	5.6
Dec-05	16.562	-1.2	5.878	-1.6	10.986	-1.8	53.376	0.6

## **A. Estimates of Natural Gas Production by Area for EIA-914**

Figures 1A through 7A compare the latest estimates based on the EIA-914 data with the latest estimates based on current State data. The figures show that the EIA-914 estimates have the correct magnitude and trends.

The data from the EIA-914 survey are accurate for two reasons.

- Most operators are very conscientious about the data they submit on the EIA-914 survey form, and they make resubmissions for very small differences. Some operators have resubmitted data multiple times for all historical months just to make sure we had the most accurate data available even though their changes were insignificant.
- We discover errors through our quality control measures. For example, by checking what the operators report to the States, a few errors were found. Sources of these errors include: misunderstanding of the instructions; reporting data for the wrong area; difficulty assimilating data from a purchased company; and incorrect handling of CO<sub>2</sub> volumes from injection projects. For a few of these, the operators were reporting incorrectly to the State, but not to EIA. In this regard the EIA-914 survey has improved the quality of State data in two States, Texas and Wyoming.

The EIA-914 has become the standard to measure the quality of the previous methods rather than the other way around. For example, the estimates for the Gulf of Mexico derived from the EIA-914 and the previous method using State data were farther apart than we deemed acceptable. We took a careful look at how the estimates were created, and found the calibration period used in the previous method was lagging. After the calibration period was moved up, the two estimates were in agreement.

Figure 1A compares the latest Texas State data based estimates to the 914-based estimates. The two methods generally have the same magnitude and the same trends. The State of Texas began using a new reporting system and form in January 2005. This caused a change in the revision patterns of the State data and a change in CO<sub>2</sub> production reporting, which may be at least partially responsible for the difference (roughly 2%) in the two estimates early in 2005. Because of this uncertain reliability in the Texas reported data during the transition, the EIA-914 based estimates were approved for official use in November 2005.

**Figure 1A. Texas Gross Gas Production**

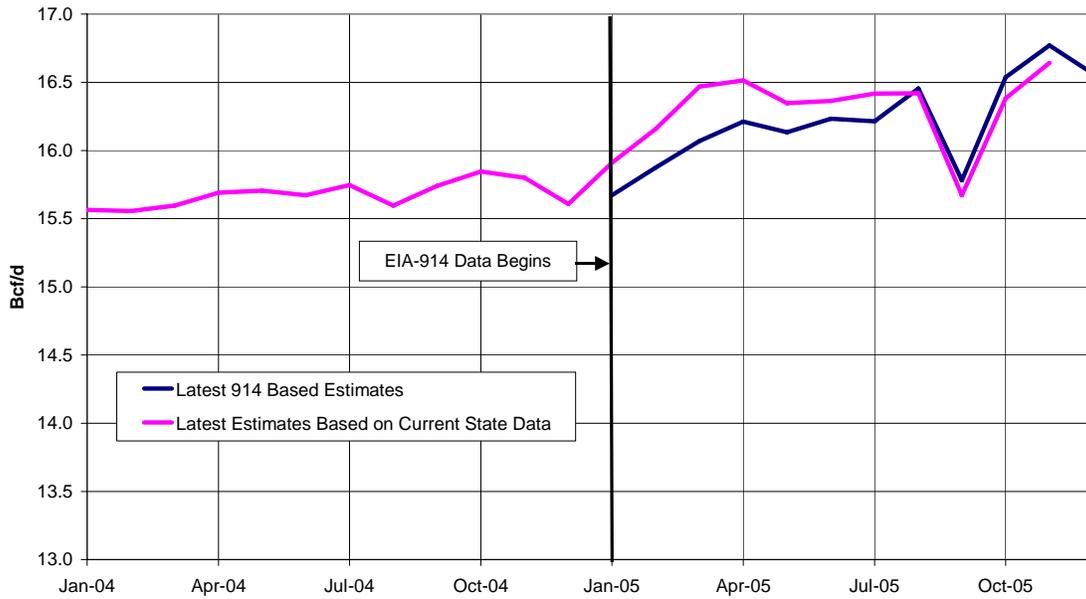


Figure 2A compares the latest Minerals Management Service (MMS) data based estimates to the EIA-914-based estimates. The two methods generally have the same magnitude and the same trends. The large month-to-month changes in the Federal Offshore Gulf of Mexico (GOM) are caused when production is shut in for hurricanes.

**Figure 2A. Federal Gulf of Mexico Gross Gas Production**

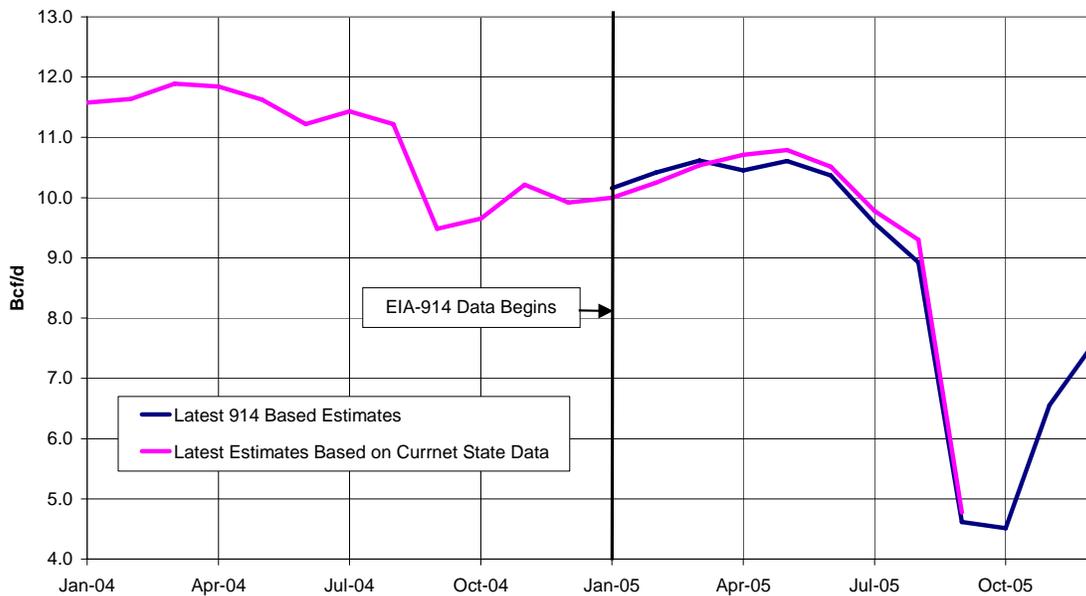


Figure 3A compares the latest Wyoming State data based estimates to the EIA-914 based estimates. The two methods generally have the same magnitude and the same trends. However, the EIA-914 estimates appear to be 2 to 3 percent too high. A periodic recalibration of the EIA-914 model could dramatically reduce the difference, an option that is currently under consideration.

**Figure 3A. Wyoming Gross Gas Production**

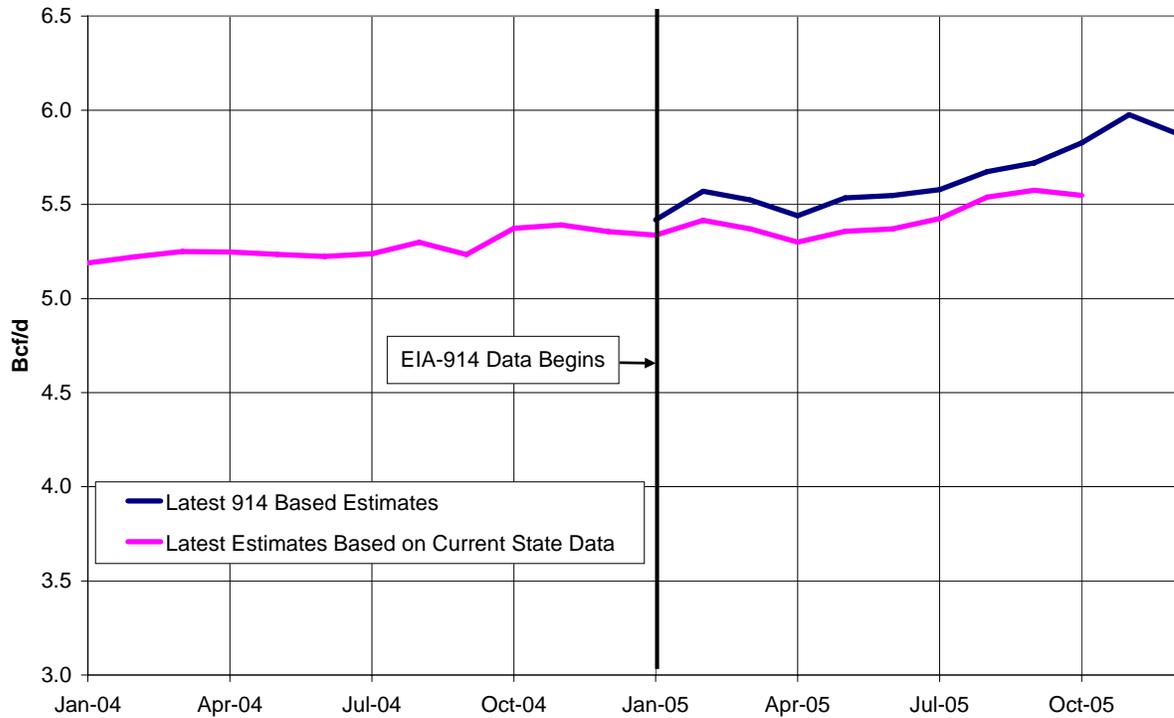


Figure 4A compares the latest Oklahoma State data based estimates to the 914-based estimates. The two methods generally have the same magnitude and the same trends. As shown in the graph the more recent State reported data can be erratic. The State data becomes more stable with time and revisions.

**Figure 4A. Oklahoma Gross Gas Production**

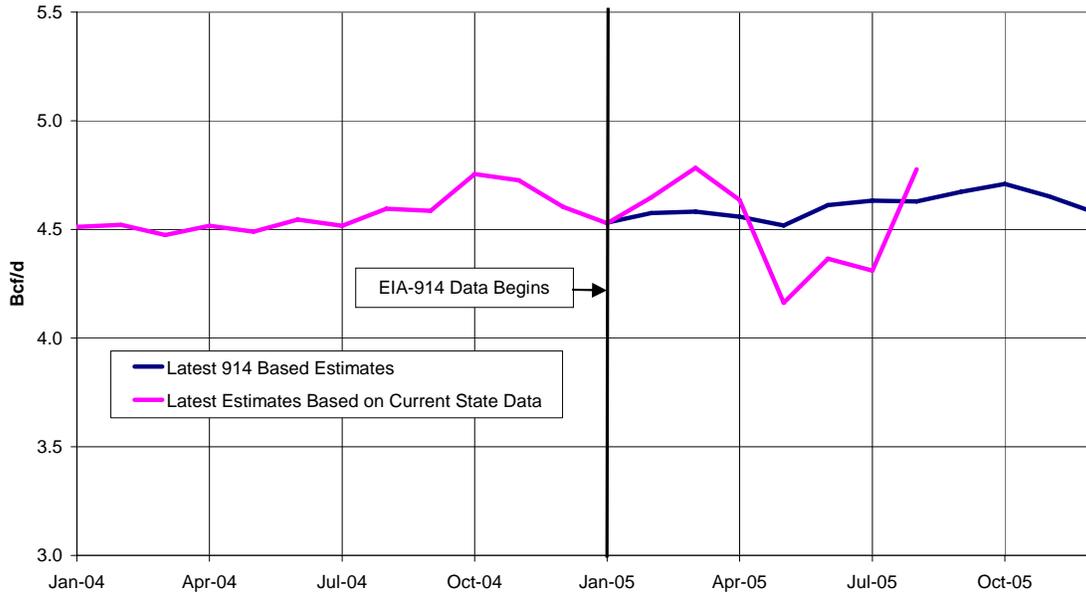


Figure 5A compares the latest New Mexico State data based estimates to the 914-based estimates. The two methods generally have the same magnitude and the same trends.

**Figure 5A. New Mexico Gross Gas Production**

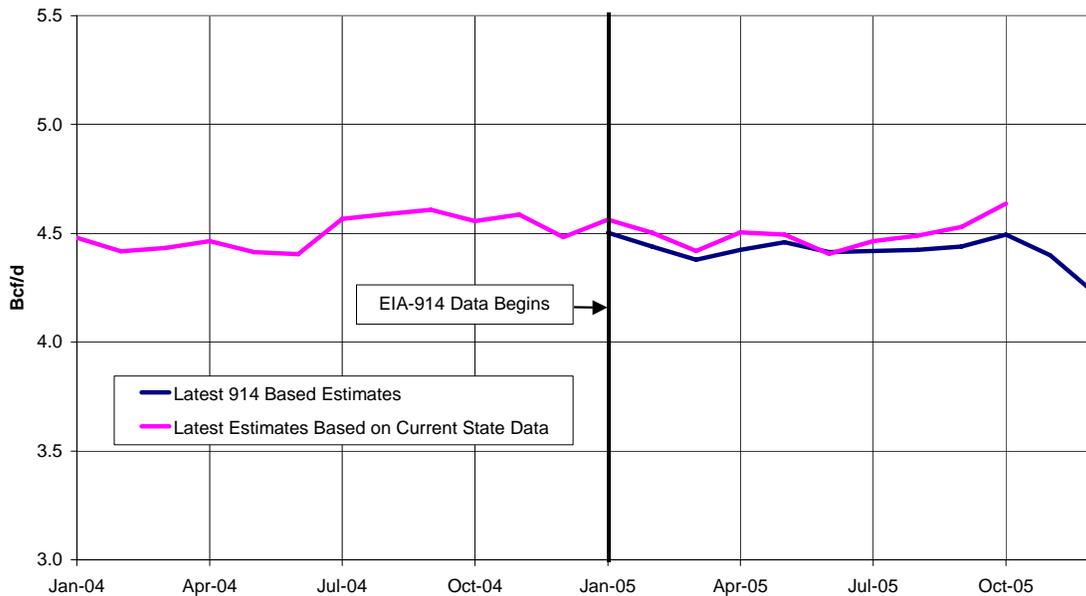


Figure 6A compares the latest Louisiana State data based estimates to the 914-based estimates. The two methods generally have the same magnitude and the same trends.

The large month-to-month changes in Louisiana are real. They are caused when production is shut in for hurricanes.

Figure 6A. Louisiana Gross Gas Production

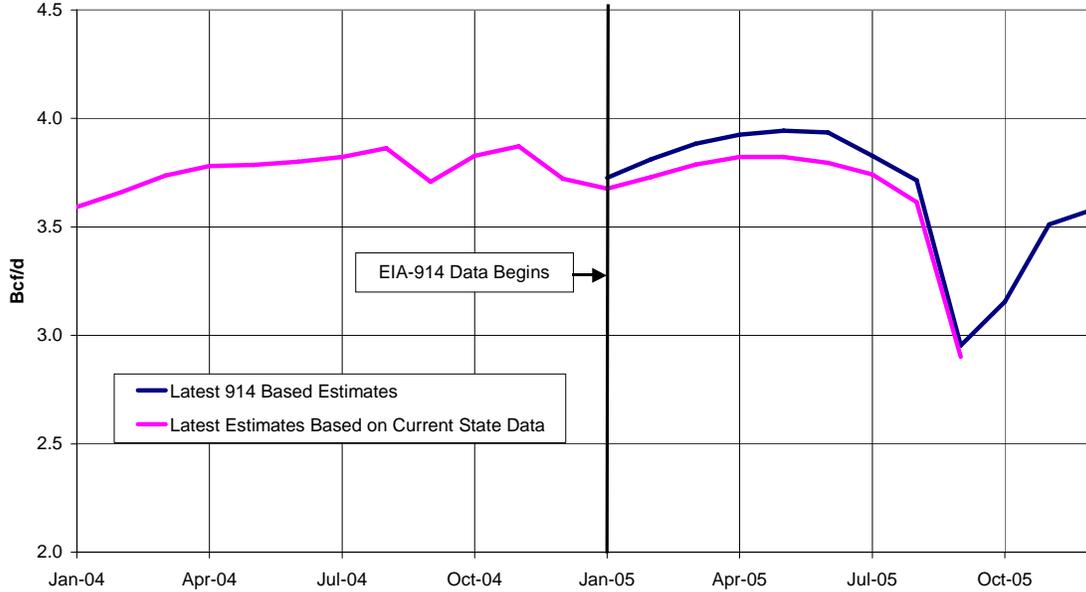
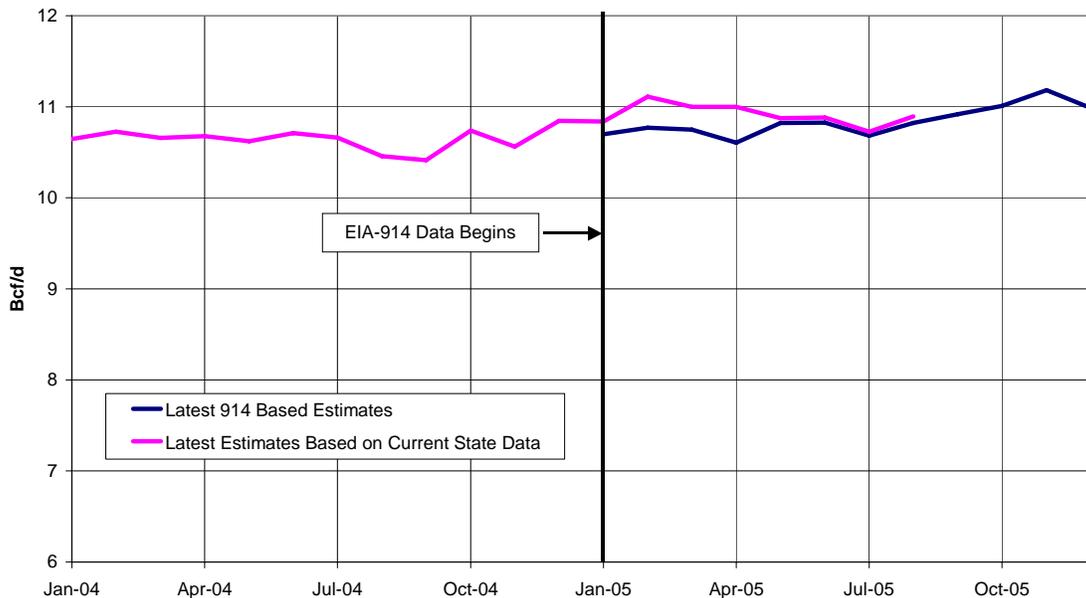


Figure 7A compares the latest State data estimates for the Other States to the 914-based estimates. The two methods generally have the same magnitude and the same trends. Since the Other States estimates are based on the five main surveyed States, they exhibit

Figure 7A. Other States Gross Gas Production



a similar pattern.

## B. EIA-914 Estimates Compared to the Previous Method Estimates

Figures 1B through 7B compare the first reported EIA-914 based estimates with the previously used method's first reported estimates for the EIA-914 areas. The previous methods vary from State to State and are described in the document [How EIA Estimates Natural Gas Production](#). The first estimate of gross production can be significantly different from the latest or final estimate of gross production. Generally these plots show the convergence of the two methods as corrections and resubmissions associated with the survey start-up were entered. Oklahoma is different in that it shows the erratic nature of the State reported data in recent months and the gradual smoothing as the data were cleaned up and corrected over time by the State. The EIA-914 routine revisions and resubmissions are relatively small.

Figure 1B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for Texas. As mentioned earlier, Texas 914 based estimates have already been approved as official gross gas production estimates by EIA. After a startup period during which respondent submission errors were discovered and corrected, the two methods converged.

Figure 1B. Texas Production Comparison

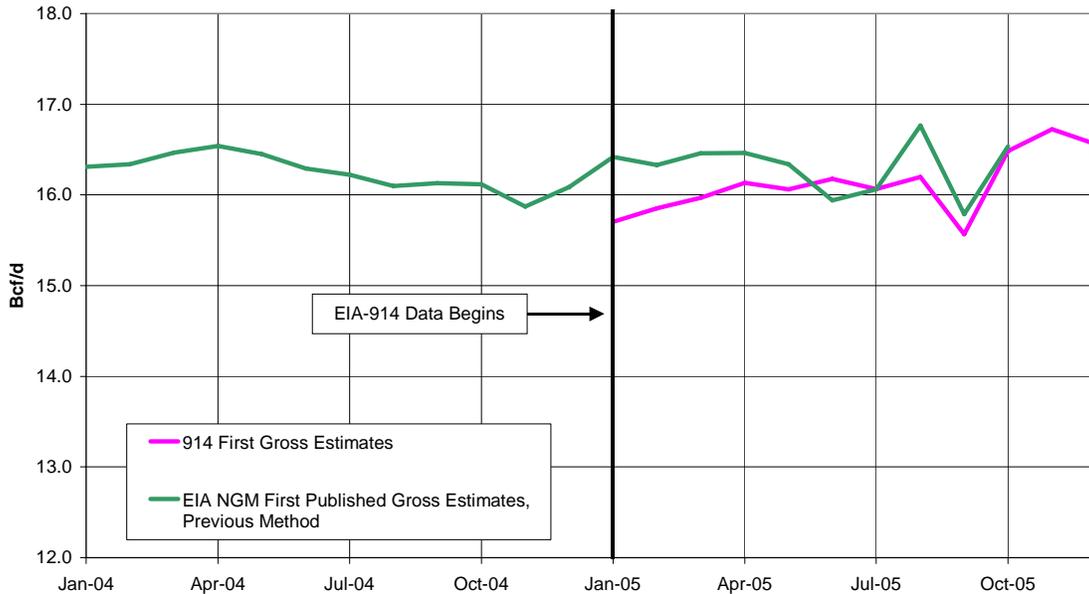


Figure 2B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for the GOM. Initially for the GOM the difference between the previous method estimates and the EIA-914 based estimates was larger than shown in Figure 2B. An analysis of the data and estimating procedures of both methods led to the conclusion that the calibration of the previous method should be changed. This change in the previous method brought the two estimates closer together.

Figure 2B. GOM Production Comparison

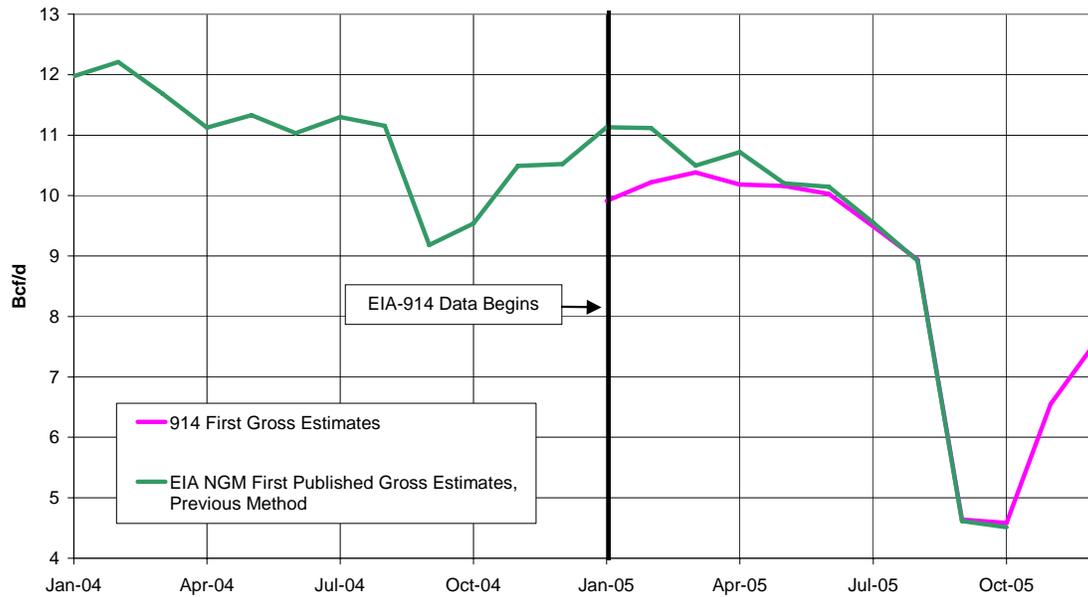


Figure 3B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for Wyoming. The two estimates are generally running parallel. A few corrections and resubmissions were made in Wyoming. Some of the corrections that were made as a result of the EIA 914 survey interaction with respondents were actually made to the State reported data not the EIA-914 data.

Figure 3B. Wyoming Production Comparison

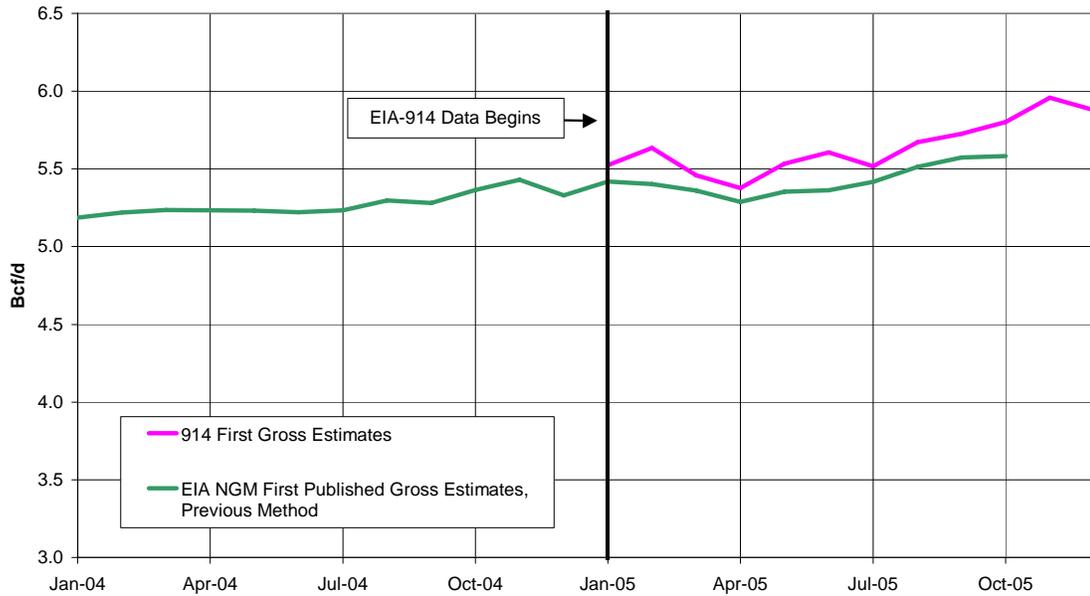


Figure 4B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for Oklahoma. In Oklahoma the previous method estimates are based on State reported data. The most current data reports can range from zero to double what will finally be reported in the extreme. Taken in this light, the EIA-914 based estimates are in good agreement with the previous method estimates.

Figure 4B. Oklahoma Production Comparison

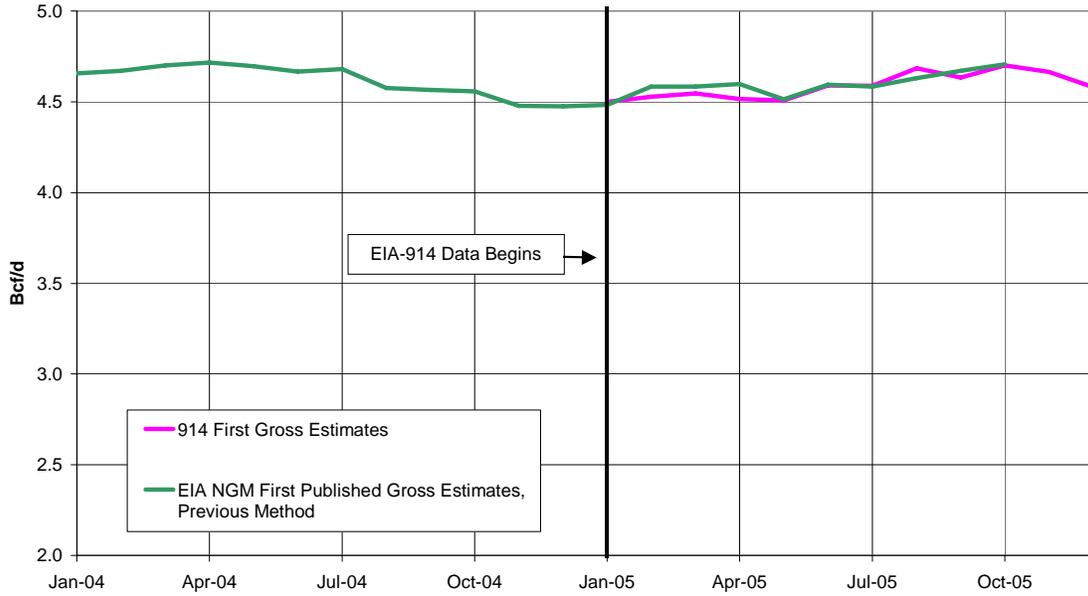


Figure 5B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for New Mexico. The EIA-914 based estimates and the previous method estimates are in agreement in New Mexico. An adjustment for CO<sub>2</sub> field production was made after comparing company data reported to the State and to the EIA-914 that identified a difference in handling the CO<sub>2</sub> field production reports.

Figure 5B. New Mexico Production Comparison

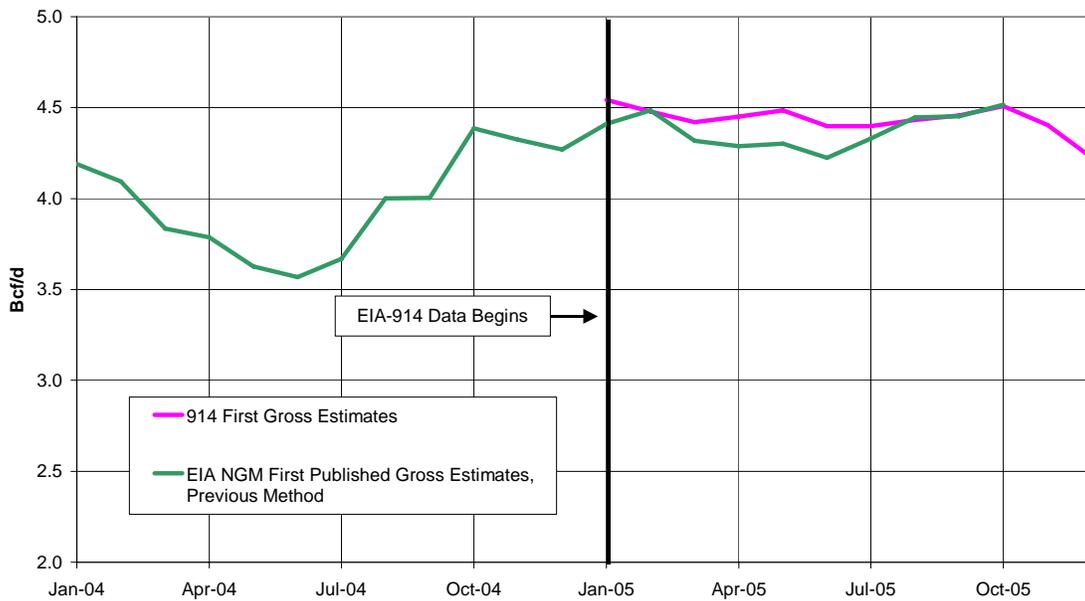


Figure 6B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for Louisiana. In Louisiana, the difference between the EIA-914 based estimates and the previous method estimates was more than expected early in 2005. However, in recent months the estimates have come together. There were some small corrections and revisions to the EIA-914 submissions.

**Figure 6B. Louisiana Production Comparison**

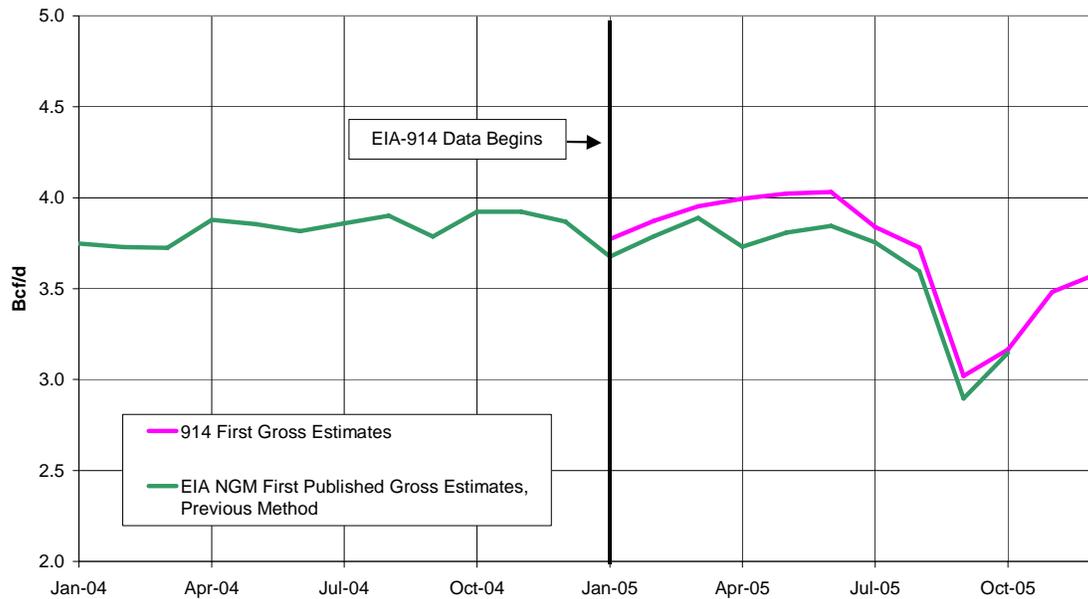
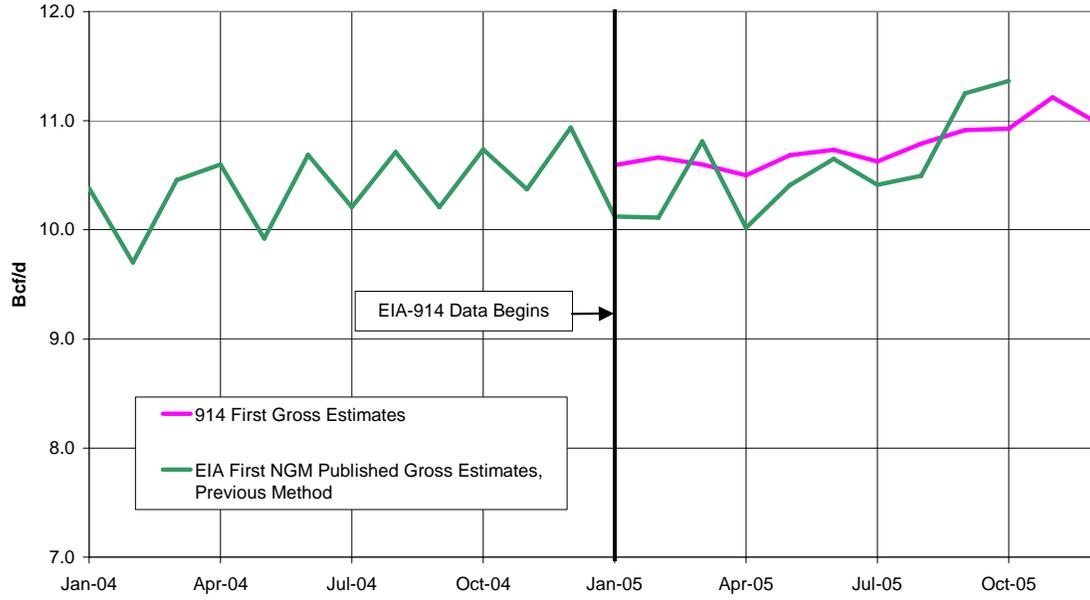


Figure 7B shows a comparison of the first estimates determined by the previous method and the first estimates from the EIA-914 survey data for the Other States. The two estimates generally show the same magnitude. The estimates from the previous method are somewhat erratic while the EIA-914 based estimates are smoother.

Figure 7B. Other States (Excluding Alaska) Production Comparison



### C. EIA-914 Based Estimates; Corrections, Revisions, and Resubmissions

Figures 1C through 7C show the first and latest EIA-914 derived estimates of gross production. Generally the differences between the first and latest estimates are due to resubmissions and corrections from operators. These tend to be small; however, there was a learning curve in the first few months of the survey for the operators. After the discovery and notification to the operators of errors, the resubmitted corrections brought the first and latest estimates closer together. In the following plots this is most noticeable in Texas, the GOM, New Mexico, and Louisiana. Because the Other States estimate is derived from the estimates for the 5 main areas (excluding GOM), it too shows the first and latest estimates coming together.

Figure 1C shows the first and latest EIA-914 based estimates for Texas. Differences between the two estimates are less than 1.5 % and usually much smaller reflecting very small reported revisions.

Figure 1C. Texas 914 Based Gross Gas Production Estimates

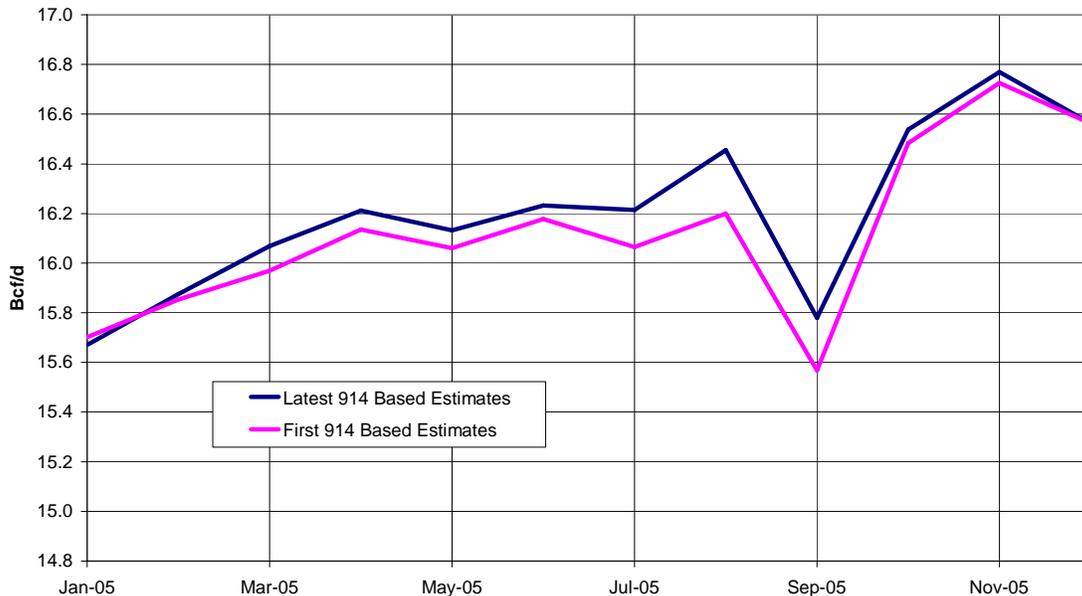


Figure 2C shows the first and latest EIA-914 based estimates for the GOM. During the first half of the year the differences between the two estimates is larger than in the second half. This likely reflects a learning curve for the operators and a few corrections.

Figure 2C. GOM 914 Based Gross Gas Production Estimates

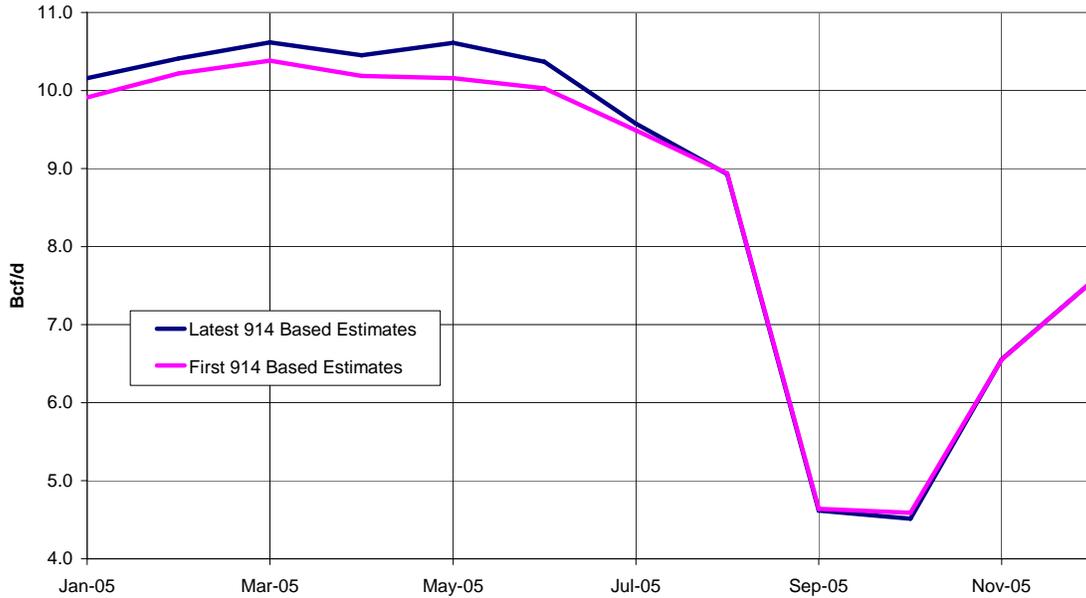


Figure 3C shows the first and latest EIA-914 based estimates for Wyoming. The last half of the year shows close agreement between the two estimates. The first half of the year indicates some small corrections and revisions that resulted from EIA-914 team analysis and feedback to the respondents.

Figure 3C. Wyoming 914 Based Gross Gas Production Estimates

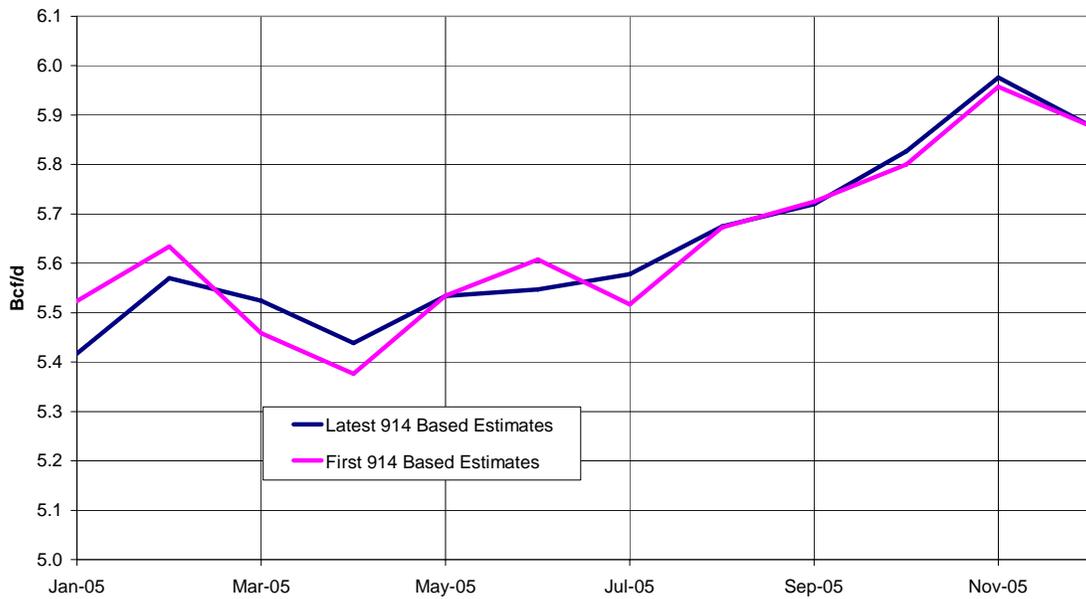


Figure 4C shows the first and latest EIA-914 based estimates for Oklahoma. Differences in the two estimates may be caused in part by operators reporting estimated volumes and then submitting a revision since the data are often not available to them within the required 40 day reporting period.

**Figure 4C. Oklahoma 914 Based Gross Gas Production Estimates**

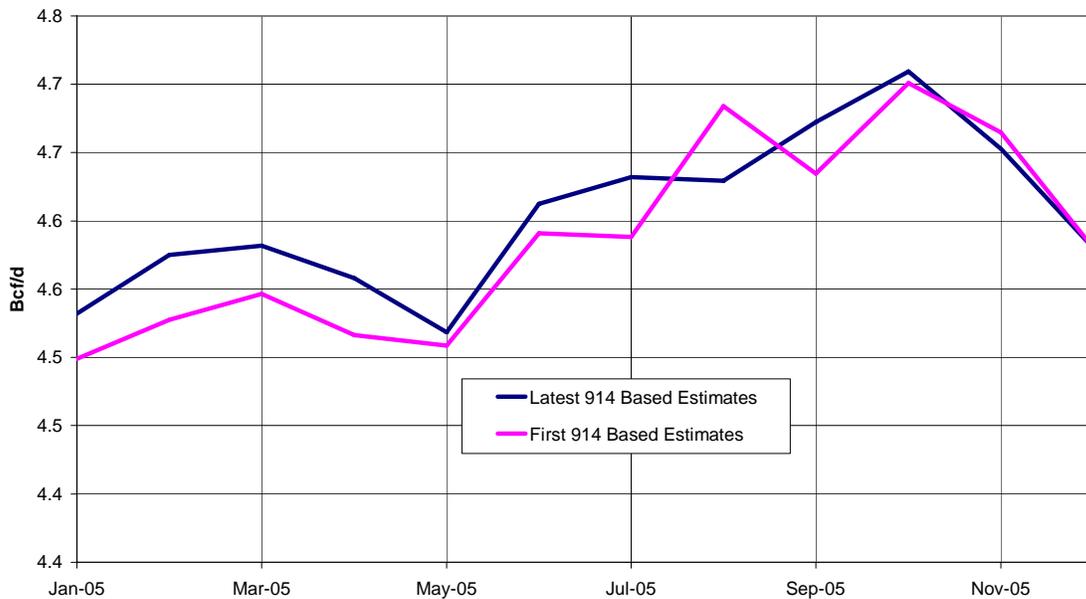


Figure 5C shows the first and latest EIA-914 based estimates for New Mexico. Early differences in the two estimates are due to the incorrect reporting of CO<sub>2</sub> volumes in addition to the normal startup corrections and revisions.

**Figure 5C. New Mexico 914 Based Gross Gas Production Estimates**

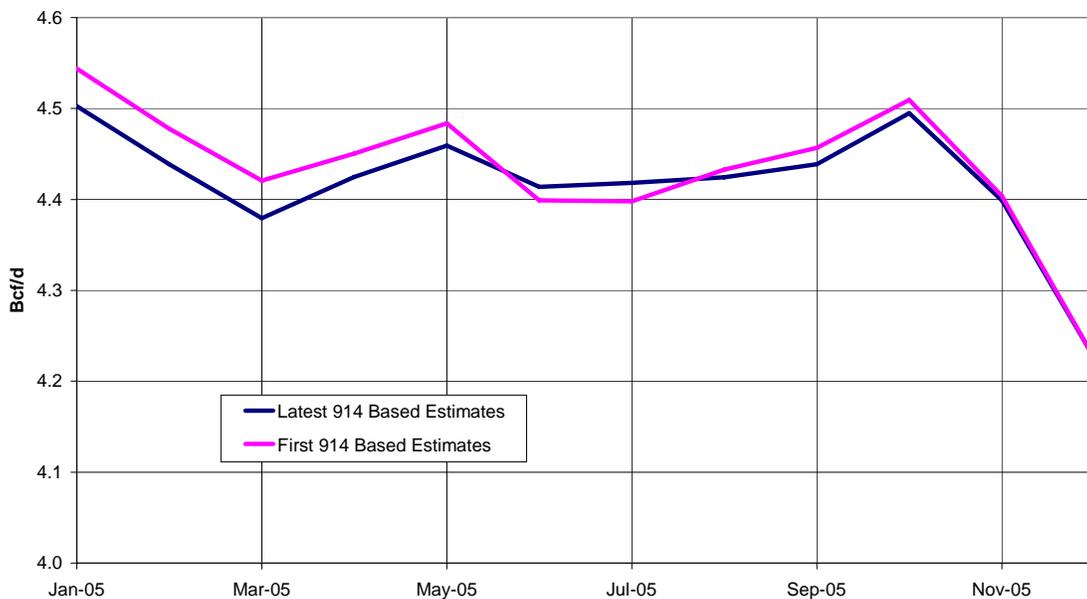


Figure 6C shows the first and latest EIA-914 based estimates for Louisiana. Early differences in the two estimates are due to some small corrections and the normal revisions expected in the beginning of a new survey.

**Figure 6C. Louisiana 914 Based Gross Gas Production Estimates**

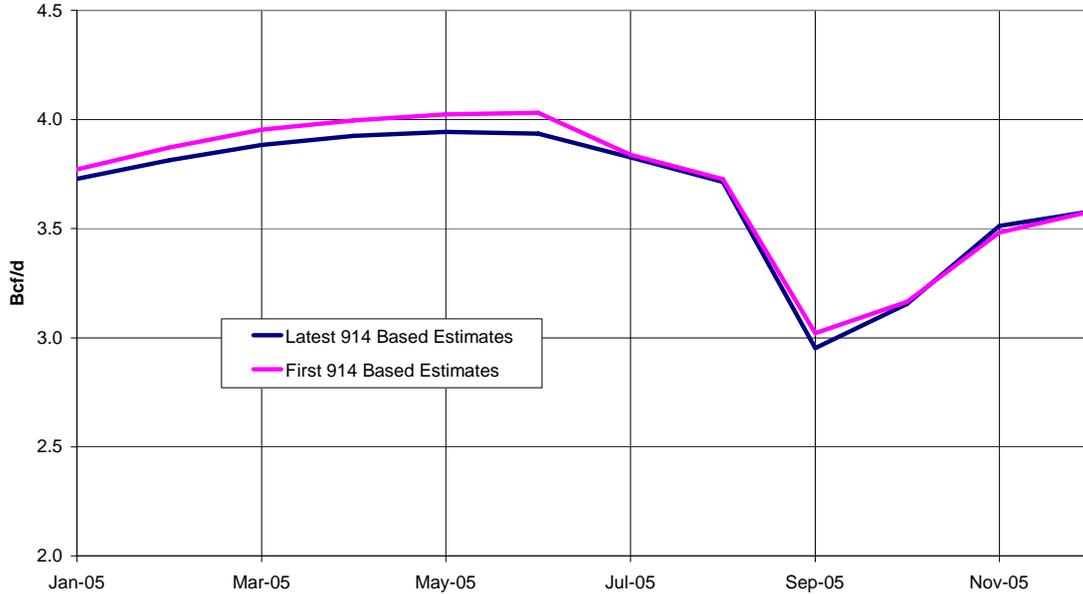
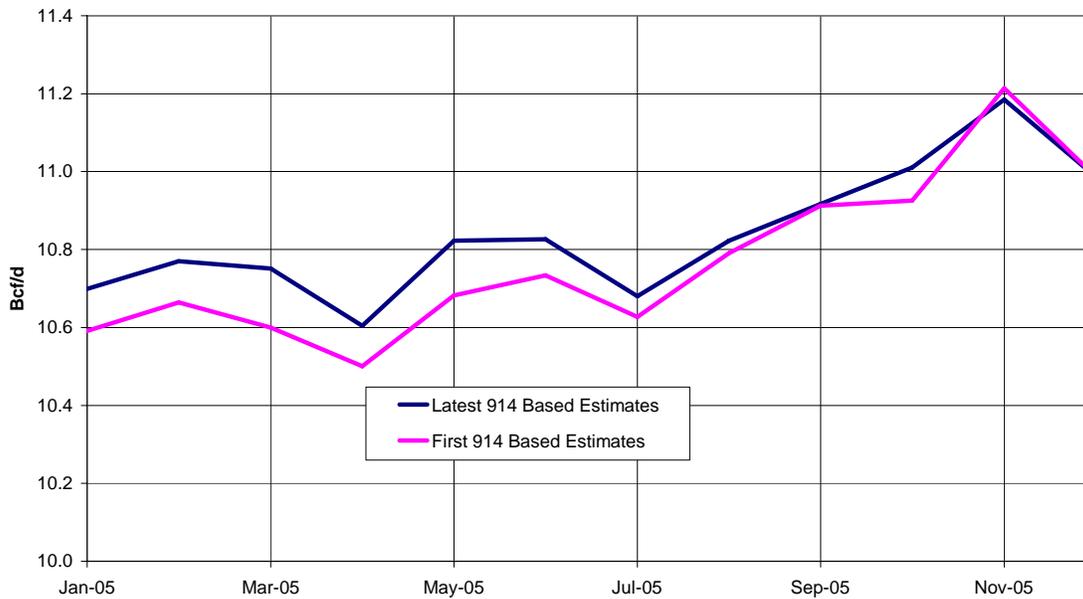


Figure 7C shows the first and latest EIA-914 based estimates for the Other States. Since the Other States estimates are based on the five main States they show the same pattern of converging estimates reflecting startup corrections and revisions.

**Figure 7C. Other States 914 Based Gross Gas Production Estimates**



## D. Error Bounds of Gross Gas Production Estimates

The error bounds were constructed by determining the average absolute error for production estimates using the previous methods for six years of estimates (1998 – 2003). The average absolute error was applied to the production estimates as a positive and a negative and then plotted as an error band above and below the production estimates. As can be seen in the following graphs, the EIA-914 based estimates generally continue within the error bands of the estimates from the latest State data, while being published two months earlier.

Figure 1D shows the average error bands for Texas. The EIA-914 based estimates continue the trend of the previous methods and are contained within the error bands. Note that at the end of 2004 the errors of the first published estimates were more than the average error. Texas initiated a new production reporting system that temporarily caused revision submissions to lag behind their normal timing. This situation was recognized and modifications were made to the standard previous methods to account for the changes in reporting. The resulting errors were more than average, but less than they would have been without the applied modifications. It's likely that much of the difference in the first quarter of 2005 between the EIA-914 based estimates and the estimates based on State data was the result of the change in State reporting due to the implementation of Texas' new reporting system.

Figure 1D. Texas Gross Gas Production with 2 Percent Error Bands

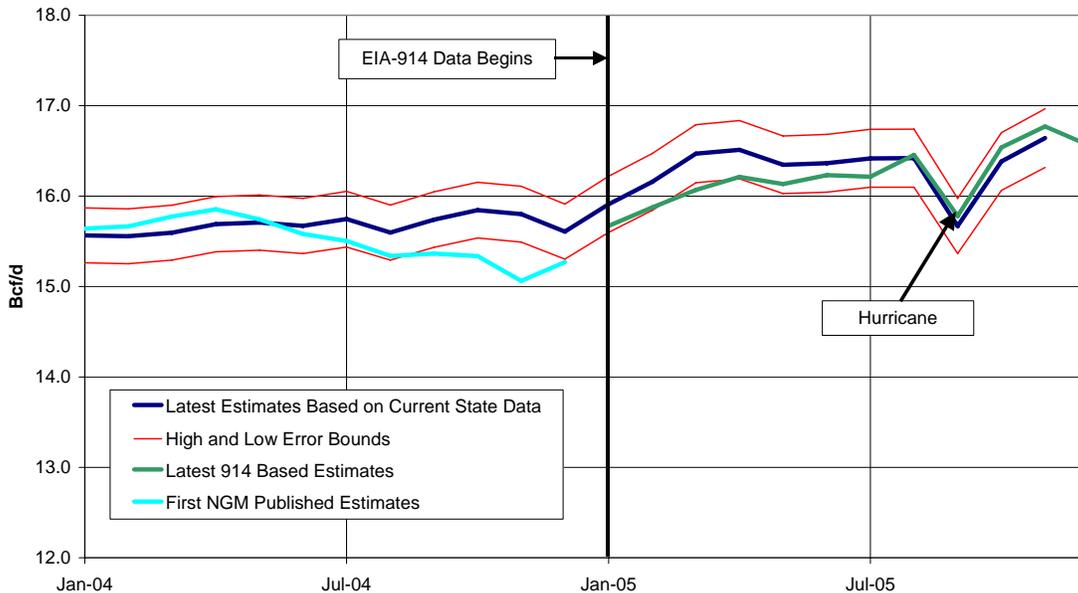


Figure 2D shows the average error bands for the GOM. The EIA-914 based estimates follow the trend of the previous method's estimates and remain within the average error

bands. Note that in 2004 the first published estimates are usually within the average error bands except for a few small excursions. The errors were kept relatively small for the 2004 hurricane by using some additional shut in data from the MMS and expert judgment of our staff. Current production information is practically non-existent for the GOM and it's especially important to have reliable, up to date production information when a major storm affects the Gulf. The EIA-914 data were very important in the 2005 hurricane season.

**Figure 2D. Federal Gulf of Mexico Gross Gas Production with 4 Percent Error Bands**

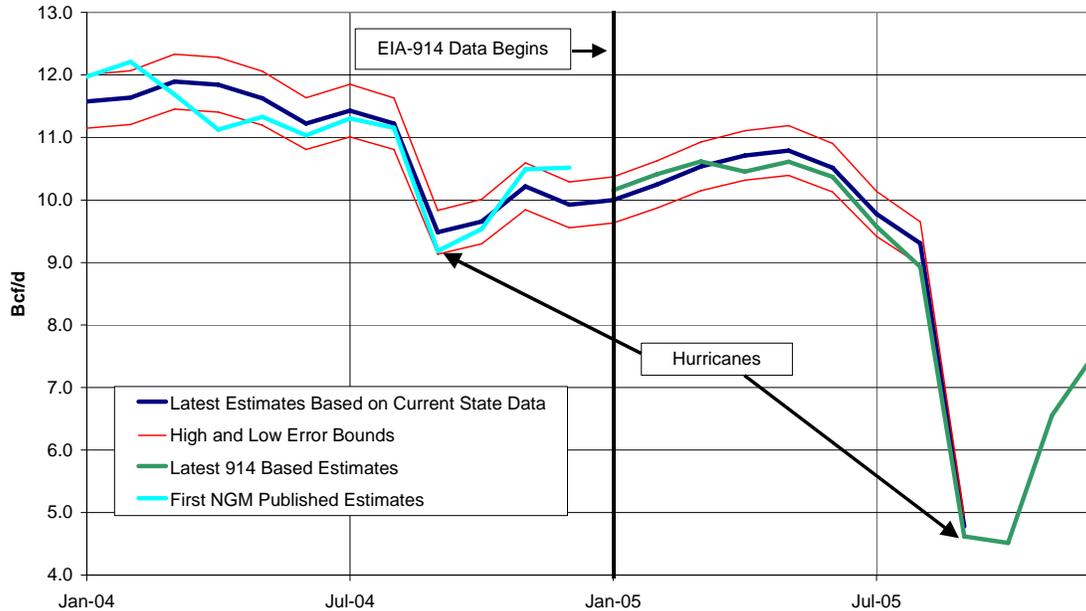


Figure 3D shows the average error bands for Wyoming. The EIA-914 based estimates are on trend with the previous estimates and remain well within the average error bands. The first published estimates in 2004 are also well within the average error bands although this hasn't always been the case as indicated by the wide 13 percent average error bands.

Figure 3D. Wyoming Gross Gas Production with 13 Percent Error Bands

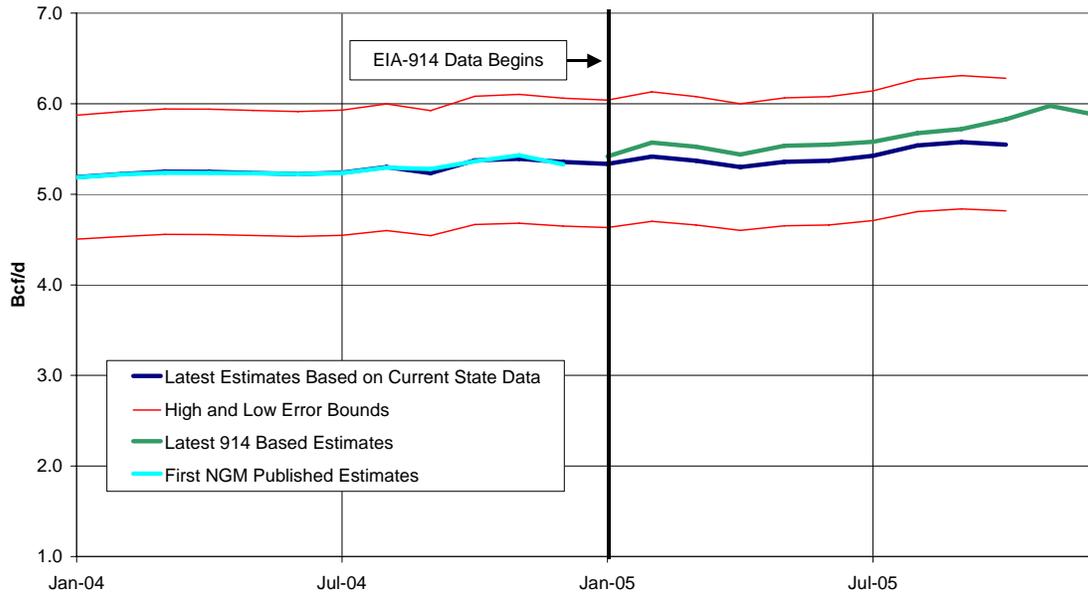


Figure 4D shows the average error bands for Oklahoma. The EIA-914 based estimates are roughly the same magnitude as the previous method's estimates and generally fall within the average error bands. The first published estimates for 2004 are within the average error bands. The previous method estimates depend on State reported data that can be erratic in the most recent months but smoothes out over time as revisions are reported. Notice that the latest data in the first half of 2004 is smooth as compared to the first half of 2005. The EIA-914 data appears to be relatively smooth.

**Figure 4D. Oklahoma Gross Gas Production with 6 Percent Error Bands**

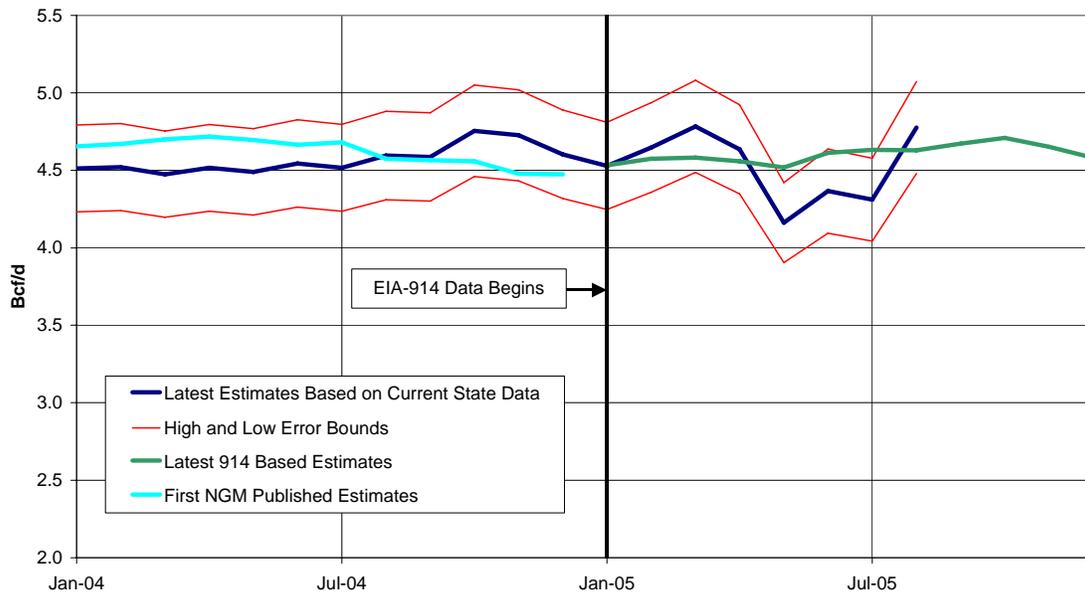


Figure 5D shows the average error bands for New Mexico. The EIA-914 based estimates continue on trend from the previous method estimates and are well within the average error bands. Note that in 2004 the first published estimates were in error by almost 20% in June.

Figure 5D. New Mexico Gross Gas Production with 4 Percent Error Bands

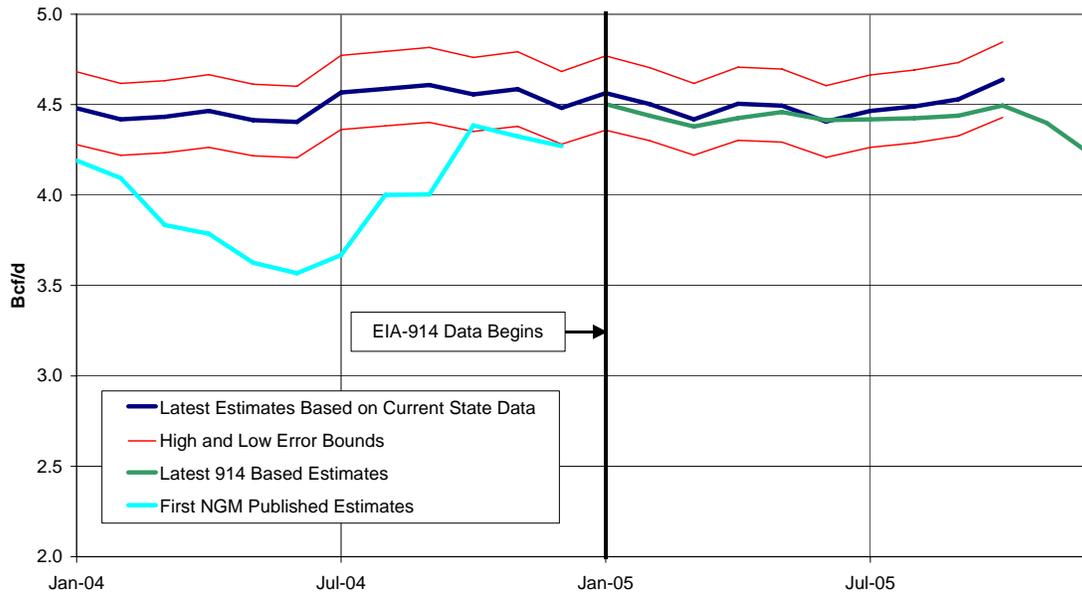


Figure 6D shows the error bands for Louisiana. The EIA-914 based estimates follow the trend of the previous estimates in 2004. Hurricanes in the fall of 2005 dramatically reduced the State's production. The first published estimates in 2004 are within the average error bands including the hurricane event in the fall.

**Figure 6D. Louisiana Gross Gas Production with 6 Percent Error Bands**

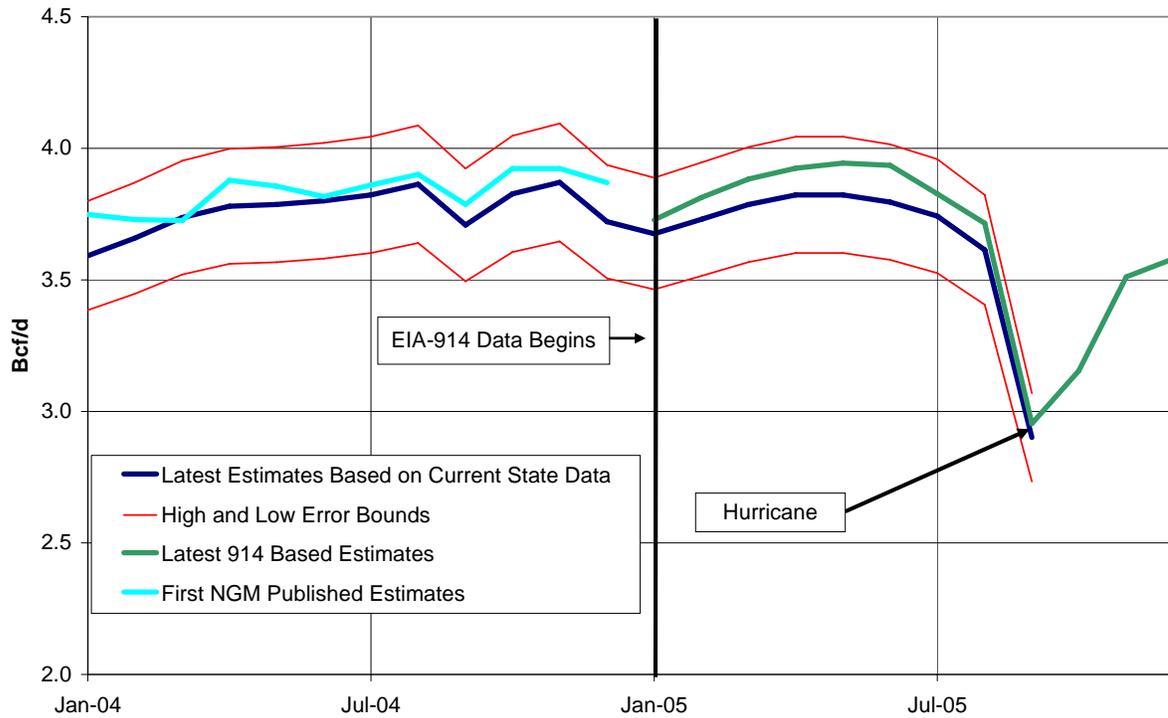


Figure 7D shows the average error bands for the Other States. The EIA-914 based estimates are generally on trend and the same magnitude as the latest previous estimates, and within the average error bands. The separation that appears early in 2005 fades later in the year as the two estimates converge. The latest estimates based on State data in 2005 are likely to have substantial revisions in the future. Also the latest estimates are much smoother than the first estimates in 2004. The first published estimates in 2004 were erratic and had several substantial excursions outside the average error bands early in the year.