



U.S. Energy Information Administration
Office of Energy Statistics
Office of Oil, Gas, and Coal Supply Statistics

Supporting Statement for Survey Clearance:

U.S. Energy Information Administration's (EIA) Oil and Gas Reserves System Surveys:

FORM EIA-23L, Annual Survey of Domestic Oil and Gas Reserves (Field Version)

Form EIA-23S, Annual Survey of Domestic Oil and Gas Reserves (Summary Version) – Requesting Suspension

Form EIA-64A, Annual Report of the Origin of Natural Gas Liquids Production

OMB No. 1905-0057

Part B:

Statistical Methods

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B. STATISTICAL METHODS

A.1. Respondent Universe

Form EIA-23L

The Form EIA-23L, *Annual Survey of Domestic Oil and Gas Reserves (Field Version)* collects data on domestic reserves of crude oil, condensate, and natural gas. Form EIA-64A, complimentary to the EIA-23L, collects data on natural gas liquids. These data are used to develop national and regional estimates of proved reserves of domestic crude oil, condensate, natural gas, and natural gas liquids, and to facilitate national energy policy decisions.

Operators of crude oil and natural gas wells were selected as the appropriate respondent population for the Form EIA-23L, because the well operators have access to the most current and detailed reserve information. Therefore, they presumably have better proved reserve estimates than do other possible classes of respondents, such as working interest or royalty owners.

The universe of currently active oil and natural gas well operators in the United States contains roughly 13,000 operators. Though the larger well operators are quite well-known to EIA, they comprise only a small portion of all operators. The small well operators are not well-known and are difficult to identify, because they go into and out of business more easily, frequently alter their corporate identities, make relatively large property sales and acquisitions that significantly change their size, and often change addresses. EIA uses commercial vendors of production data, such as Drilling Info (DI), and operator data from state regulatory agencies, to build and maintain its survey frames.

EIA estimates and publishes data that meet predetermined reliability constraints on proved reserves and production for crude oil, natural gas, and lease condensate by state for most states, and by state subdivision for the States of Alaska, California, Louisiana, New Mexico, and Texas. EIA also publishes data by reservoir type for shale and coalbed methane by state/subdivision. Each operator reporting on the survey is asked to report proved reserves and production for crude oil, natural gas, and lease condensate by field for each field in which it operates, as well as the reservoir type associated with the reserves. Shale, coalbed methane, and conventional are the main reservoir types reported by operators. Reservoir types of low permeability and chalk are also used. (Hereafter, the term “state/subdivision” refers to an individual subdivision within a state or an individual state that is not subdivided.)

Form EIA-64A

The Form EIA-64A, *Annual Report of the Origin of Natural Gas Liquids Production*, collects information on the annual volumes of natural gas received and natural gas liquids extracted at domestic gas processing plants, by area of origin. It also includes the total gas shrinkage resulting from the natural gas liquids extracted and the annual volume of natural gas utilized as fuel at gas processing plants. These data enable estimating natural gas plant liquids production and reserves.

Operators of natural gas plants were selected as the appropriate respondent population for the Form EIA-64A because they have access to the most current and detailed information on natural gas plant liquids. Therefore, these operators presumably have better gas plant liquids production and gas shrinkage data than do other possible classes of respondents, such as gas producers or pipelines.

The Form EIA-64A and the Form EIA-816, *Monthly Natural Gas Plant Liquids Report*, are scheduled to be combined and replaced in 2014 by the newly proposed Form EIA-915, [Monthly Gas Processing and Liquids Report](#).

A.2. Statistical Sampling, Imputation, and Estimation Procedures

A.2.1. Sampling

Current Form EIA-23L

The current survey samples for the Form EIA-23L and Form EIA-23S were a combination of certainty strata for large well operators and probability proportional to size (PPS) samples for smaller operators. Operator size is determined by level of production, which is obtained from the commercial data vendor, DI, from state agencies, or the Bureau of Safety and Environmental Enforcement (BSEE). Roughly half of all sampled respondents came from the certainty strata, and the other half came from the PPS sample conducted for each survey. There were roughly 1,200 total respondents for Forms EIA-23L and EIA 23S, combined. Sample selection was performed using national operator production.

Proposed Form EIA-23L

EIA proposes a cut-off sample for the Form EIA-23L, which will include some former respondents to the Form EIA-23S, which is proposed to be suspended. Cut-off samples are comprised of all operators with measures of size larger than a predefined production threshold. The reporting burden for operators below the predefined threshold is eliminated. Reductions to sample sizes from cut-off sampling also have the potential to reduce burden/cost to EIA. Because smaller operators have, in the past, been responsible for a high percentage of reporting errors and nonresponse, cut-off sampling may also reduce the levels of non-sampling error affecting the published estimates (see Knaub [2007, 2008] on cut-off sampling in general, Royall [1970] on model variance, and Knaub [2001] on model validity and variance). Cut-off sampling also allows data collection and validation/editing efforts to be focused on larger operators, whose responses are more likely to influence published summary-level data. Sample selection is performed using state/subdivision operator production.

Estimates are required for multiple attributes (natural gas, oil, and lease condensate by state/subdivision and by reservoir type). Thus, a variant of cut-off sampling, *quasi-cut-off sampling*, allows a sample design that yields reliable estimates for the various attributes (sometimes called “target variables,” or “variables of interest” -- see Knaub [2011a]). Because many operators selected for their production in one attribute (e.g., liquids) will also have production in other attributes (e.g., gas), a few more respondents may be added to the sample than the minimum number required to meet preset reliability constraints for a particular attribute in a particular state/subdivision. This may cause some state/subdivisions to appear to have a few “extra” respondents scattered throughout the population below the cutoff threshold, but the total number of respondents doesn’t increase.

The proposed expanded cut-off sample for the Form EIA-23L will have roughly 850 respondents, compared with roughly 1,200 respondents included in the previous samples (cutoff and PPS) for forms EIA-23L and EIA-23S, combined. As in the past, sampling will be based on annual production volumes of the well operators, but at the state/subdivision and geological province level, not the U.S. level as before (Geological provinces define the estimation groups, See section B.2.2). EIA’s proposed changes to the Form EIA-23L sampling process enable developing the new cut-off sample, eliminating the PPS sample of the smaller operators, and eliminating the need to collect the Form EIA-23S (for smaller operators). Roughly 90 percent of U.S. oil and natural gas reserve volumes will be reported on the Form EIA-23L, leaving roughly 10 percent to be estimated.

The cut-off sample thresholds for the Form EIA-23L will be selected based on the target estimated relative standard error (RSE) value of 5 percent for all publication groups. The RSE is a percentage measure of the precision of a survey statistic and is used as one way to measure error induced by sampling. RSEs are estimated to account for using model-based predicted values in place of missing and non-sampled data for the quantities of interest (reserves). Most sampled areas will be able to achieve the 5% RSE, but some areas with mostly small operators may not, because the 5% condition would necessitate sampling a large number of extremely small operators. In these cases a more reasonable (higher) cutoff will be imposed to avoid sampling these extremely small operators, to reduce respondent burden and to stay within EIA's resource constraints. In some situations, data for these areas will be combined or withheld for dissemination purposes.

The sampling cut-off production rates and the survey sample will be determined as follows:

- 1) The sampling frame will be constructed from commercial data provided by DI and data provided by state and federal regulatory agencies. A census will be taken of Alaska and a near census of the Federal offshore Gulf of Mexico well operators.
- 2) Operators will be sorted by their gas production, largest to smallest, for each state/subdivision and geographic province and reservoir type.
- 3) For each state/subdivision and reservoir type, the largest operator from each geographic province will be added to the sample.
- 4) Operators will be added to the sample one at a time for each state/subdivision publication group. To add an operator, the largest operator from each geologic province which makes up the state/subdivision will be considered. Whichever one of those operators reduces the anticipated RSE of the estimated reserves the most will be added to the sample. This process will be repeated until the estimated RSE for each published state/subdivision estimate is 5% (or as low as possible if 5% is unattainable in a particular area consisting mostly of extremely small operators). The lowest gas production rates sampled in this way will be the gas production cut-offs used for the state/subdivision and geologic provinces in subsequent operational sampling procedures. This selection procedure will be performed for every possible state/subdivision substratum. Some state/subdivision substrata may be combined.
- 5) Operators will be sorted by their oil production, largest to smallest, for each state/subdivision and geographic province and reservoir type.
- 6) For each state/subdivision and reservoir type, the largest operator from each geographic province will be added to the sample.
- 7) Operators will be added to the sample one at a time for each state/subdivision publication. To add an operator, the largest operator from each geologic province which makes up the state/subdivision will be considered. Whichever one of those operators reduces the anticipated RSE of the estimated reserves the most will be added to the sample. This process will be repeated until the estimated RSE for each published state/subdivision estimate is 5% (or as low as possible if 5% is unattainable in a particular area). The lowest oil production rates sampled in this way will be the oil production cut-offs used for the state/subdivision and geologic provinces. This selection procedure will be performed for every possible state/subdivision substratum. Some state/subdivision substrata may be combined. Operators producing less than 500 barrels of oil per day nationally will not be selected in this fashion, regardless of their impact on RSE calculations.

See section B.2.7 for estimates of anticipated RSEs.

Form EIA-64A

The EIA-64A is a census survey of natural gas processing plants. All natural gas processing plant operators are requested to file a Form EIA-64A for each of their plants. Plants are requested to report natural gas liquids production by the area of origin of the natural gas processed. The majority of the plant operators report only one area of origin for the natural gas processed by the plant. The state or the area of origin reported is generally also the plant location.

The Form EIA-64A gas plant survey frame contains data on all known active and inactive natural gas processing plants in the United States. The survey frame contains roughly 600 active natural gas plants, and many new processing plants are being built to facilitate the production of tight oil and shale gas resources. Each year, EIA provides Form EIA-64A to all known natural gas processing plant operators as of December 31 of the reporting year. In addition, plant operators whose plants were shut down or dismantled during the reporting year are required to complete forms for that portion of the reporting year the plants were operated. Many new processing plants are being built to facilitate the production of tight oil and shale gas resources.

A.2.2. Estimating Proved Reserves

The published estimates of U.S. proved reserves and production are the sum of the estimates for the individual states. Correspondingly, the estimates for the states for which estimates are published separately by subdivision (California, Louisiana, New Mexico, and Texas) are the sum of the subdivision estimates. The remaining states are not subdivided and may be considered as a single subdivision. The cut-off sample accounts for roughly 90 percent of the U.S. proved reserves for both oil and gas, leaving only 10 percent to be estimated.

Production data from another source (DI or the state regulatory agencies) are used to estimate proved reserves for the non-surveyed operators. The estimates are based on reported reserves and production at the operator/field level. Likewise, reserve estimates for the non-surveyed operators are performed at the operator/field level. The estimates are created using weighted least squares to fit an equation relating production to reserves. Operators are grouped into geological provinces, and the equation is fitted separately for each province.

Estimation groups are developed by geologic provinces to benefit from the inherently higher geologic affinity and more similar stage of resource development that these provinces provide. The boundaries of the geologic provinces used for this purpose are similar to the province and basin boundaries developed by the United States Geological Survey (viewable at <http://certmapper.cr.usgs.gov/geoportal/catalog/search/browse/browse.page>). Forty-five geologic provinces are identified, though only about forty regions are used in practice. Some provinces are combined because they have too few operator/fields for sufficient statistical rigor when analyzed individually.

Use of this estimation procedure reduces reporting and analysis burden by minimizing the number of operators that have to be surveyed. Since the statistical distributions of production and proved reserves are to a significant degree positively skewed, weighted linear regression estimation is used to reduce a propensity for dominance of the provincial fit by the largest operators and largest fields. The weight is defined as inverse of the operator/field's size or annual production.

The following classical ratio estimation (CRE) function is used in the provincial estimation models:

$$(1) RFP = x * PFP$$

where:

RFP = Operator's Year End Reserves in Field (F) in Province (P),

PFP = Operator's Annual Production in Field (F) in Province (P), and

x = fit parameter determined by weighted least squares.

For each geologic province, classical ratio estimation (CRE) functions were derived for conventional liquids production and conventional gas production, using Equation (1). Four more functions are derived for shale gas, coal bed methane gas, shale oil, and coal bed liquids. Operators that report a reserve to production ratio greater than 50 are excluded from the calculation of the province coefficients. (Note that the aforementioned situation is rare—the reported values of this type are typically based on less than a full year's production.)

The CRE function is applied to data for non-sampled operators from DI, or operator/field production data from the states, to estimate the proved reserves of non-surveyed operators in all states, except Illinois, Indiana, and Tennessee. Current production information is not available in these three states, so the same estimation procedure described above is not applicable.

Obtaining operator production data for the smaller oil and gas producing states of Tennessee, Illinois, and Indiana requires an alternative approach to using DI data, because DI excludes these states or the data is not current. Samples of operators in these states must be built from lists of oil and gas companies licensed to do business in the state, internet searches, and past reports on the Forms EIA-23L and EIA-23S. Because production data is not current or not available, the sampling process described in the previous section cannot be used. If the reserves in these states are surveyed, the summary-level data (U.S. level and "Miscellaneous States" level) may be published including these states 'as reported' (i.e., no estimates for the total state population will be generated for these states). The reserves for these individual states will not be published.

The largest operators in the states of Illinois, and Indiana, and Tennessee should be identifiable. However, the frame will be incomplete and may be insufficient to reliably estimate reserves for non-sampled operators. These three states, when combined, are estimated to hold less than 0.5 percent of U.S. total oil and condensate reserves and less than 1.0 percent of U.S. total natural gas reserves.

EIA will continue to study the available information for Tennessee, Illinois, and Indiana to determine if and when reliable proved reserve estimates can be generated using the same methods as in the other states. In particular, EIA will research state agencies, including agencies other than oil and gas regulatory agencies, and industry trade journals, newsletters, etc, to build a sample frame.

Figure 1 shows the map of geologic provinces used to group the reported data and estimate proved reserves for the non-sampled operators. The reported reserves and the estimated reserves are summed to the field level. The field level reserves are then summed to the state/subdivision level which is then summed to the U.S. level.

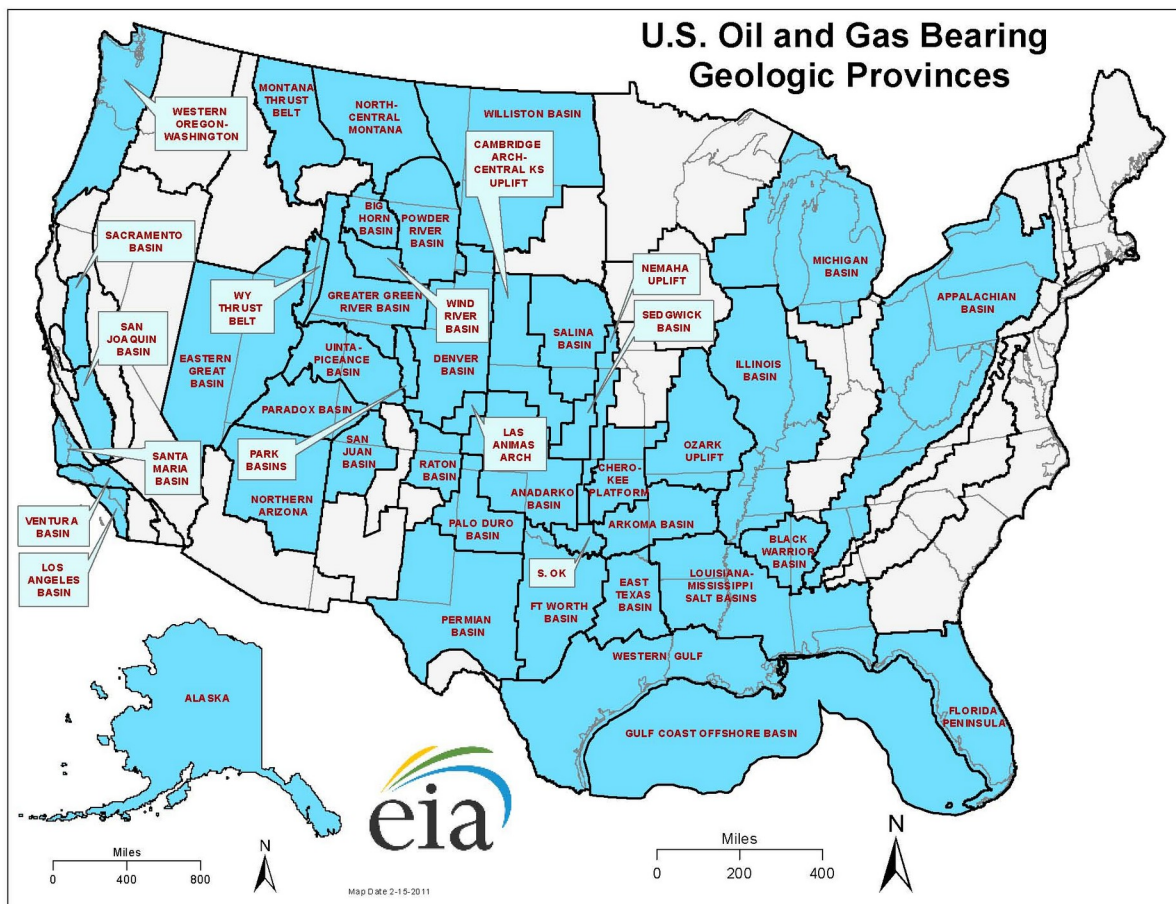


Figure 1: US Oil and Gas Bearing Geologic Provinces

A.2.3. Estimating Reserve Balancing Categories

Estimated proved reserve balancing categories (i.e., revisions, extensions, new discoveries, etc.) are assumed to have the same relationship to estimated year-end reserves as the reported proved reserve balancing categories have to the reported year-end reserves. Ratios for the total reported categories in a province are applied to the estimated reserves volumes to calculate the estimated balancing categories. Estimated balance items will have the same proportion to year-end reserves as do the reported volumes.

The instructions for Form EIA-23L specify that, when reporting proved reserves balance data, the following arithmetic equation applies:

Proved Reserves at End of Previous Report Year

- + Adjustments
- + Revision Increases
- Revision Decreases
- Sales
- + Acquisitions

- + Extensions
 - + New Field Discoveries
 - + New Reservoir Discoveries in Old Fields
 - Report Year Production
- = Proved Reserves at End of Report Year

Any remaining difference in the annual proved reserves balance between the published previous reporting year-end proved reserves and current reporting year-end proved reserves, not accounted for by the estimated proved reserves changes, is included in the adjustments for the area. One of the reasons that adjustments are necessary is that the inclusion of operators with the same operating characteristics in each year's sample is uncertain. There is no guarantee that, in the smaller producing states/subdivisions, the same small operators will be selected each reporting year, or the operators selected will have comparable production volumes when compared with operators selected in a prior reporting year.

Other reasons for more substantial adjustments to the annual proved reserves balance may include any combination of the following:

- The frame sample coverage may or may not have improved between survey years, such that more or fewer operators were included in the reporting year than the previous year.
- One or more operators may have reported data incorrectly in one reporting year or the next, but not both, and the error was not detected by data validation/edit rules processing.
- Operation of properties was transferred during the reporting year from operators not in the frame, or operators not selected for the sample, to surveyed operators.
- Operation of properties was transferred during the reporting year to an operator with a different evaluation of the proved reserves associated with the properties than that of the previous year's operator.
- The respondent changed the classification of their natural gas from non-associated gas to associated-dissolved gas, or vice versa.
- The trend in reserve changes imputed for the non-sampled operators, which was based on the trend reported by the sampled operators, did not reflect the actual trend for the non-sampled operators.

The causes for adjustments are known for some, but not all instances of imbalance. The only problems for which the effects cannot be expected to balance over a period of several years are problems associated with an inadequate survey frame or with any actual trend in reserve changes for non-sampled operators not being the same as the reserve changes for sampled operators. EIA continues to attempt to improve sources of operator data to resolve problems in frame completeness.

A.2.4. Estimating Natural Gas Liquids Reserves and Dry Natural Gas

The published reserves, production, and reserves change statistics for crude oil, lease condensate, and natural gas, wet after lease separation, are derived from data reported on Form EIA-23L and the application of the estimation methods discussed, previously. The information collected on Form EIA-64A is then utilized in converting the estimates of the wet natural gas reserves into two components: plant liquids reserve data and dry natural gas reserve data.

In estimating the volumes of natural gas on a dry basis, downward adjustments of the natural gas data, wet after lease separation, are made. These reductions are based on estimates of the gaseous equivalents of the liquids removed (in the case of production), or expected to be removed (in the case of reserves),

from the natural gas stream at natural gas processing plants. Form EIA-64A collects the volumetric reduction, or shrinkage, of the input natural gas stream that results from the removal of the Natural Gas Plant Liquids (NGPL) at each natural gas processing plant.

The shrinkage volume is then allocated to the plant's reported area or areas of origin. Because shrinkage volume is, by definition, roughly in proportion to the NGPL recovered (i.e., the volume of NGPL produced), this allocation is in proportion to the reported production of NGPL volumes for each area of origin. However, these derived shrinkage volumes are rejected if the ratio between the shrinkage and the NGPL production (gas equivalents ratio) fall outside certain limits of physical accuracy. The ratio is expected to range between 1,558 cubic feet per barrel (where NGPL consists primarily of ethane) and 900 cubic feet per barrel (where NGPL consists primarily of natural gasoline). When the computed gas equivalents ratio falls outside these limits, an imputed ratio is utilized to estimate the plant's natural gas shrinkage allocation to each reported area of origin.

This imputed ratio is calculated for the aggregate of all other plants from the area that are reporting production and shrinkage and also are having a gas equivalent ratio within the aforesaid limits. The imputed ratio is applied only if there were at least five other plants reporting NGPL production in a producing area. If there are less than five other plants, the imputed ratio is calculated based on all plants in the survey for which the individual gas equivalents ratio is within the acceptable limits. Less than one percent of gas liquids production is associated with shrinkage volumes imputed in this manner. Based on the Form EIA-64A survey of 2010, the national weighted average gas equivalents ratio was computed to be 1,243 cubic feet of natural gas shrinkage per barrel of NGPL recovered.

The total shrinkage volume (reported plus imputed) for all plants reporting a given area of origin is then subtracted from the estimated value of natural gas production, wet after lease separation, yielding dry natural gas production for the area. The amount of the reduction in the wet natural gas production is then expressed as a percentage of the wet natural gas production. Dry natural gas reserves and reserve changes are determined by reducing the wet natural gas proved reserves and proved reserve changes by the same percentage reduction factor.

A further refinement of the estimation process is used to generate an estimate of the natural gas liquids reserves in those states with coalbed methane fields. The states where this procedure is applied are Alabama, Arkansas, Colorado, Illinois, Indiana, Kansas, Louisiana, Maryland, Montana, New Mexico, Ohio, Oklahoma, Pennsylvania, Tennessee, Utah, Virginia, West Virginia, and Wyoming. The natural gas liquids reserves for Illinois, Indiana, and Tennessee are not published individually, but are included in national aggregates. The first step in the process is to identify all Form EIA-23L reported coalbed methane fields. The assumption is that coalbed methane fields contain little or no extractable natural gas liquids. Therefore, when the normal shrinkage procedure is applied to the wet gas volume reserve components, the estimate of state coalbed methane volumes are excluded and are not reduced for liquid extraction. Following the computation for shrinkage, each coalbed field gas volume reserve component is added back to each of the dry gas volume reserve components in a state. The effect of this calculation is that the large increases in proved reserves in some states from coalbed methane fields do not cause corresponding increases in the EIA-64A derived estimates of state natural gas liquids proved reserves.

To generate estimates for each element in the proved reserves balance for plant liquids in a given producing area, the first step is to group all natural gas processing plants that reported this area as an area-of-origin on their Form EIA-64A and, then, sum the liquids production attributed to this area over all respondents. Next, the ratio of the liquids production to the total wet natural gas production for the area is determined. This ratio represents the percentage of the wet natural gas recovered as natural gas liquids.

Finally, it is assumed that this ratio is applicable to the reserves and each component of reserve changes (except adjustments), as well as production.

Therefore, each element in the wet natural gas reserves balance is multiplied by this recovery factor to yield the corresponding estimate for plant liquids. Adjustments of natural gas liquids are set equal to the difference between the end of previous reporting year proved reserve estimates, based upon the current reporting year Form EIA-23L and Form EIA-64A data collections, and the end of current reporting year proved reserve estimates published in the preceding year's annual reserves report.

Adjustments of dry natural gas are set equal to the difference between the end of previous year reserves estimates, based upon the current report year Form EIA-23L and Form EIA-64A surveys, and the end of current year reserve estimates published in the preceding year's annual reserves report.

A.2.5. Imputation for Item Non-Response

Form EIA-23L

Survey questionnaire items for which a response is not received are anticipated to be rare for the proposed sampling method for the Form EIA-23L. Non-response items will be imputed, using Equation (1) in the same manner as for the non-sampled cases.

Form EIA-64A

Natural gas liquids recovery rates are calculated from data supplied on Form EIA-64A. These rates are applied to proved reserves of wet natural gas (estimated from data collected on Form EIA-23L) to derive dry natural gas proved reserves data. When plants fail to report data, their production data from the Form EIA-816 are obtained, and an estimated shrinkage factor, based on past data for shrinkage, is applied to impute dry natural gas proved reserves for that plant.

A.2.6. Frame Maintenance

Forms EIA-23L

Since EIA's inception in 1977, EIA has maintained an operator sampling frame from which the Form EIA-23L samples have been drawn. This frame is intended to include all active crude oil and natural gas well operators in the United States.

The sampling frame maintenance procedure uses state production records and commercial information databases (DI) to update information on the definite and possible crude oil and natural gas well operators already listed, and to add information about apparent new operators. This procedure identifies both active operators and inactive/non-operators, thereby improving the sampling frame for future sample selections. The Form EIA-23L sampling frame also retains and properly identifies the names and addresses of both definite and possible non-operators (which are often prior operators) so that these operators can more easily be reclassified to the active operator list, should future review indicate a resumption of operating status.

Form EIA-64A

Each year, the Form EIA-64A plant frame is compared to listings of natural gas processing plants from the Form EIA-816, Form EIA-757, the *LPG Almanac*, and the *Oil and Gas Journal*. A list of possible changes to the plant frame is compiled each year. Telephone calls to the newly-identified plants are conducted to verify their operating status. Changes identified during frame maintenance are coordinated with the Form EIA-816 and EIA-757 Program Offices at EIA.

A.2.7. Efforts to Reduce Total Survey Error

Frame Coverage Errors

Of all the sources of controllable error connected with the Form EIA-23L survey, errors in selecting the survey frame are expected to be the most consequential. If the sampling frame does not list all well operators in a given state, the sample selected from the sampling frame for the state will not be representative of the entire operator population, a condition called “undercoverage.”

Undercoverage is a problem with certain states, but it does not appear to be a problem with respect to the total domestic proved reserves estimates for either crude oil or natural gas. The proposed sampling process should greatly reduce the potential undercoverage error. Using a state/subdivision cutoff instead of a U.S. total cutoff should greatly reduce the potential to miss a significant operator in a state.

While it is relatively straightforward to use existing sources to identify large operators and find addresses for them, such is not the case for small operators. The Form EIA-23L frame is most likely to be deficient in states where a large portion of total proved reserves and production is accounted for by small operators. These states are not likely to allocate sufficient resources to keep track of all operators on a current basis. Some undercoverage of this type seems to exist, particularly with respect to natural gas operators. EIA is continuing to work to remedy the undercoverage problem in those states where this problem has occurred.

Reporting Errors and Data Processing Errors

Reporting errors on the part of respondents are of concern in a survey of the magnitude and complexity of the Form EIA-23L. Several steps have been taken by EIA to minimize and detect such problems. The survey instrument is carefully developed, and it includes a detailed set of instructions for filing data, subject to a common set of definitions similar to those already used by the industry. Data validation/editing software is continually developed to detect different kinds of probable reporting errors and flag them for resolution by analysts, either through confirmation of the data by the respondent or through submission of amendments to the filed data. Data processing errors, consisting primarily of random keypunch errors, are detected by the same software.

Estimation Errors by Respondents

The principal data elements of the Form EIA-23L survey consist of respondent estimates of proved reserves of crude oil, natural gas, and lease condensate. However, until a particular reservoir has been fully produced to its economic limit and abandoned, the proved reserves of the reservoir are not subject to direct measurement, but instead must be inferred from limited, imperfect, or indirect evidence. As a result, respondents cannot perfectly estimate their proved reserves, and such estimates can change over time.

Sampling Errors

As in most establishment surveys, Form EIA-23L reserves and production data are highly skewed. Most reserves data for natural gas, oil, and lease condensate are provided by relatively few well operators, and there are many small operators. The classical ratio estimator (CRE) is model-based and is well-suited for the cut-off sampling design used for the Form EIA-23L. CRE is based on well-established theory with readily available standard error estimators (see Royall [1970] on model estimation and variance). The model-based CRE (see Knaub[2005]) is quite robust for estimation of both out-of-sample cases and for non-response.

Based on the 2011 Form EIA-23 data collection, EIA anticipates RSEs by state and subdivision similar to the following:

Table 1: Anticipated Estimated Natural Gas Reserves RSEs

| Region | Estimated RSE | Region | Estimated RSE |
|---------------|----------------------|---------------|----------------------|
| AK . | 0% | OH . | 5% |
| AL . | 2% | OK . | 2% |
| AR . | 1% | PA . | 3% |
| CA 5 | 4% | TX 5 | 4% |
| CA 10 | 3% | TX 10 | 4% |
| CA 50 | 4% | TX 20 | 4% |
| CA 90 | 5% | TX 30 | 4% |
| CO . | 2% | TX 40 | 3% |
| FG . | 3% | TX 50 | 2% |
| FL . | 0% | TX 60 | 3% |
| FP . | 3% | TX 70 | 4% |
| KS . | 4% | TX 75 | 3% |
| LA 5 | 4% | TX 80 | 1% |
| LA 10 | 4% | TX 85 | 3% |
| LA 50 | 1% | TX 90 | 3% |
| MI . | 4% | TX 95 | 2% |
| MS . | 4% | UT . | 3% |
| MT . | 3% | VA . | 0% |
| ND . | 3% | WV . | 3% |
| NM 10 | 2% | WY . | 1% |
| NM 50 | 1% | | |
| NY . | 5% | | |

Table 2: Anticipated Estimated Crude Oil Plus Lease Condensate Reserves RSEs

| Region | Estimated RSE | Region | Estimated RSE |
|---------------|----------------------|---------------|----------------------|
| AK . | 2% | NM 50 | 11% |
| AL . | 8% | OH . | 6% |
| AR . | 46% | OK . | 6% |
| CA 5 | 1% | PA . | 11% |
| CA 10 | 3% | TX 5 | 4% |
| CA 50 | 7% | TX 10 | 4% |
| CA 90 | 7% | TX 20 | 2% |
| CO . | 2% | TX 30 | 6% |
| FG . | 2% | TX 40 | 7% |
| FL . | 6% | TX 50 | 16% |
| FP . | 3% | TX 60 | 6% |
| KS . | 9% | TX 70 | 14% |
| LA 5 | 5% | TX 75 | 5% |
| LA 10 | 4% | TX 80 | 2% |
| LA 50 | 16% | TX 85 | 2% |
| MI . | 11% | TX 90 | 7% |
| MS . | 4% | TX 95 | 5% |
| MT . | 3% | UT . | 5% |
| ND . | 1% | WV . | 9% |
| NE . | 19% | WY . | 3% |
| NM 10 | 3% | | |

Unit Non-response

Non-response is anticipated to be minimal for the proposed Form EIA-23L sampling method. Because estimated reserves are published at aggregated levels by geographic region, these rare non-responses are not anticipated to have a significant impact on published totals. For states where a large share of total proved reserves is accounted for by smaller operators, any errors in estimating aggregated data are expected to be somewhat larger than in states where a large share of total proved reserves is accounted for by larger operators.

A.3. Maximizing Response Rates

EIA uses standard procedures to conduct the data collections for the Form EIA-23L and Form EIA-64A. An introductory letter signed by a responsible EIA official is sent to each company that is selected as a respondent to the data collections. Follow-up procedures for non response consist of an email message or a reminder letter (for those not using email) to all companies that do not return a completed survey form by the due date. This initial re-contact is followed by repeated email messages, letters, and phone calls until a response is received or other agreeable solution is found.

A.4. Testing Procedures

With regard to collection instruments, the changes proposed to the Form EIA-23L sampling methodology will change only the Form EIA-23L instructions to make these instructions consistent with the language used to describe the sampling process. Form EIA-23L instructions have also been updated to reflect revised online EIA Glossary terms. Furthermore, changes are not proposed for the Form EIA-64A data collection. Therefore, no cognitive testing or review was determined to be necessary at this time.

A.5. Statistical Consultations

For additional information concerning this data collection, please contact Steven Grape at (202) 586-1868, or steven.grape@eia.gov.

For information concerning this request for OMB approval, please contact the agency Forms Clearance Officer, Alethea Jennings, at (202) 586-5879, or alethea.jennings@eia.gov.

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