Documentation Report

GASCAP

Wellhead Gas Productive Capacity Model Documentation

June 1993

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Energy Information Administration

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GASCAP

Wellhead Gas Productive Capacity Model Documentation

June 1993

Energy Information Administration
Office of Oil and Gas
U.S. Department of Energy
Washington, DC 20585

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1. Introduction

Statement of Purpose

The Wellhead Gas Productive Capacity Model (GASCAP) has been developed by EIA to provide a historical analysis of the monthly productive capacity of natural gas at the wellhead and a projection of monthly capacity for 2 years into the future. The impact of drilling, oil and gas price assumptions, and demand on gas productive capacity are examined. Both gas-well gas and oil-well gas are included. Oil-well gas productive capacity is estimated separately and then combined with the gas-well gas productive capacity.

This documentation report provides a general overview of the GASCAP Model, describes the underlying data base, provides technical descriptions of the component models, diagrams the system and subsystem flow, describes the equations, and provides definitions and sources of all variables used in the system. This documentation report is provided to enable users of EIA projections generated by GASCAP to understand the underlying procedures used and to replicate the models and solutions.

Intended Audience

This report should be of particular interest to those in the Congress, Federal and State agencies, industry, and the academic community, who are concerned with the future availability of natural gas.

Legal Citation

Section 205(a)(2) of the Department of Energy Organization Act of 1977 (Public Law 95-91) states: "The Administrator shall be responsible for carrying out a central, comprehensive, and unified energy data information program which will collect, evaluate, assemble, analyze, and disseminate data and information which is relevant to energy resource reserves, energy production, demand, and technology, and related economic statistical information, or which is relevant to the adequacy of energy resources to meet demands in the near and longer term future for the Nation's economic and social needs." EIA Standard 91-01-03 is complied with.

Model Summary

The lower 48 States is divided into States/areas that have production data by well listed by Dwight's EnergyData, Inc. (Dwight's). This consisted of gas-well gas production data from 14 States and the Gulf of Mexico Federal Offshore Outer Continental Shelf (OCS). The Gulf of Mexico OCS and six States (Texas, Louisiana, California, Kansas, New Mexico, and Oklahoma) are studied separately. Five States are grouped together as the Rocky Mountains: Colorado, Montana, North Dakota, Utah, and Wyoming. The Southeast group consists of Alabama, Arkansas, and Mississippi. An additional 18 States are studied as one group. These States are Arizona, Florida, Illinois, Indiana, Kentucky, Maryland, Michigan, Missouri, Nebraska, Nevada, New York, Ohio, Oregon, Pennsylvania, South Dakota, Tennessee, Virginia, and West Virginia. Both gas-well gas and oil-well gas productive capacity are estimated for each State/area.

Monthly and annual gas-well gas production data from Dwight's Inc., and EIA data series are not generally the same; however, the differences in production between the two sources has generally been small. Annual adjustment factors are developed and applied to Dwight's data to ensure that the difference between the production data from the two sources is eliminated on an annual basis. The historical monthly production data presented in this report may still differ, however, from those published in other EIA publications since the published production figures are EIA-normalized Dwight's monthly data.

Gas-well productive capacity is estimated using monthly production from each gas-well completion. The monthly peak-rate is selected each year for every vintage in each State/area. In this model, vintage gas-well gas production is defined as the production from all well completions in a State/area with first production beginning in the same calendar year. For example, production from all well completions going on stream for the first time in Texas in 1972 would be called the Texas 1972 vintage gas-well gas production. The monthly peak-rate selected is the sum of all of the gas-well completions peak-rates within the particular vintage without regard to the month in which the gas-well completion peak-rate occurred. The vintage-level peak-rates are summed to obtain the total peak-rates for each State/area. These peak-rates are assumed to be the same as the productive capacities for the purpose of obtaining vintage year productive capacity as a function of cumulative production. Productive capacity changes as gas is produced and new gas-well completions go on stream, which are a function of drilling. The historical average vintage productive capacities on a per well basis are established and projected using the estimated number of monthly new wells going on production.

Oil-well gas productive capacity is estimated for the same States/areas that gas-well gas productive capacity is estimated. Oil wells are considered to be producing at their normal and full capacity as required by the lease operators and State proration/regulation requirements. Differences in oil-well gas production capacity and oil-well gas production are assumed negligible. Future oil-well gas productive capacity is obtained by projecting oil production and multiplying by the State/area annual gas-oil ratio (GOR) as calculated from the latest *Natural Gas Annual* and *Petroleum Supply Annual*.

The total lower 48 States gas demand, which will be met by domestic production, is prorated and allocated for each State/area on the basis of their historical market share. The oil-well gas is subtracted from the total demand to get gas-well gas demand. If gas-well gas demand is greater than gas-well gas productive capacity in a given State, the demand is set equal to productive capacity, and the excess demand is prorated to other States/areas that had surplus productive capacity.

Total productive capacity is the summation of gas-well gas and oil-well gas productive capacities. The positive difference between the productive capacity and demand is the surplus gas productive capacity. The productive capacity is defined as the volume of gas that can be produced from a well, reservoir, or field during a given period of time against a certain wellhead back-pressure under actual reservoir conditions excluding restrictions imposed by pipeline capacity, contract, or regulatory bodies.

Model Archival Citation and Model Contacts

GASCAP is used by the Energy Information Administration (EIA) to estimate the historical wellhead productive capacity of natural gas for the lower 48 States for 10 years and to project the productive capacity for the next 2 years. The latest archival package was completed in March of 1993 as GASCAP92 on archival tape F40862. The archival package was for the March 1993 publication *Natural Gas Productive Capacity for the Lower 48 States, 1982 through 1993*, DOE/EIA-0542. Model contacts are John H. Wood, James N. Hicks, Hafeez Rahman, and Velton T. Funk on (214) 767-2200.

Report Organization

This report is divided into four chapters and nine appendices. Chapter 1 is the Introduction. Chapter 2 provides an overview of the Wellhead Gas Productive Capacity Model in terms of structure, subsystems, flow, and scope. Chapter 3 contains the theory of the Model, the derivation of the equations, the solution, procedure, and methodology. Chapter 4 provides detailed technical descriptions for the variables, data, and parameters for each of the subsystems. The model abstract, variable definition listing, location of variables, location of equations, listing of Job Control Language, listing of computer code, and macros are supplied in the appendices.

2. Model Overview

The description of the Wellhead Gas Productive Capacity Model (GASCAP) in this chapter is addressed to an audience of nontechnical but informed energy analysts. It is intended to provide the reader with a general overview of the structure, theory, and analytical capabilities of GASCAP.

GASCAP was developed in 1989 and 1990, and revised in 1992 by the Dallas Field Office, Office of Oil and Gas, Energy Information Administration (EIA), U.S. Department of Energy. GASCAP consists of mainframe and personal computer programs.

Assumptions

Assumptions along with the reasons for their adoption follow:

- **Wellhead gas productive capacity is a function of production and drilling.** Wells must be drilled and be capable of producing to ensure an adequate productive capacity
- **The number of new gas-well completions is a function of drilling.** In order to ensure that there is an adequate number of gas-well completions, new wells must be drilled.
- **Abandonment of individual wells is captured by the hyperbolic decline function for the group of wells included in a given vintage year for each area.** In every group of wells included in a vintage year, some will be abandoned throughout the producing history of the wells included in the group of vintage year wells.
- **Limits placed on the hyperbolic equation exponent are from 1.001 through 3.0.** The limits placed on the hyperbolic equation exponent will ensure that all curves decline within the accepted range for most well completions.
- **New gas-well completion producing characteristics can be modeled from the characteristics of historical completions.** Productive capacities for the new gas-well completions are expected to exhibit characteristics that are similar to those of recent gas-well completions.
- **Oil wells are currently producing at full capacity; therefore, oil-well gas production and oil-well gas capacity are equal.** Oil wells are considered to be producing at their normal and full capacity as required by the lease operators and State proration/regulation requirements. Oil-well gas production is a function of oil production and the producing gas-oil ratio; therefore, the difference between oil-well gas productive capacity and gas production is assumed to be negligible.
- **U.S. demand for gas production can initially be allocated to producing areas by month based on the current production market share.** Future gas demand was prorated to each State/area on the basis of the most recently available regional gas demand.

GASCAP Structure

The purpose of GASCAP is to estimate the monthly historical dry gas productive capacity for 10 States/areas and the lower 48 States and project monthly capacity for two more years. Dry gas is generally transported by interstate gas pipelines and delivered to consumers. However, the fundamental data for gas production at the wellhead are in terms of gross gas. Figure 1 is a process flow diagram representing the GASCAP Model structure. This flow diagram illustrates the data flow of inputs, processes, and outputs.

GASCAP produces projections of monthly dry gas productive capacity for three scenarios. These scenarios from the latest *Short-Term Energy Outlook* represent different levels of oil and gas prices and production, and are labeled as "Low," "Base," and "High" cases. These scenarios lead to different input data parameter assumptions for well completions, drilling, oil and gas prices, and demand for gas production in GASCAP.

The structure of the GASCAP model can be described in five steps: 1) historical gas production, 2) historical gas-well productive capacity, 3) new gas-well completions, 4) gas demand, and 5) productive capacity projections.

Historical Gas Production

Historical gas-well gas production data are obtained from Dwight's for all States/areas except for the 18 States. Dwight's data are the preferred data source because gas production is needed on a well completion basis. For the 18 States, Dwight's data are available for only 2 States, which are small gas producers. Therefore, for the 18 States, gas production is obtained from EIA's *Natural Gas Annual* and *Natural Gas Monthly*, but gas production from these publications is not by well completion.

The monthly gas-well gas production belonging to each State/area vintage is tabulated versus its cumulative production. Vintage gas-well gas production is defined as the production from all well completions in a State/area with first production beginning in the same calendar year. For example, production from all well completions going on stream for the first time in Texas in 1972 would be called the Texas 1972 vintage gas-well gas production.

The first vintage year varies by State but is usually the first year of reported production data. For expediency, the earliest that a vintage year can be is 1969. All wells that began producing in or prior to the first vintage year are included in the first vintage year. For example, the first vintage year for California is 1978. However, the production for wells that began producing in 1950 are included in the 1978 vintage. Also, the cumulative production prior to the first vintage year is included in the cumulative production for the first vintage year when available. Note that in areas containing more than one State (Rocky Mountain and Southeast), the State with the fewest reported years determines the first vintage year for the area.

Conversion factors are developed and used to convert Dwight's gross gas-well gas production to EIA's dry gas production. These factors are developed using annual production volumes from Dwight's gas tapes and EIA's *Natural Gas Annual* publications.

Historical Gas-Well Productive Capacity

A peak production rate is determined each year for every vintage in each State/area. The peak rate selected for each year is the sum of all of the gas-well completion peak rates within a particular vintage without regard to the month in which the gas-well completion peak rate occurred. It is assumed that if a gas-well completion in a vintage produced at a maximum rate during any month of the year, the gas-well completion should have been capable of at least this production rate in prior months. This rate is assumed to be the productive capacity.

Figure 1. Process Flow Diagram

New Gas-Well Completions

The number of rigs drilling is estimated as a function of oil and gas revenues. The percentage of rigs drilling for gas is also a function of oil and gas revenues. The product of these two estimates gives the number of rigs drilling for gas. A historical ratio of area gas-well completions per rig drilling for gas provide the factor needed to estimate the number of gas-well completions by State/area.

Gas Demand

The demand for gas production or future gas production volumes to be scheduled are determined by using the *Short-Term Energy Outlook: Quarterly Projections*. These quarterly production volumes are prorated to the State/area level, converted to monthly production volumes, and then into daily rates for the month.

Productive Capacity Projections

Productive capacity projections include gas-well gas and oil-well gas capacity projections. The gas-well gas productive capacity projections are estimated by vintage year using curve fitting techniques for the historical estimated capacities. The number of new gas-well completions are multiplied by the average of the initial gas flow rates at capacity and the ultimate recoverable gas on a per well basis to project new vintage year capacities. Oil-well gas capacity is obtained by multiplying the future oil production rates by the appropriate gas-oil ratio. The sum of the gas-well gas and oil-well gas productive capacities yields the total gas productive capacity.

Input Data

The input data in this model are from non-DOE and DOE sources. These data sources along with the data used are listed as follows:

Non-DOE Input Sources:

- Dwight's EnergyData, Inc., Oil and Gas Reports, Richardson, TX
Monthly natural gas production by well
- Baker Hughes Incorporated
Number of rigs drilling for gas
Total number of rotary rigs by month
- Gas-well completions for the 18 States are from EIA computations based on well reports submitted to the American Petroleum Institute by the Petroleum Information Corporation.

DOE Data Input Sources:

- *Natural Gas Annual*
Marketed gas production by State
Gross gas-well gas production by State
Gross oil-well gas production by State

- *Natural Gas Monthly*
Marketed gas production by State
- *Short-Term Energy Outlook (STEO)*
Dry gas production
Natural gas wellhead prices for low, base, and high cases
Oil price forecast
- *Petroleum Supply Annual*
Oil production by State

Output Report

The execution of GASCAP generates output data files for each of the 10 areas in the lower 48 States. The historical part includes the latest complete year of data available from Dwight's. The projections are for the next 2 years for three scenarios: low, base, and high cases from STEO. The output reports include: 1) historical and projected monthly dry gas production and capacities, 2) the number of gas-well completions added during the year and producing in December, and 3) the percent of total gas-well gas wellhead productive capacity in December by well age. These outputs provide the basis for written reports to EIA, DOE, and other segments of the Government and the public.

Alternative Approaches and Reason for Selection

The EIA's Dallas Field Office has prepared five other reports on gas productive capacity over the past several years. These reports dealt with selected large gas fields in some of the major gas-producing areas. The data in the reports were based on gas-well back-pressure tests and estimates of gas in-place for each field or reservoir. Most of the well-testing theory used in these reports has been known since 1936 when the Bureau of Mines published Monograph 7.

Data for the reports were generally available only for the larger fields in the major producing States and areas (Texas, the Gulf of Mexico Outer Continental Shelf [OCS], New Mexico, Kansas, Arkansas, Louisiana, and Oklahoma). Back-pressure test data for other States are not available in public or commercial data files. Even in States where back-pressure tests are routinely required, many wells are exempt from testing. Wells that produce large volumes of water are commonly exempt from testing because even expensive workovers may not restore production when such wells are shut-in for testing purposes. Furthermore, the necessary gas in-place estimates for reservoirs are not readily available. Reliable estimates of gas in-place for a large number of fields or reservoirs require major commitments of engineering resources, even if the necessary data are available.

The ideal study on gas productive capacity for the lower 48 States would be based on accurate and current well tests and include every producing field and reservoir. The lack of complete well test data, good reservoir-level data, and time coupled with personnel constraints make this impractical. In addition, it is difficult to integrate the impact of future drilling and gas demand changes into this type of study. Therefore, the current approach was developed. Production data by well for a large number of the gas producing States and the Gulf of Mexico OCS are available from Dwight's EnergyData, Inc., and can be categorized by vintage (the year a well first produced). That is, all gas production from wells that began production in a given year can be grouped together. Therefore, this approach was selected and applied to 14 States and the Gulf of Mexico OCS. Production data by well are not available for 16 of the remaining 18 gas producing States, which were placed in a separate group. Monthly state-wide production data are available for these 18 States from EIA's *Natural Gas Monthly* reports.

3. Equations and Theory of the Model

This chapter provides a detailed description of data sources, estimation techniques, and computations used to produce each of the Wellhead Gas Productive Capacity Model (GASCAP) outputs. The intent of this chapter is to provide sufficient information to allow replication of the GASCAP values.

Historical Gas Production

The first step in estimating gas-well gas productive capacity is to obtain the gas-well gas production for each well completion in every State/area by month. This is available from Dwight's EnergyData, Inc., Oil and Gas reports for all States/areas except the 18 States. Monthly production is available for the 18 States from EIA but not by well completion. The gas production data are reported in thousand of cubic feet (Mcf).

As mentioned in Chapter 2, the monthly gas-well gas production for each State/area vintage is tabulated along with its cumulative production. Vintage gas-well gas production is defined as the production from all well completions in a State/area with first production beginning in the same calendar year. For example, production from all well completions going on stream for the first time in Texas in 1972 would be called the Texas 1972 vintage gas-well gas production.

Historical Gas-Well Productive Capacity

From the discussion in Chapter 2, peak production rate is determined each year for every vintage in each State/area. The peak rate is defined as the sum of all of the gas-well completion peak rates within a particular vintage without regard to the month in which the gas-well completion peak rate occurred. It is assumed that if a gas-well completion in a vintage is produced at a maximum rate during any month of the year, the gas-well completion should be capable of at least this production rate in prior months.

After the peak rates are determined, a screening process (Figure 2) is used to eliminate points that are not producing near capacity. The first peak rate in each vintage is eliminated because not all of the gas-well completions have produced gas for the entire first year. Furthermore, beginning with the last point, each point is compared to the previous year's point until the initial point is reached. If the previous point is higher, it is retained. If it is lower, it is rejected (point 11). This is done because a rate versus cumulative production curve should show a decline when the wells are producing near productive capacity. Next, a straight line is used to connect the fourth and last points and extended backward through the second and third points. The second and third points are rejected if these points fall below the straight line. This process is repeated using the last and third data point to check the second data point. If the data points fall below both straight lines, it is assumed that the low peak rates could be attributed to reasons other than physical limitations of the wells; i.e., low demand, proration, temporary mechanical problems, etc.

After the first trial of the screening process is complete, the next step is to fit the remaining points with a hyperbolic curve. The hyperbolic curve fit is chosen because most decline curves normally encountered are hyperbolic. For example, Figure 3 shows a hyperbolic fit for the peak rates versus cumulative gas production for the 1982 vintage wells in the Gulf of Mexico OCS. Initial estimates are made for the initial rate (q_i) the or Y - intercept, and the ultimate recovery, (G_{ul}) or the X - intercept. Although this curve might appear to be exponential, there is a slight curvature. The exponent B is close to 1, indicating that the curve comes close to being an exponential curve.

Figure 2. Screening Process

Note:	Point No.	Reason for Point Rejection
	1	Point 1 always omitted
	2 & 3	Falls below straight line connecting 4th and last points
	7	More than one standard deviation below the estimated value
	11	Point 12 is larger.

Source: Energy Information Administration, Office of Oil and Gas.

Figure 3. Gross Gas-Well Gas Productive Capacity for the Gulf of Mexico OCS 1982 Vintage

Source: Energy Information Administration Model GASCAP92 C012993, based on production data from Dwight's EnergyData, Inc.

The rate versus cumulative production relationship for this type of decline is (see Bibliography, J.J. Arps):

$$G_p = \frac{q_i^b}{D_i(1-b)} (q_i^{1-b} - q^{1-b}) \quad (1)$$

where G_p = cumulative gas produced, thousand cubic feet
 q_i = initial gas flow rate at capacity, thousand cubic feet per day
 q = gas flow rate at capacity, thousand cubic feet per day
 D_i = initial daily decline rate
 b = hyperbolic decline exponent.

In equation (1), cumulative gas produced, G_p , becomes the ultimate recoverable gas, G_{ul} , when the flow rate, q , is at abandonment conditions. Assuming that the flow rate at abandonment conditions is zero, equation (1) becomes:

$$G_{ul} = \frac{q_i}{D_i(1-b)}. \quad (2)$$

Rearranging (1),

$$q = \left(q_i^{1-b} - \frac{D_i(1-b)}{q_i^b} G_p \right)^{\frac{1}{1-b}}. \quad (3)$$

Simplifying (3),

$$q = q_i \left(1 - \frac{D_i(1-b)}{q_i} G_p \right)^{\frac{1}{1-b}}. \quad (4)$$

Substituting (2) in (4),

$$q = q_i \left(1 - \frac{G_p}{G_{ul}} \right)^{\frac{1}{1-b}}. \quad (5)$$

Substituting B for $\frac{1}{1-b}$,

$$q = q_i \left(1 - \frac{G_p}{G_{ul}} \right)^B \quad (6)$$

Equation (6) is used to describe the hyperbolic decline of the peak flow rates of each vintage curve.

In 1956, J.J. Arps in his report entitled *Estimation of Primary Oil Reserves*, in the Transactions of the American Institute of Mining, Metallurgical and Petroleum Engineers, stated that W.W. Cutler, Jr., of the U.S. Bureau of Mines indicated that most decline curves normally encountered are of the hyperbolic type with values for the exponent b between 0 and 0.7, while the majority is between 0 and 0.4. This means that the values of the exponent B are between 1.0 and 3.3, while the majority is between 1.0 and 1.7. The accepted range for B in the GASCAP model is from 1.001 to 3.0. The lower value of 1.001 was chosen rather than 1.0 because a value of 1.0 used in equation (9) would result in division by 0 which would cause the model to abort. Values of B greater than 3.0 tend to give unrealistically large values of G_{ul} . In addition, the raw production data was often distorted by low gas demand. This caused an apparent very rapid production rate decline and an accompanying large B that was not based on the physical capability of wells to produce gas. A data screening algorithm was used during the decline curve fitting process to identify low production rate data points caused by low demand. The highest B allowed during a curve fit to initiate this process was 3.0.

Productive capacity rather than peak rate is desired for the vintage curves. However, only the vintage curve's peak rate could be obtained. Peak rate can be close to productive capacity if the demand for gas-well gas is much higher than normal for at least 1 month during the year. In the model, demand is defined as the monthly gas volume produced for the lower 48 States, State/areas, or vintage. If demand were to remain low for every month of the year, the highest peak rate for the year would be lower than the actual productive capacity.

Another screening process is performed to eliminate low rates that could be a result of low demand and affect the curve so that the productive capacity points, which are approximated by the peak rates, would be low. In this model, if an actual or observed point is more than one standard deviation lower than the corresponding calculated value on the vintage curve, the actual point would be rejected.

The remaining data points are then refitted keeping B constant and allowing q_i and G_{ul} to vary. This process is applied to all vintages except the last three.

The initial rates (q_i) for the last three vintage years are calculated independently of the regression analysis. The q_i for the last historical vintage year is a historical average on a per well basis as described later. The q_i for the previous two vintages is determined by averaging the ratio between the calculated q_i and the peak rate in the second year of production. These average ratios were taken for the 7 years prior to the last 3 years. The resulting ratios were multiplied by the peak rate in the second year of production to provide a fixed q_i .

For the projections of the capacity for vintage curves beginning with the last historical vintage year, the values of q_i , G_p , and the corresponding q are needed on a well completion basis and are obtained by averaging these values for the last three historical vintage years, not including the last one. The gas flow rate, q_v , is the average of the per well capacities for December of the second production year. G_{pv} is the average gas produced per well through December of the second production year. G_{ulv} is the average ultimate recovery on a per well completion basis and was obtained by substituting the previously derived values for q_{iv} , G_{pv} , and q_v in the following equation, which is a rearrangement of equation (6) after dividing each term by the number of gas-well completions, v,

$$G_{ulv} = \frac{G_{pv}}{1 - (q_v/q_{iv})^{1/B}} \quad (7)$$

The q_i and G_{ul} on a per well completion basis were multiplied by the number of new well completions in each year to obtain the q_i and G_{ul} for each year.

Projected Productive Capacity of Old Vintage Wells

After the historical productive capacity vintage curves were developed through the last historical data year, these curves were projected for two more years. Productive capacity curves also had to be developed for all well completions going on stream in these projected years. It is assumed that the productive capacity for the total well completions beginning production during the vintage year will increase throughout the vintage year and will start to decline the next year.

To start the projection routine, the flow rate at capacity was calculated from each vintage for each month starting in January of the first projected year. The production for each vintage for any month is calculated by allocating the expected demand to each vintage based on the capacity of each vintage. The cumulative production for each vintage is the sum of the cumulative production at the beginning of the month and the allocated production. The new well completions (well completions going on production each month for the first time) are used for the current vintage capacity calculations.

All old vintages are projected for 2 years. The production rate as a function of cumulative production, G_p , is given by equation (6). The production rate can also be written as a function of time, t , as described by Arps, although in his formulation, $B = \frac{1}{1-b}$:

$$q = q_i \left(1 + \frac{q_i (B - 1) t}{G_{ul}} \right)^{\frac{B}{1-B}} \quad (8)$$

Equation (8) is the hyperbolic equation that describes production rate decline as a hyperbolic function of time.

The calculation of the time, t , that corresponds to the vintage productive capacity at the beginning of the month is calculated by solving equation (8) for time:

$$t = \frac{G_{ul} \left[\left(\frac{q}{q_i} \right)^{\frac{1-B}{B}} - 1 \right]}{(B-1)q_i} \quad (9)$$

where q is the flow rate at capacity (productive capacity) at the beginning of the month. The number of days in the month are added in order to step forward to calculate the vintage productive capacity at the beginning of the next month.

The maximum possible cumulative production to the end of the month is calculated by the following equation which is a rearrangement of equation (6):

$$G_p = G_{ul} \left[1 - (q/q_i)^{1/n} \right]. \quad (10)$$

Furthermore, the productive capacities for the nine States/areas are multiplied by load factors. In this model, annual load factors for the last 10 historical years are derived by dividing the annual production from all gas-well completions producing in December of the specific year by the annual production from all gas-well completions that produced in any month during the same year. The load factor for each State/area is obtained by taking an average of the 10 annual load factors. The load factors are applied because frequently there are gas-well completions shut-in due to mechanical problems.

The cumulative gas produced to the beginning of a specific month is subtracted from the maximum possible cumulative gas produced at the end of the month to get maximum productive capacity for the month for each vintage.

The productive capacities for each vintage year are summed and the demand is allocated to each vintage by its percentage of the total capacity. The allocated production is added to the cumulative production at the beginning of a specific month for each vintage and the process is repeated, starting with the calculation of time (t) in equation (9).

Figure 4 displays the historical production rates, the adjusted peak rates, the theoretical capacity rates, and the projected rates for vintage year 1982 for the Gulf of Mexico OCS.

Figure 4. Capacity and Production Rates for the Gulf of Mexico OCS for 1982 Vintage Year

Sources: •Production: Energy Information Administration, Office of Oil and Gas and Dwight's Energydata, Inc.
•Theoretical and adjusted peaks: Model GASCAP92 C012993.

Projected Productive Capacity of New Vintage Wells

The demand for gas is the volume of gas wanted from gas-well completions. The maximum volume that can be produced is the productive capacity.

If demand approaches the capacity of the old wells to produce gas, the new wells (i.e., wells with near original capacity) will be called upon to produce at greater rates. This will cause the capacities of wells brought on in January to begin a higher rate of decline than normal (what usually happened in the historical data). Therefore, the productive capacity of wells brought on in January will be significantly less than their initial capacity, and the cumulative production (G_p) will be higher at the end of the year.

If, however, demand decreases as a percentage of productive capacity, the new wells will not be pulled as hard, their capability of production will be greater than normal, and their corresponding cumulative production will be less. Figure 5, a theoretical hyperbolic type curve, illustrates this discussion. The difference in the cumulative production (ΔG_p) is the difference between the annual production under normal demand (Case 1) and low demand (Case 2) at the end of the first year. Since capacity has been defined as a function of cumulative production, the difference in cumulative production for each of the above can be determined by subtracting the actual cumulative production from the historical normal cumulative production (mean production rates for all previous vintage years per well completion). This is done on a monthly basis for the first year of production for each new vintage year.

Monthly production capacity for a new vintage year is a function of the wells completed during the month plus the amount contributed by wells completed earlier in the year. Each month the productive capacity for wells completed that month is assumed to be one-half of the month's well completions times the average initial rate (q_i) per well for the previous three vintage years (obtained as described earlier). The productive capacity for earlier wells was determined as a function of normal cumulative production modified by the need to meet the allocated demand from the wells completed in the prior months.

Figure 5. Theoretical Hyperbolic Type Curve for Production and Capacity

Sources: Energy Information Administration, Office of Oil and Gas.

The equation is as follows:

$$q_k = \left(\frac{1}{2} v_k + \sum_{j=0}^{k-1} v_j \right) \left(\frac{q_i}{v} \right) \left[1 - \frac{\sum_{j=0}^{k-1} \Delta G_{p_j}}{\left(\frac{G_{ul}}{v} \right) \sum_{j=0}^{k-1} v_j} \right]^B \quad (11)$$

where

- q_k = productive capacity in month k, thousand cubic feet per day
- v_k = number of gas-well completions for month k
- v = total number of gas-well completions for the vintage year
- q_i = initial flow capacity, thousand cubic feet per day
- ΔG_p = difference between the gas produced during the month and the amount of gas that would have been produced under normal or average conditions, thousand cubic feet
- G_{ul} = ultimate gas recovery when $q=0$, thousand cubic feet
- k = month 1,2,...,12
- j = jth term in the series
- v_j = cumulative number of well gas-well completions through the previous month.

The normal cumulative production is the average cumulative production per well of the historical production of preceding vintages multiplied by the new well completions.

Productive Capacity for the 18 States

Because production and well counts by vintage year are not available for 15 of the 18 States, a different technique is used for these States. Monthly peak rates are determined from monthly gas-well gas production data obtained from the *Natural Gas Monthly*. The number of new well completions are determined from the API drilling statistics.

The following equation describes the current year's productive capacity as a function of last year's productive capacity and productive capacity from wells brought on in the last 12 months or during the last year.

$$q_{pk(m)} = q_{pk(m-1)} \exp^{D(G_{pv}(m-1))} + q_{gi} v_{m-1} \quad (12)$$

where

- m = year
- q_{pk} = peak production rate, thousand cubic feet per day
- D = decline rate of old production, wells per billion cubic feet
- G_{pv} = cumulative production per well, billion cubic feet per well
- v = total number of new gas-well completions for the year
- q_{gi} = initial gas production rate for new wells, thousand cubic feet per day.

For projection purposes the equation was converted to a monthly basis as follows:

$$q_{pk(m,n)} = q_{pk(m,1)} \exp^{D(G_{pv(m,n-1)})} + q_{gi} v_{m,n-1} \quad (13)$$

where	m	=	year
	n	=	month
	$q_{pk(m,n)}$	=	peak production rate for year (m) and month (n)
	$q_{pk(m,1)}$	=	calculated January peak production rate for year (m) used as the starting point to cumulate new well completions for monthly projections
	D	=	decline rate for old production, wells per billion cubic feet
	$G_{pv(m,n-1)}$	=	cumulative production per well, to month n-1 for year (m), billion cubic feet per well
	$v_{m,n-1}$	=	new well completions to month (n-1) for year (m)
	q_{gi}	=	initial production rate for new wells, thousand cubic feet per day.

Drilling and Gas-Well Completions

One facet of gas-well gas productive capacity is the productive capacity of new gas-well completions. The initial productive capacity of new wells is determined from the regression program. Therefore, a projection of new gas-well completions is needed to complete the forecast.

The number of new well completions coming on stream is based on a projection of the number of rigs running and an estimate of the number of gas-well completions per rig. The history of the number of rigs running by State/area is obtained from Baker Hughes and the history of the number of producing gas-well completions is obtained from Dwight's.

Drilling Rig Model

A model has been formulated to predict the number of drilling rigs from oil and gas income. The model generates monthly rig counts from monthly income data. In addition to oil and gas incomes, a term to account for seasonality is included in the model.

Oil income is used as a daily rate each month and is the product of the lower-48 daily oil production and the world oil price. Gas income is calculated in the same manner. The product of the lower-48 daily gas production and the U.S. average gas price determines the gas income. Prices are adjusted to constant 1990 dollars using the gross domestic product (GDP) deflator. Both income streams are exponentially smoothed prior to being used in the model.

The model formulation is as follows:

$$Rigs_i = Sn * b * \left[(SOI_i)^d + a * \left(\frac{\sum_{i=24}^{i-12} GI}{12} \right) * \left(\frac{SGI_i}{SGI_{i-12}} \right) \right]^d \quad (14)$$

where
Rigs = the total number of rigs drilling for oil and gas
SOI = smoothed oil income
SGI = smoothed gas income
GI = gas income
Sn = seasonality factor (equation (17))
i = current month
a = 0.640402 (constant)
d = 1.206404 (constant)
b = 2.039463 (constant).

Oil income and gas income are exponentially smoothed using the following equation:

$$SI_i = I_i * \alpha + SI_{i-1} * (1 - \alpha) \quad (15)$$

where
SI = smoothed income
I = income
 α = exponential smoothing coefficient
i = current month
 α_{SGI} = 0.324548 (constant exponential smoothing coefficient for smoothed gas income).

The monthly exponential smoothing coefficient for oil income is determined by the following equation:

$$\alpha_{SOI_i} = \frac{2}{2 + [h * \exp^{(c * ((SOI6_i - SOI6_{i-2}) - |SOI6_i - SOI6_{i-2}|))}]} \quad (16)$$

where
h = 11.15438 (constant)
c = 0.04 (constant)
SOI6 = smoothed oil income with a constant exponential smoothing coefficient of 0.2857 (equivalent to a 6-month smoothing)
i = current month.

A seasonality formula having the same general shape as the historical rig seasonal pattern was developed. The seasonality factors were calculated for each month using the developed formula:

$$\begin{aligned}
 Sn_{i=1} &= f \quad \text{for January} \\
 Sn_{i=2} &= f + \frac{l}{2^{i-1}} \quad \text{for February} \\
 Sn_{i=3} &= f + \frac{l}{2^{i-2}} + \frac{l}{2^{i-1}} \quad \text{for March} \\
 Sn_{i=4} &= f + \frac{l}{2^{i-3}} + \frac{l}{2^{i-2}} + \frac{l}{2^{i-1}} \quad \text{for April} \\
 Sn_{i=5,11} &= Sn_{i=4} + j \cdot (i-4) \quad \text{for May thru November} \\
 Sn_{i=12} &= Sn_{i=11} + \frac{j}{3} \quad \text{for December}
 \end{aligned} \tag{17}$$

where

Sn	=	the 12 different seasonality factors for January through December
i	=	1 through 12 for the corresponding months January through December
l	=	-0.19825 (constant)
j	=	0.026165 (constant)
f	=	1.073709 (constant).

Percentage Gas Rigs Model

A model has been formulated to determine the percentage of rigs drilling for gas. The model uses oil and gas income and a special factor, b , to handle coalbed methane and tight gas sand drilling. Monthly percentages are determined from monthly income values and the rig counts.

Oil income is used as a daily rate each month and is the product of the lower-48 daily oil production and the world oil price. Gas income is calculated in the same manner. The product of the lower-48 daily gas production and the U.S. average gas price determines the gas income. Prices are adjusted to constant 1990 dollars using the GDP deflator. Both income streams are exponentially smoothed prior to being used in the model.

The percent gas rigs model is as follows:

$$GRR_i = \left[a + e * (SOI_{i-1}) + \left(d * (SGI_{i-1}) + f * \left(\frac{GI3_{i-1} - GI3_{i-13}}{GI3_{i-13}} \right) * (1 + b) \right) \right] * 100 \quad (18)$$

where

GRR	=	gas rig ratio as a percent
SOI	=	smoothed oil income
SGI	=	smoothed gas income
GI3	=	3-month running average of gas income
α_{SGI}	=	0.08 (constant exponential smoothing coefficient for gas income)
α_{SOI}	=	0.139771 (constant exponential smoothing coefficient for oil income)
b	=	0.517667 (constant coalbed methane and tight gas sand drilling factor (1+b))
a	=	0.262762 (constant)
d	=	0.002974 (constant)
e	=	-0.0018 (constant)
f	=	0.085367 (constant)
i	=	current month.

Projected Gas-Well Completions

The monthly projected gas-well completions are calculated for each State/area for each of three case assumptions. This is accomplished by allocating the combined results of the Drilling Rig Model and the Percentage Gas Rigs Model based on a 3 year historical distribution (DF) then multiplying by the 3 year historical annual average completions per annual total drilling gas rig (CPR) (equation (19)).

$$NC_i = Rigs_i * \left(\frac{GRR_i}{100} \right) * DF * CPR \quad (19)$$

where

NC	=	new gas-well completions
Rigs	=	the total number of rigs drilling for oil and gas
GRR	=	gas rig to total rig ratio as a percentage
DF	=	distribution factor for the State/area determined from the proportion of lower-48 gas rigs drilling in the State/area over the most-recent three calendar years
CPR	=	gas-well completions per gas rig determined from the State/area Dwight December well count and the annual total Baker-Hughes gas rigs in the State/area over the most-recent three calendar years
i	=	month.

4. Data, Variables, and Parameters

Historical Gas-Well Productive Capacity

Gas-well productive capacity is estimated using Dwight's EnergyData, Inc., for monthly gas-well production data. The data processing flow is diagrammed in Figure 6. The data are copied, sorted, and edited. The first year of production is defined as a vintage year. The monthly peak rate is selected each year for every vintage in each State/area. The monthly peak rate selected is the sum of all of the gas-well completion peak rates within the particular vintage without regard to the month in which the gas-well completion peak rate occurred. The vintage-level peak rates are summed to obtain the total peak rates for each State/area. These peak rates are assumed to be the same as the productive capacities. Productive capacity changes as gas is produced and new gas-well completions go on stream, which are a function of drilling. The historical average vintage productive capacities on a per well basis are established and projected using the estimated number of monthly new wells going on production. Total peak rates are assumed to be the same as productive capacity. An additional 18 States are considered as one group. Production data are available from EIA for each of the 18 States but not by well completion. The gas-well gas production data are fit with regression routines, and the equation parameters and historical data are prepared for the projection routine.

Preprocessing of Dwight's Data

The well production history data for the States named in Chapter 1 are purchased from Dwight's EnergyData, Inc., on cartridge tape. Dwight's tapes are copied by State and product (gas or oil) to EIA cartridge tapes. These tapes are kept in the EIA/DOE library. These tapes are processed further to facilitate in-house use. This processing includes:

- Copying Dwight's tapes to in-house computer cartridge tapes.
- Writing the "sortkey" to the first 16 positions of each record. The sortkey is made up of the field ID and the operator ID.
- All records are then sorted by this sortkey, the well or lease ID, and the record type.
- The sortkey is checked for valid numeric data and occurrences of 999 in the lifting or flowing wells data fields are changed to zeros.

Processing of Dwight's Data for GASCAP

Four data tapes for use in the GASCAP model are further processed by:

- Identifying and deleting the CO₂ wells in New Mexico and Colorado
- Identifying the gas fields that are present on the Federal Pacific OCS tape and combining them with the State of California gas wells.

These tapes plus the other gas tapes used in GASCAP are then processed to identify and amend production anomalies. Only production records with supplemental information are kept for further processing. A load factor for each State/area is then determined.

Figure 6. Processing Well and Production Data

Assimilate and Categorize Dwight's Data

The data are further processed for modeling purposes by:

- Determining peak daily rates and the cumulative production for every year for each well
- Determining year of first production (vintage)
- Summing the monthly production, peak rates, cumulative production and number of producing wells by vintage and month
- Converting to SAS data sets for use in regression routines.

Regressions and Historical Capacity Estimates

Dwight's Data

The SAS data sets (of Dwight's data) are run through a series of regressions on equation (6) in Chapter 3 to facilitate automatic data handling and to eliminate data points that are more than one standard deviation lower than the calculated productive capacity. Equation (6) is approximately linear in log-log space. Therefore, a linear regression routine can be used to obtain initial estimates of q_i (B1), G_{ul} (B2), and B (B3). The log of both sides of equation (6) are taken and fit with SAS PROC REG.

The resulting parameter estimates are used as initial estimates in a nonlinear regression on equation (6), in SAS PROC NLIN. The resulting estimates for the input data are compared and data points that are more than one (1) standard deviation lower than the predicted value are removed from consideration and another nonlinear regression is performed. A list of the parameters is contained in Appendix I.

Note that a minimum of five data points are required for the three parameter fits. If there are less than five data points, one of the parameters (B3 - the exponent) is set to the average of all valid fits and a two-parameter regression is run. If there are only two data points, both the exponential parameter (B3) and the initial production parameter (B1) are set to the averages and a one-parameter model is regressed. The average parameters are used to project one valid point data sets and to project the future vintage years. The initial productive capacity parameter (B1) and the ultimate recovery parameter (B2) are averaged on a per well basis. These averages are multiplied by the number of wells or the projected number of wells to get valid estimates of the parameters.

After the parameters have been determined for each vintage year, they are saved for use in the projection routine. The original data and the results of the regressions are also passed on to the projection routine.

All JCLs and programs used to accomplish preprocessing, assimilation of the data, and regression are found in Appendix B.

Eighteen States Data

An additional 18 States are considered as one group. Data are limited for this group of States, and only 3 of the 18 States are included in Dwight's data files; namely, Nebraska, Oregon, and South Dakota. Production data are available from EIA for each of the 18 States, but not by well completion. The 18 States are:

- Arizona
- Florida
- Illinois
- Indiana
- Kentucky
- Maryland
- Michigan
- Missouri
- Nebraska
- Nevada
- New York
- Ohio
- Oregon
- Pennsylvania
- South Dakota
- Tennessee
- Virginia
- West Virginia

Because production and well counts by vintage year are not available for 15 of the 18 States, a different technique is used for these States. Monthly peak rates are determined from monthly gas-well gas production data obtained from the *Natural Gas Monthly*. The number of new well completions are determined from the API drilling statistics.

Drilling and Gas-Well Completions

One facet of gas-well gas productive capacity is the productive capacity of new gas-well completions. The initial productive capacity of new wells is determined from the regression program. Therefore, a projection of new gas-well completions is needed to complete the forecast (Figure 7).

The number of new well completions coming on stream is based on a projection of the number of rigs running and an estimate of the number of gas-well completions per rig. The history of the number of rigs running by State/area are obtained from Baker Hughes and the history of the number of producing gas-well completions is obtained from Dwight's data.

Drilling Rig Model

As discussed in Chapter 3, a model has been formulated to predict the number of drilling rigs from oil and gas income. The model generates monthly rig counts from monthly income data. In addition to oil and gas incomes, a term to account for seasonality is included in the model.

Oil income is used as a daily rate each month and is the product of the lower-48 daily oil production and the world oil price. Gas income is calculated in the same manner. The product of the lower-48 daily gas production and the U.S. average gas price determines the gas income. Prices are adjusted to constant 1990 dollars using the gross domestic product (GDP) deflator. Both income streams are exponentially smoothed prior to being used in the model.

The Solver routines contained in the spreadsheet software Excel are used to simultaneously determine values for all the parameters in equations (13) through (16). To define the parameter values, Solver is required to minimize the sum of the squares of the differences between the actual and estimated number of drilling rigs. Equation (13) is given a condition that the number of rigs drilling for gas determined by the gas income term had to be at least 25 percent of the total rigs determined by equation (13) each month.

To normalize or benchmark the model data to the actual data, all parameters are fixed except for the multiplier *b*. Solver is run again but only over the last 12 months. Benchmarked model data are used for the forecast period.

Oil and gas production and prices for the forecast period are taken from the STEO models. Three scenarios are used to forecast drilling rigs; a base case, a low case, and a high case. The base case gas production forecast from the STEO model is decreased by 4 percent and increased by 4 percent to provide the low and high case gas production forecasts. Oil production and oil and gas prices for the three cases come directly from the STEO models.

Figure 7. Projection of New Gas-Well Completions

Percentage Gas Rigs Model

As previously mentioned in Chapter 3, a model has been formulated to determine the percentage of rigs drilling for gas. The model uses oil and gas income and a special factor to handle coalbed methane and tight gas sand drilling. Monthly percentages are determined from monthly income values.

Oil income is used as a daily rate each month and is the product of the lower-48 daily oil production and the world oil price. Gas income is calculated in the same manner. The product of the lower-48 daily gas production and the U.S. average gas price determines the gas income. Prices are adjusted to constant 1990 dollars using the GDP deflator. Both income streams are exponentially smoothed prior to being used in the model.

The Solver routines contained in the spreadsheet software Excel are used to simultaneously determine values for all the parameters in equation (17). To define the parameter values, Solver is required to minimize the sum of the squares of the differences between the actual and estimated gas rig ratios.

Because of increasing tax credits, coalbed methane and tight gas sand drilling started to become a significant portion of gas well drilling in 1988. The coalbed methane and tight gas sand drilling factor (1+b) is first applied in January 1988 at 1/24 its full value. The factor grew linearly until it reached its full value in December 1989 (24 months). The factor remained at full value until January 1993 when it was reduced by half. It will remain at half value for the rest of the year.

The model data are normalized or benchmarked to the actual data. The model data are spliced to the last month of actual data by using the ratio of actual data divided by model data. The splicing ratio is applied to the model data through the end of the forecast. Benchmarked model data are used for the forecast period.

Oil and gas production and prices for the forecast period are taken from the STEO models. Three scenarios are used to forecast the percent gas rigs: a base case, a low case, and a high case. The base case gas production forecast from the STEO model is decreased by 4 percent and increased by 4 percent to provide the low and high case gas production forecasts. Oil production and oil and gas prices for the three cases come directly from the STEO models.

Projected Gas-Well Completions by State/Area

The number of rigs drilling for gas in the lower 48 States are prorated to each State/area based on the last 3 years of history. The number of rigs looking for gas in each State/area are then multiplied by a ratio of completions per gas rig for one particular State/area. The ratio is the historical number of gas-well completions producing in December according to Dwight's divided by the annual average number of rigs drilling for gas for the last 3 years.

Projected Gas Demand and the Initial Projection Schedule

Projected Total Gas Demand

The dry gas demand for the United States developed by EIA in STEO is used as a basis to schedule monthly gross gas-well and oil-well gas for the 10 States/areas in the lower 48 States. First the U.S. quarterly dry gas production demand for the projected 2 years is obtained from STEO. Then Alaska's production demand is subtracted from the U.S. demand to obtain the dry gas demand for the lower 48 States. The quarterly dry gas demand is then distributed to the 10 States/areas and converted to a gross gas basis. Next the quarterly gross gas

for each State/area is distributed by month using the latest historical marketed gas production available for each State/area as a basis.

Projected Oil-Well Gas Demand

Monthly oil production for the lower 48 States for the projected 2 years is obtained from STEO and prorated among the 10 States/areas for the projected 2 years. Oil wells are considered to be producing at their normal and full capacity as required by the lease operators and State regulatory requirements. Oil-well gas production is a function of oil production and the gas-oil ratio (GOR); therefore, the difference between oil-well gas productive capacity and oil-well gas production is assumed negligible. The monthly oil production estimates for the projected 2 years are multiplied by the last historical annual GOR to obtain the oil-well gas production and productive capacity for the projected 2 years.

Projected Gas-Well Gas Demand

The monthly EIA gross oil-well gas demand is subtracted from the monthly EIA gross total gas demand to obtain the monthly EIA gross gas-well gas demand for the projection period. The gross demand for Kansas is left on a total gas basis to remain compatible with the total gas values contained in the Dwight's Kansas data.

A single total gas quarterly demand projection is available from the STEO. Three different gross gas-well gas demand schedules are derived from this single total gas demand projection by virtue of differing oil-well gas projections. The three oil-well gas projections are a direct result of the varying STEO economic assumptions and resultant oil forecasts.

Initial Projection Schedule

The EIA projected gross gas-well gas demand is converted to gross Dwight's-basis gas-well gas to be used in the mainframe projection routines (Figure 8). Kansas data are converted and projected on a Dwight's total gas basis to remain compatible with Dwight's production data. No conversion factor is required for the 18 States because there is no need for normalization as there are no Dwight's data for this group. The conversion factor for each of the remaining eight States/areas is calculated as the quotient of EIA gross annual gas-well gas production, for the most recent historical year in the *Natural Gas Annual*, and the Dwight's gross annual gas-well gas production as calculated in preparatory GASCAP processing for the same calendar year.

The projected monthly gross Dwight's-basis gas-well gas demand is combined with projected new gas-well completions and output as a single ASCII file which is the initial scheduled basis for the mainframe projection routines. Each State/area has 2 years of monthly projections for each of three cases.

Projection Routine

After the equation parameters and the historical fits of the data have been accomplished, the parameters and data are used by the projection routine to project monthly productive capacity for 2 years. The initial demand for gas-well gas production is checked against the capacity each month. As long as capacity is greater than demand, no change is made. When the monthly demand exceeds capacity, the production is set equal to capacity for as long as demand is greater than capacity. After all equal States/areas have been projected, the demand is checked against the production. Any shortages that occur are summed by month and reallocated to the State/area which had surpluses and a new demand schedule is made, then a new projection is made. This process continues until 1) all demand is met or 2) all States/areas are producing at capacity (Figure 9).

Figure 8. Initial Gas-Well Gas Demand Schedule

Figure 9. Projection Process Demand Schedule

Monthly Gas Production and Productive Capacity

Historical and projected production and productive capacity data are merged after demand, production, and capacity have been reconciled through the PC reallocations and the mainframe projection routines. Monthly data for ten historical years and two projected years are processed in the PC systems to support the publication of *Natural Gas Productive Capacity for the Lower 48 States*.

Dwight's-basis monthly gas-well gas gross production and gas-well gas gross productive capacity are calculated for each area and case in the mainframe projection routines. A single file containing both historical gas-well gas production and historical gas-well gas productive capacity is concatenated from mainframe data files and downloaded to the PC. The individual State/area and case projected production and capacity data files created by the projection routines are also concatenated into a data file for each case and downloaded to the PC (Figure 10).

The mainframe downloads are parsed into spreadsheets using automated parsing routines tailored to the specific type of information, either history or projections, in the file. Each State/area has a spreadsheet which contains historical gas-well production and historical productive capacity data. Projections of gas-well gas production and gas-well productive capacity are maintained in separate low-, base-, and high-case spreadsheets for each State/area. Each State/area also has a spreadsheet of the percentage of total capacity by well age. Oil-well gas data are maintained exclusively within the PC system. Each case is retained in its own data spreadsheet. The oil-well gas data share a common historical time period which is supplemented with case-specific projections.

Total Gas

Monthly total natural gas production and total natural gas productive capacity are the summation of individual calculations of gas-well gas and oil-well gas data. Various conversions are applied to the data to merge them on common bases and to report them on a dry EIA basis. The conversion factors themselves are defined to adjust monthly production data to ensure their summation agrees with EIA annual totals as published in the *Natural Gas Annual*. Identical conversions are applied to corresponding production and productive capacity data. The reported EIA dry productive capacity data are, therefore, influenced by conversions designed to adjust production.

Monthly Dwight's-basis gross gas-well gas production and capacity are processed through several steps in order to report production and capacity on a monthly dry EIA basis. The sequential steps to achieve dry EIA-basis gas are: 1) Convert gross Dwight's-basis gas-well gas to gross EIA-basis gas-well gas using an annual conversion factor compatible with the calendar year of the monthly data, 2) add EIA gross oil-well gas to get EIA total gross gas, and 3) apply the EIA annual dry gas to EIA annual gross gas conversion factor appropriate for the calendar year of the monthly data to arrive at monthly dry gas which are consistent with the annual totals in the *Natural Gas Annual*.

Gas-Well Gas

The monthly gas-well gas production and gas-well gas productive capacity are calculated on a Dwight's basis. The Dwight's-basis monthly data are downloaded to PC spreadsheet routines which use simple annual ratios as conversion factors to normalize the monthly Dwight's-basis data to be consistent with annual gross gas-well gas totals as officially published by EIA in the *Natural Gas Annual*. Annual conversion factors for Texas, Louisiana, and the Gulf of Mexico Federal OCS required special handling since the definition of these States/areas in GASCAP as three separate entities varies from the two entities recognized in the *Natural Gas Annual*. Special handling was also necessary for Kansas since Dwight's data contain total gas only. The conversion for Kansas was developed for combined gas-well gas and oil-well gas since Dwight's Kansas gas data are not segregated.

Figure 10. Monthly Gas Production and Capacity Data

Oil-Well Gas

Production and productive capacity of natural gas from oil wells are considered in the GASCAP modeling procedures to be identical. Oil-well gas is calculated for most States/areas by multiplying monthly oil production by an annual gas-oil-ratio. The gas-oil-ratio is determined for each historical year using annual State/area oil-well gas volumes from the *Natural Gas Annual* and oil volumes reported in the *Petroleum Supply Annual*. The most current historical State/area gas-oil-ratio is used for the projections. As with gas-well gas, special handling of oil-well gas was necessary for Texas, Louisiana, and the Gulf of Mexico Federal OCS.

Table Generation

The State/area summary tables which display information on production, productive capacity, surplus, and utilization are created by assembling data from several spreadsheets. The monthly production and capacity data are converted to a dry EIA basis. Only the months of January, June, and December of each of the years covered in the report are displayed in the summary tables.

Figure Generation

Several types of figures are produced for each State/area and for the lower 48 States. The data streams which are graphically displayed for production and capacity, and the well-age productive capacity are automatically produced by spreadsheet macros. Spreadsheet data are manually imported from named-ranges into Harvard Graphics charts.

Appendix A

Model Abstract

Name: Wellhead Gas Productive Capacity

Acronym: GASCAP

Description: GASCAP estimates the historical wellhead productive capacity of natural gas for the lower 48 States and projects the productive capacity for 2 years. The Short-Term Energy Outlook (STEO) output for low, base, and high cases is used to estimate the number of active rigs and oil and gas well completions. The projected oil production is used to estimate the oil-well gas production (which is assumed to be producing at capacity) using a constant gas-oil ratio. The gas demand is also taken from STEO. The difference between demand and oil-well gas production is assumed to be the gas-well gas demand and the production as long as capacity exceeds demand.

Purpose: GASCAP is used to project the natural gas wellhead productive capacity for the lower 48 States. It also allows quantification of the available productive capacity and the projected capacity under differing future scenarios.

Date of Last Model Update: None

Part of Another Model: No

References to Any Other Models: None

Documentation reference: None

Official Model Representatives:

- **Office:** Oil and Gas
- **Division:** Reserves and Natural Gas
- **Branch:** Reserves and Production
- **Model Contacts:** John H. Wood, James N. Hicks, Hafeez Rahman, and Velton T. Funk
- **Telephone:** 214-767-2200

Archive Media and Installation Guides: Cartridge tape available from NEIC for GASCAP92, for the report *Natural Gas Productive Capacity for the Lower 48 States 1982 through 1993*, DOE/EIA-0542(93), published March 1993.

Energy System Described: GASCAP measures and predicts wellhead natural gas productive capacity.

Coverage:

- **Geographic:** Lower-48 natural gas producing States
- **Time Unit/Frequency:** Evaluates 10 years of historical data and project productive capacity for 2 years.
- **Products:** Natural gas
- **Economic Sectors:** Not applicable

Modeling Features:

- **Model Structure:** The model consists of a series of Statistical Analysis System (SAS) procedures utilizing a modified rate of gas production versus cumulative gas production (Rate-cum) equation.
- **Modeling Techniques:** SAS, utilizing the least squares, nonlinear regression procedure (NLIN) with the Marquardt computational method, was used to fit hyperbolic equations to the data.
- **Special Features:** None

Non-DOE Input Variables and Sources:

- Dwight's EnergyData Inc, Richardson, TX, Oil and Gas Reports
 - State monthly natural gas production by well
- Baker Hughes Incorporated
 - Number of active rotary rig and number of active rotary gas rig
- American Petroleum Institute
 - Drilling statistics monthly tapes

DOE Data Input Variables and Sources:

- *Natural Gas Annual*
 - Marketed gas production by State -- Tables 44-94
 - Gross gas production by State -- Tables 44-94
 - Oil-well gas production by State -- Tables 4 and 44-94
- *Natural Gas Monthly*
 - Marketed production of natural gas by State -- Table 7
- *Short Term Energy Outlook*
 - Dry gas production forecast -- Table 11
 - Oil and gas price forecasts -- Table 5
- *Petroleum Supply Annual*
 - Crude oil production -- Table 14

Computing Environment:**Main Frame**

- **Hardware:** IBM 3090E Model 400
- **Operating System:** MVS/XA
- **Languages:** FORTRAN / SAS / COBOL
- **Memory requirement:** 1500K
- **Storage requirement:** 1200 tracks of 3380 disk space
- **Estimated run time:** 4 hours CPU time

Personal Computer

- **Hardware:** Compaq Deskpro 386/20
- **Operating System:** MS DOS
- **Software:** LOTUS 123 / EXCEL / ARBITER / HARVARD GRAPHICS
- **Memory requirement:** 2000K
- **Storage requirement:** 10 Mb hard disk space
- **Estimated run time:** 1 hour

Independent Expert Reviews Conducted: None

Status of Evaluation Efforts: None

Bibliography:

Arps, J.J. *Estimation of Primary Oil Reserves*. Transactions of the American Institute of Mining, Metallurgical, and Petroleum Engineers. Volume 207 (Dallas, TX, 1956).

Cutler, W.W., Jr. *Estimation of Underground Oil Reserves by Well Production Curves*. USBM Bull. 228, 1924.

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Gas Fields in Kansas, New Mexico, and Arkansas*. DOE/EIA-0416(83). (Washington, DC, September 1983).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Fields in Louisiana*. DOE/EIA-0506. (Washington, DC, December 2, 1987).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Fields in Louisiana and Texas Federal Offshore Areas*. DOE/EIA-0471. (Washington, DC, January 23, 1986).

Energy Information Administration. *Natural Gas Annual*. DOE/EIA-0131. (Washington, DC, 1982 - 1991).

Energy Information Administration. *Natural Gas Monthly*. DOE/EIA-0130. (Washington, DC, January 1982 - December 1992).

Energy Information Administration. *Natural Gas Productive Capacity for the Lower 48 States 1980 through 1991*. DOE/EIA-0542. (Washington, DC, January 24, 1991).

Energy Information Administration. *Petroleum Supply Annual*. DOE/EIA-0340. (Washington, DC, 1980 through 1991).

Energy Information Administration. *Short-Term Energy Outlook Quarterly Projections*. DOE/EIA-0202. (Washington, DC, December 1992 Fourth Quarter).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Gas Fields in Texas*. DOE/EIA-0342(82). (Washington, DC, October 1982).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Gas Fields in Texas Railroad Commission District 8*. DOE/EIA-0342. (Washington, DC, April 1982).

Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1991 Annual Report*. DOE/EIA-0216(91). (Washington, DC, November 1992).

Hurst, William. *A Study of Transient or Unsteady State of Flow in the Hugoton Field and its Effect Upon Deliverability*. Testimony and Exhibit before Federal Power Commission, Docket No. G-20570, June 1960.

Natural Gas Supply Association. *Natural Gas Supply Association Survey Natural Gas Field Deliveries and Productive Capacity as of January 1, 1992*. (Washington, DC, September 1992).

National Petroleum Council. *Petroleum Storage and Information*. (Washington, DC, April 1989).

Rawlins, E.L., and Schellhardt, M.A. *Back-Pressure Natural Gas Wells and Their Application to Production Practices*. U.S. Bureau of Mines Monograph 7, 1936.

Appendix B

Preprocessing of Dwight's Data

Dwight's data tapes are sent directly to the EIA tape library. The information needed to process these tapes (tape numbers and data through date) is mailed to the Dallas Field Office. The JCL to execute depends on the number of tapes for each State's data type (oil or gas). Some State data are contained on one cartridge tape, other States require more than one cartridge tape for the data. Figure B1 is the flow diagram for the Dwight's processing steps. Regardless of the number of tapes, the changes that are made to each JCL are basically the same. Some standard changes are:

ZZ = State code (OK, LA, TX, etc.)
ZY = Year data received, current year.
ZZMDY = ZZ=State code, M=numeric month (5, 12, etc.), DY=data through year (91, 92, etc.)
UID = User ID for EIA computer system.

The data tape numbers must be changed to reflect the just received tape numbers. Be very careful to get these tape numbers right and be sure multi tapes are listed in the exact order. The TIME parameter in the JCLs can change to suit the time of day you want to run the JCL. All sort times are suggested for overnight - especially the multi tapes. The JCLs are liberally commented for ease of use.

Single Cartridge Tapes

If a State requires a single cartridge tape, then execute JCL **DWTPROCG** for gas data and **DWTPROCO** for oil data. These two JCLs will copy the Dwight's cartridge tape to an EIA cartridge tape, add a "Sortkey" (the field and operator ID is repeated in the first 16 positions of each record), sort each record by the sortkey, and replace nonnumeric data in sortkey with zeros, and the oil lifting and flowing wells containing 999 are replaced with zeros.

Multi Cartridge Tapes

If a State requires more than one tape, the same steps as executed for a single tape are executed in separate JCLs for processing ease. Copy the Dwight's tapes to EIA tapes by executing **DWT2DOEG** for gas data and **DWT2DOEO** for oil data. Add a "Sortkey" (the field and operator ID is repeated in the first 16 positions of each record) by executing **DWTKEYZZ** where ZZ = the State CA (oil), LA (gas), OK (gas), or TX (oil and gas). Each of the output State tapes are then sorted by executing **DWTSRTZZ** where ZZ = the State CA (oil), LA (gas), OK (gas), or these for Texas - **DWTSRTXG** (gas) and **DWTSRTXO** (oil). Next execute **REPLACEG** for gas which replaces nonnumeric data in sortkey with zeros or **REPLACE** for oil which replaces nonnumeric data in sortkey with zeros and changes 999 in lifting or flowing wells to zeros.

GASCAP Processing of Dwight's Data

After the preprocessing steps are completed, you are ready to continue processing the data for GASCAP. All States input to GASCAP have their production data edited by **DWTEGAS** which replaces production spikes with a smoothed average based on criteria in the program. The program **NEWREC** then collapses the edited data by deleting all the ID and Test records and keeping only the production records with some special indicators and gas cumulative (if any) written to them.

Figure B1. Process Flow Diagram for Gas-Well Data

Some States have special processing that must be executed before the production edit and collapsing of data routines are run. These are explained in the next sections as well as the editing and collapsing routines.

Deleting CO₂ Wells

The CO₂ wells in Colorado and New Mexico are identified by executing **DWTC309A**. The fetch data are edited by keeping only those records with 'C' in col 36 and only those you feel have been identified by Dwight's correctly as CO₂. Then all cols after col 32 are deleted. This is saved with an Irec1 of 32 and used as input (DD name INCO2) to **DWTEDCO2** which writes the Colorado or New Mexico State data without these wells. Editing and collapsing is then done - see that section which follows.

Special Processing for California

Gas wells for the Federal Pacific OCS are included on the oil tape by Dwights. These gas wells must be identified and copied from the oil tape to the California State tapes. **CAPART1** determines which gas wells on the oil tape, based on the GOR, are to be added to the gas data. These IDs are written to fetch (DD name SUMRECS) where they are examined. Currently, only Pitas Point (ID 003600000) and Santa Clara (004200000) are kept. The first 2 cols are production year. Change the year to a blank in col 1. Then delete all cols after col 32 and all lines that do not have the two IDs. Then delete all the lines with 003600000 but one and delete all cols on that one line after col 10. This ID should be the very first one. Now put a blank and 9 9'S as the last ID so the program will know when to quit. Now put this ID list as instream data in **CAPART2** program **OPFPLDS**. These are the wells that will be extracted from the oil Federal Pacific OCS tape and then concatenated to the end of the gas tape and sorted. Editing and collapsing is then done - see that section which follows.

Editing and Collapsing the Data

If no special processing is needed or after special processing is accomplished, the next step is to execute **EDITNEW**. The COBOL program **DWTEDEGAS** replaces production spikes with a smoothed average based on data patterns in the production records for the same well, and Cobol program **NEWREC** collapses the file by deleting all the ID and Test records and keeping only the production records with some special indicators written and gas cumulative (if any) written to them. Output from **NEWREC** is now ready for processing in **GASCAP**.

Calculating a Load Factor

DWTLFAC calculates a load factor for 10 years to be used to adjust the theoretical capacity curve in the projection program of **GASCAP**. Instream JCL data in DD name NUM allows for the 10-year interval to be requested.

Vintage and Peak Production Process

The **VINTPEAK** program is written in FORTRAN77. It receives a data set for each State/area from the Dwight data edit. The data is on a per well basis. The program determines which year the well first had production (vintage year). The program determines the largest average daily rate of production in a month for each year. Midmonth cumulative production is determined by summing half of the current month's production to the cumulative production through the end of the previous month. The midmonth cumulative productions, the monthly productions, the average daily production rate, the peak rates and the midmonth cumulative productions that coincide to the peak rate are summed by vintage year and production year and production month where applicable. If initial production occurred on or before the first Dwight record year in a State/area, that first record

year becomes the year-prior-to-records-vintage. All early data are summed into this vintage. The **VINTPEAK** program is run over nine State/areas and outputs a data set for each State/area.

ATMPLZZ is a SAS program that accesses the data output by **VINTPEAK** by State/area. Several test screens are applied to the data and symbols are assigned to each data point to indicate whether it will be kept or not. The first screen checks to make sure peak production rates are declining. The second screen uses the peak rates and associated cumulative production determined annually by vintage. The last or latest data point, and the Vintage year plus four are connected with a straight line equation using cumulative production as the independent variable. If the vintage year plus three or the vintage year plus two or the vintage year plus one data points are less than the calculated value, that data point is labelled invalid. The process is repeated with the last data point and the vintage year plus three data points to check the vintage year plus two or plus one data points. The process is repeated with the vintage year plus two data points to check the vintage year plus one data point.

ATMPLZZ outputs four SAS data sets and one formatted data set for each of nine areas. The formatted data set is a table of annual production by vintage year and the annual sum of all vintages. This data is used in determining a Dwight to DOE conversion factor. The SAS data sets are passed to **BSASTMPL**.

BSASTMPL is a SAS program that reads in the four SAS data sets for each of nine States, deletes empty records, and combines them into four data sets which include data from all nine States. This data can now be processed through the regression fits in one step (**CHYP9TMP**).

CHYP9TMP is a SAS program that passes the data through several regression routines. Data points falling more than one standard deviation below the predicted results are omitted and **CHYP9TMP** refits the remaining data. When not enough data points are available (using the $2n + 1$ rule where n = the number of variables in the equation) average values are substituted. Four data sets are output. One data set contains the equation parameters which feed the projection routine **EPROJZZ**. Other data sets contain the estimated historical capacity.

DRD4TMPL is a SAS program that reads one of the data sets created by **CHYP9TMP** and the earlier monthly production data set, and prepares them for use in **EPROJZZ**.

Table B1. Reference Table of JCLs, Programs, and Functions

JCL Name	Program Name	Language	Function
ATMPLZZ		SAS	Screen data for nonconformities and outputs four SAS and one formatted data sets. The formatted data set contains annual production figures which are used to get Dwight/EIA conversion factors for production.
BSASTMPL		SAS	Concatenate the four SAS data sets output by ATMPLZZ to four data sets sorted by area to facilitate use in the regression program CHYP9TMP.
CAPART1	DWTIDPD DWTGOR	COBOL COBOL	Write new records with ID and monthly oil and gas. Extract gas ID's from oil file.
CAPART2	OFFFLDS IEBGENER IEBGENER SORT DWTEDGAS NEWREC	COBOL IBM Utility IBM Utility IBM Utility COBOL COBOL	Write gas records from oil file. Copy gas CA tape to disk for concatenation later. Concatenate CA state gas and OCS oil records. Sort the concatenated California disk file. Write new gas file with edited production records. Compress gas files - keep production records only.
CHYP9TMP		SAS	Read gas production data from SAS data sets created by BSASTMPL. Calculates the parameters for the hyperbolic decline curve equation using the Marquardt non-linear least squares method.
DRD4TMPL		SAS	Prepare monthly production data for projection routine.
DWTC309A	DWTC309A	COBOL	Write Dwight designated CO ₂ fields to fetch.
DWTEDC02	DWTDC02 DWTEDGAS NEWREC	COBOL COBOL COBOL	Write new gas file without CO ₂ fields. Write new gas file with edited production records. Compress gas files - keep production records only.
DWTLFAC	DWTLFAC	COBOL	Calculate a load factor.

Table B1. Reference Table of JCLs, Programs, and Functions (Continued)

JCL Name	Program Name	Language	Function
DWTPROCG	IEBGENER	IBM Utility	Copy single volume Dwight's gas tape to EIA tape.
	DWTKEY	COBOL	Write sortkey to each record.
	SORT	IBM Utility	Sort records by sortkey.
	REPLACEG	COBOL	Replace data in specified data fields.
DWTPROCO	IEBGENER	IBM Utility	Copy single volume Dwight's oil tape to EIA tape.
	DWTKEY	COBOL	Write sortkey to each record.
	SORT	IBM Utility	Sort records by sortkey.
	REPLACE	COBOL	Replace specified data fields on oil records.
DWT2DOEG	IEBGENER	IBM Utility	Copy multi volume Dwight's gas tape to EIA tape.
	DWTKEY	COBOL	Write sortkey to each record.
	SORT	IBM Utility	Sort records by sortkey.
	REPLACEG	COBOL	Replace specified data fields on gas records.
DWT2DOEO	IEBGENER	IBM Utility	Copy multi volume Dwight's oil tape to EIA tape.
	DWTKEY	COBOL	Write sortkey to each record.
	SORT	IBM Utility	Sort records by sortkey.
	REPLACE	COBOL	Replace specified data fields on oil records.
DWTKEYCA	DWTKEY	COBOL	Write sortkey to each California oil record.
DWTKEYLA	DWTKEY	COBOL	Write sortkey to each Louisiana gas record.
DWTKEYOK	DWTKEY	COBOL	Write sortkey to each Oklahoma gas or oil record.
DWTKEYTX	DWTKEY	COBOL	Write sortkey to each Texas gas or oil record.
DWTSRTCA	SORT	IBM Utility	Sort California oil by sortkey.
DWTSRTLA	SORT	IBM Utility	Sort Louisiana gas by sortkey.
DWTSRTOK	SORT	IBM Utility	Sort Oklahoma gas by sortkey.

Table B1. Reference Table of JCLs, Programs, and Functions (Continued)

JCL Name	Program Name	Language	Function
DWTSRTXG	SORT	IBM Utility	Sort Texas gas by sortkey.
DWTSRTXO	SORT	IBM Utility	Sort Texas oil by sortkey.
GASEDNEW	DWTEGAS NEWREC	COBOL COBOL	Write new file with edited gas production records. Compress gas files - keep production records only.
REPLACE	REPLACE	COBOL	Replace specified data fields on oil records.
REPLACEG	REPLACEG	COBOL	Replace specified data fields on gas records.
VINTPEAK	VINTPEAK	FORTTRAN	Determine vintage year and peak rates for each well record, sum monthly production rates and cumulative production, and peak rates and associated cumulative production by vintage year.

Table B2. JCL Listings

CAPART1

```

1. //UIDUCAP1 JOB (6972,DAL,,15),GASCAP,REGION=1200K
2. //*****
3. //* "CAPART1" WRITTEN PRODUCTION RECORDS WITH WELL-ID & MONTHLY GAS
4. //* & OIL ARE PASSED TO FIND OIL WELLS YOU WANT TO USE AS GAS WELLS.
5. //*****
6. //* WRITE NEW RECORDS WITH WELL-ID AND MONTHLY GAS AND OIL.
7. //*****
8. //DWTIDPD EXEC PGM=DWTIDPD,TIME=(00,49)
9. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
10. //INDWT DD DSN=CN6972.PRJ.DWTZY.OFPMDY,DISP=OLD
11. //DWTMOD DD DSN=CN6972.PRJ.DWTZY.OFPMDY.PRODRECS,UNIT=DASD,
12. // DCB=(RECFM=FB,LRECL=227,BLKSIZE=2270),
13. // DISP=(NEW,CATLG,CATLG),SPACE=(TRK,(400,100),RLSE)
14. //SYSDBOU DD SYSOUT=A
15. //SYSOUT DD SYSOUT=A
16. //*****
17. //* WRITES EACH OIL ID THAT WE WANT TO INCLUDE WITH THE GAS BASED ON
18. //* THE PROGRAM'S CRITERIA TO BE A GAS FIELD ON THE OIL TAPE. FETCH THE
19. //* OUTPUT OF SUMRECS. THE FIRST 2 COLS ARE PRODUCTION YEAR. CHANGE
20. //* THE YEAR TO BE A BLANK IN COL 1. THEN DELETE ALL COLS AFTER COL 32,
21. //* AND ALL LINES THAT DO NOT HAVE AN ID OF 003600000 OR 004200000. THE
22. //* ONLY 2 OIL FIELDS YOU KEEP ARE PITAS POINT & SANTA CLARA. THEN
23. //* DELETE ALL THE LINES WITH 003600000 BUT ONE AND DELETE ALL COLS ON
24. //* THAT ONE LINE AFTER COL 10. THIS ID SHOULD BE THE VERY FIRST ONE.
25. //* NOW PUT 9 9'S AS THE LAST ID SO PROGRAM WILL KNOW WHEN TO QUIT.
26. //* NOW PUT THESE ID'S AS INSTREAM JCL OF OFPFLDS AND RUN SAME.
27. //*****
28. //DWTGOR EXEC PGM=DWTGOR,TIME=(00,29)
29. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
30. //PRODRECS DD DSN=CN6972.PRJ.DWTZY.OFPMDY.PRODRECS,DISP=OLD
31. //SUMRECS DD SYSOUT=A,DCB=(RECFM=FB,LRECL=245,BLKSIZE=2450)
32. //SYSDBOU DD SYSOUT=A
33. //SYSOUT DD SYSOUT=A

```

CAPART2

```

1. //UIDUCAP2  JOB (6972,DAL,,999),GASCAP
2. //*****
3. //* "CAPART2" FINISH PROCESSING OF CALIFORNIA OIL AND GAS TAPES AS
4. //* STARTED IN CAPART1.  EACH STEP IS EXPLAINED.
5. //*****
6. //* WRITE NEW DWIGHT TYPE FILE WITH ONLY OIL FIELDS FROM CALIFORNIA
7. //* FEDERAL PACIFIC OIL TAPE THAT WE WANT TO INCLUDE WITH THE GAS
8. //* FIELDS.  THE 2 OIL FIELDS TO INCLUDE WITH THE GAS ARE PITAS POINT
9. //* AND SANTA CLARA.  THESE WERE DETERMINED BY THE OUTPUT FROM JCL
10. //* CAPART1.  THE LAST INSTREAM ID MUST BE ALL 9'S (9 9'S LONG) SO THE
11. //* PROGRAM WILL KNOW IT HAS REACHED THE LAST ID.
12. //*****
13. //STEP1      EXEC PGM=OFPLDS,TIME=(00,39),REGION=1200K
14. //STEPLIB    DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
15. //INDWT      DD DSN=CN6972.PRJ.DWTZY.OFPMDY,DISP=OLD
16. //DWTMOD     DD DSN=CN6972.PRJ.DWTZY.OFPOIL.GAS,UNIT=DASD,
17. //           DCB=(RECFM=FB,LRECL=466,BLKSIZE=4660),
18. //           DISP=(NEW,CATLG,CATLG),SPACE=(TRK,(400,100),RLSE)
19. //SYSDBOUT   DD SYSOUT=A
20. //SYSOUT     DD SYSOUT=A
21. //FLDIDS     DD *
22. 003600000
23. 00420000013200756043112043602S1
24. 00420000013200756043112051900S3
25. 00420000013200756043112052800D2
26. 00420000013200756043112052800S3
27. 00420000013200756043112053700D1
28. 00420000013200756043112053700D2
29. 00420000013200756043112058700S1
30. 00420000074898256043112053000S2
31. 00420000074898256043112054700S1
32. 00420000074898256043112061400S2
33. 00420000074898256043112062300S1
34. 00420000074898256043112062300S2
35. 00420000074898256043112068100S1
36. 00420000074898256043112068400S1
37. 999999999
38. /*
39. //*****
40. //* CONCATENATION UTILITY LIKES ALL DATASETS TO HAVE THE SAME DCB.
41. //* SINCE TAPE HAS A LARGER BLOCK SIZE, YOU MUST COPY IT TO DISK AND
42. //* USE THE SMALLER BLOCK SIZE SO YOU CAN PUT IT WITH THE OIL DATA.
43. //* SO COPY CALIFORNIA GAS TAPE TO DISK USING SMALLER BLOCK SIZE.
44. //*****
45. //COPY       EXEC PGM=IEBGENER,TIME=(01,15)
46. //SYSUT1     DD DSN=CN6972.PRJ.DWTZY.GCAMDY,UNIT=TAPEC,DISP=OLD
47. //SYSUT2     DD DSN=CN6972.PRJ.DWTZY.GCAMDY.DISK,UNIT=DASD,
48. //           DCB=(RECFM=FB,LRECL=466,BLKSIZE=4660),
49. //           DISP=(NEW,CATLG,CATLG),SPACE=(TRK,(400,50),RLSE)

```

CAPART2 (Continued)

```

50. //SYSIN      DD DUMMY
51. //SYSPRINT   DD SYSOUT=A
52. //SYSOUT     DD SYSOUT=A
53. //*****
54. //* CONCATENATE CALIFORNIA GAS/OIL DISK DATA SETS.
55. //*****
56. //STP1       EXEC PGM=IEBGENER,TIME=(01,25)
57. //SYSUT1     DD DSN=CN6972.PRJ.DWTZY.GCAMDY.DISK,DISP=OLD
58. //           DD DSN=CN6972.PRJ.DWTZY.OFPOIL.GAS,DISP=SHR
59. //SYSUT2     DD DSN=CN6972.PRJ.TEMPDISK.CAGASOIL,UNIT=DASD,
60. //           DCB=(RECFM=FB,LRECL=466,BLKSIZE=4660),
61. //           DISP=(NEW,CATLG,CATLG),SPACE=(TRK,(400,50),RLSE)
62. //SYSIN      DD DUMMY
63. //SYSPRINT   DD SYSOUT=A
64. //SYSOUT     DD SYSOUT=A
65. //*****
66. //* SORT THE CALIFORNIA GAS/OIL DISK DATA SET.
67. //*****
68. //SORTIT     EXEC PGM=SORT,TIME=(01,30)
69. //SORTWK01   DD UNIT=SYSDA,SPACE=(CYL,(5,1))
70. //SORTWK02   DD UNIT=SYSDA,SPACE=(CYL,(5,1))
71. //SORTWK03   DD UNIT=SYSDA,SPACE=(CYL,(5,1))
72. //SORTIN     DD DSN=CN6972.PRJ.TEMPDISK.CAGASOIL,DISP=SHR
73. //SORTOUT    DD DSN=CN6972.PRJ.TEMPDISK.CAGASOIL,DISP=OLD
74. //SYSIN      DD *
75.   SORT FIELDS=(2,15,A,22,11,A,33,2,A),FORMAT=CH
76. //SYSOUT     DD SYSOUT=A
77. //*****
78. //* WRITE NEW FILE WITH EDITED PRODUCTION RECORDS.
79. //*****
80. //EDITRECS   EXEC PGM=DWTEGAS,TIME=(00,09),REGION=1200K
81. //STEPLIB    DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
82. //INDWT      DD DSN=CN6972.PRJ.TEMPDISK.CAGASOIL,DISP=OLD
83. //DWTMOD     DD DSN=CN6972.PRJ.DWTZY.GCAMDYE.PLUSOIL,UNIT=DASD,
84. //           DCB=(RECFM=FB,LRECL=466,BLKSIZE=4660),
85. //           DISP (NEW,CATLG,CATLG),SPACE=(TRK,(400,50),RLSE)
86. //DWTFET     DD SYSOUT=A,DCB=(RECFM=FA,LRECL=38,BLKSIZE=380)
87. //SYSDBOU    DD SYSOUT=A
88. //SYSOUT     DD SYSOUT=A
89. //*****
90. //* WRITE EDITED FILE WITH PRODUCTION RECORDS ONLY AND THE FIRST
91. //* PRODUCTION RECORD FOR A WELL WILL HAVE THE GCUM IF ONE WAS
92. //* AVAILABLE ON THE ID RECORD TO BEGIN WITH. IF NOT, ZEROS ARE
93. //* WRITTEN TO THIS DATA POSITION. AN 'N' IS ALSO WRITTEN TO THIS FIRST
94. //* RECORD IN COL 1 AND AN 'A' IS WRITTEN TO EACH ADDITIONAL RECORD
95. //* FOR A WELL IN COL 1.
96. //*****
97. //STEP1      EXEC PGM=NEWREC,TIME=(01,15),REGION=1200K
98. //STEPLIB    DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
99. //INDWT      DD DSN=CN6972.PRJ.DWTZY.GCAMDYE.PLUSOIL,DISP=OLD

```

CAPART2 (Continued)

```
100. //DWTMOD      DD DSN=CN6972.PRJ.DWTZY.GCAMDY.PLUSOIL,UNIT=TAPEC,
101. //              DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
102. //              DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
103. //SYSDBOUT    DD SYSOUT=A
104. //SYSOUT       DD SYSOUT=A
```

DWTC309A

```
1. //UIDUA309     JOB (6972,DAL,,999),GASCAP
2. //*****
3. //* "DWTC309A" WRITES TO FETCH THE FIELD ID AND NAME FOR THOSE ID
4. //* RECORDS WHICH HAVE ANY SPECIAL DESIGNATION IN COL 309. KEEP ONLY
5. //* THOSE RECORDS OUTPUT TO FETCH THAT HAVE A 'C' IN COL 36. DELETE
6. //* ALL AFTER COL 32 AND SAVE INTO A DATA SET WITH LRECL=32. THIS WILL
7. //* BE THE INPUT FILE TO THE FIRST STEP OF "DWTEDCO2". FOR CO AND NM.
8. //*****
9. //STEP1        EXEC PGM=DWTC309A,TIME=(00,49),REGION=1200K
10. //STEPLIB      DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
11. //INDWT        DD DSN=CN6972.PRJ.DWTZY.GCOMDY,UNIT=TAPEC,DISP=OLD
12. //DWTFT        DD SYSOUT=A,DCB=(RECFM=FA,LRECL=80,BLKSIZE=800)
13. //SYSDBOUT     DD SYSOUT=A
14. //SYSOUT       DD SYSOUT=A
```

DWTEDCO2

```
1. //UIDUDCO2     JOB (6972,DAL,,999),GASCAP
2. //*****
3. //* WRITE NEW FILE WITHOUT CO2 WELL RECORDS. FOR COLORADO AND NEW
4. //* MEXICO. INPUT FILE FOR INCO2 DD IS DATA SET CREATED BY DWTC309A.
5. //*****
6. //DELECO2      EXEC PGM=DWTEDCO2,TIME=(02,00),REGION=1200K
7. //STEPLIB      DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
8. //INDWT        DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,DISP=OLD
9. //INCO2        DD DSN=CN6972.PRJ.CO2GZZ,UNIT=DASD,DISP=OLD
10. //DWTMOD      DD DSN=CN6972.PRJ.DWTZY.GZZMDY.NOCO2,UNIT=TAPEC,
11. //              DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),VOL=(,RETAIN),
12. //              DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
13. //SYSDBOUT     DD SYSOUT=A
14. //SYSOUT       DD SYSOUT=A
15. //*****
16. //* WRITE NEW FILE WITH EDITED PRODUCTION RECORDS.
17. //*****
18. //EDITRECS     EXEC PGM=DWTEDCO2,TIME=(02,00),REGION=1200K
19. //STEPLIB      DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
```

DWTEDCO2 (Continued)

```

20. //INDWT      DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,DISP=OLD,
21. //          UNIT=TAPEC,VOL=(,,,REF=* .DELECO2.DWTMOD)
22. //DWTMOD     DD DSN=CN6972.PRJ.DWTZY.GZZMDYE,UNIT=TAPEC,
23. //          DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),VOL=(,RETAIN),
24. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
25. //DWTFET     DD SYSOUT=A,DCB=(RECFM=FA,LRECL=38,BLKSIZE=380)
26. //SYSDABOUT DD SYSOUT=A
27. //SYSOUT      DD SYSOUT=A
28. //*****
29. //* WRITE EDITED FILE WITH PRODUCTION RECORDS ONLY AND THE FIRST
30. //* PRODUCTION RECORD FOR A WELL WILL HAVE THE GCUM IF ONE WAS
31. //* AVAILABLE ON THE ID RECORD TO BEGIN WITH. IF NOT, ZEROS ARE
32. //* WRITTEN TO THIS DATA POSITION. AN 'N' IS ALSO WRITTEN TO THIS FIRST
33. //* RECORD IN COL 1 AND AN 'A' IS WRITTEN TO EACH ADDITIONAL RECORD
34. //* FOR A WELL IN COL 1.
35. //*****
36. //NEWRECS     EXEC PGM=NEWREC,TIME=(02,00),REGION=1200K
37. //STEPLIB     DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
38. //INDWT       DD DSN=CN6972.PRJ.DWTZY.GZZMDYE,DISP=OLD,
39. //          UNIT=TAPEC,VOL=(,,,REF=* .EDITRECS.DWTMOD)
40. //DWTMOD      DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,
41. //          DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
42. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
43. //SYSDABOUT  DD SYSOUT=A
44. //SYSOUT      DD SYSOUT=A

```

DWTLFAC

```

1. //UIDULFAC   JOB (6972,DAL,,999),GASCAP
2. //*****
3. //* CALCULATES A LOAD FACTOR TO BE USED TO ADJUST THE THEORETICAL
4. //* CAPACITY CURVE IN THE PROJECTION PROGRAM OF GASCAP. CALCULATE A
5. //* LOAD FACTOR FOR EACH AREA FOR 10 YEARS REQUESTED IN DD NUM.
6. //*****
7. //LOADFAC     EXEC PGM=DWTLFAC,TIME=(00,55),REGION=1200K
8. //STEPLIB     DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //INDWT       DD DSN=CN6972.PRJ.DWTZY.GFO492,DISP=OLD,UNIT=TAPEC
10. //* NUM IS BEGINNING YEAR AND ENDING YEAR FOR THE 10 YEARS TO FETCH
11. //NUM         DD *
12. //          82 91
13. //FETCH      DD SYSOUT=A
14. //SYSDABOUT  DD SYSOUT=A
15. //SYSOUT      DD SYSOUT=A

```


DWTPROCG

```

1.  //UIDUDGZZ  JOB (6972,DAL,,15),GASCAP,REGION=1200K,TIME=(07,59)
2.  //*****
3.  /*** FOR DWIGHT GAS TAPES ONLY AND FOR SINGLE VOL TAPES ONLY.
4.  /*** CREATES A TAPE FOR USE BY THE DALLAS FIELD OFFICE.
5.  /** "DWTPROCG" FOR COPYING, WRITING SORT KEY, SORTING, AND REPLACING
6.  /** NONNUMERIC DATA IN OPERATOR AND FIELD ID DATA FIELDS AND THE
7.  /** SORT KEY DATA FIELDS WITH ZEROS FOR EACH RECORD TYPE.
8.  //*****
9.  /** COPY THE DWIGHT GAS TAPE TO AN EIA CARTRIDGE TAPE. YOU MUST
10. /** PUT THE CORRECT DWIGHTS TAPE NUMBER IN THE SYSUT1 DD STATEMENT.
11. /** A TAPE NUMBER WILL BE SUPPLIED BY DWIGHT'S WHEN THEY SEND THE
12. /** TAPE TO THE DOE/EIA TAPE LIBRARY.
13. //*****
14. //COPY      EXEC PGM=IEBGENER
15. //SYSUT1    DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,DISP=OLD,
16. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),LABEL=(1,NL),
17. //          VOL=SER=DC1050
18. //SYSUT2    DD DSN=CN6972.PRJ.DWTZY.CGZZMDY,UNIT=TAPEC,
19. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180),
20. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),VOL=(,RETAIN)
21. //SYSIN     DD DUMMY
22. //SYSPRINT  DD SYSOUT=A
23. //SYSOUT    DD SYSOUT=A
24. //*****
25. /** CREATES A NEW TAPE WITH A SORT KEY. THE SORT KEY IS CREATED BY
26. /** COPYING THE FIELD AND OPERATOR ID DATA FROM THE RECORD TO THE
27. /** FRONT OF EACH RECORD.
28. //*****
29. //SORTKEY   EXEC PGM=DWTKEY
30. //STEPLIB   DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
31. //AFILE     DD DSN=CN6972.PRJ.DWTZY.CGZZMDY,UNIT=TAPEC,
32. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),DISP=OLD,
33. //          LABEL=(1,SL),VOL=(,,REF=*.COPY.SYSUT2)
34. //KEY       DD DSN=CN6972.PRJ.DWTZY.KGZZMDY,UNIT=TAPEC,
35. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),VOL=(,RETAIN),
36. //          DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
37. //SYSDBOU   DD SYSOUT=A
38. //*****
39. /** SORT BY SORT KEY (FIELD-OPERATOR IDS), WELL ID, AND RECORD TYPE.
40. //*****
41. //SORTIT    EXEC PGM=SORT,PARM=('MSG=AP')
42. //SORTLIB   DD DSN=SYS1.SORTLIB,DISP=SHR
43. //SORTWK01  DD UNIT=SYSDA,SPACE=(CYL,(50,10))
44. //SORTWK02  DD UNIT=SYSDA,SPACE=(CYL,(50,10))
45. //SORTWK03  DD UNIT=SYSDA,SPACE=(CYL,(50,10))
46. //SORTWK04  DD UNIT=SYSDA,SPACE=(CYL,(50,10))
47. //SORTWK05  DD UNIT=SYSDA,SPACE=(CYL,(50,10))
48. //SORTWK06  DD UNIT=SYSDA,SPACE=(CYL,(50,10))
49. //SORTMESS  DD SYSOUT=A

```

DWTPROCG (continued)

```

50. //SORTIN      DD DSN=CN6972.PRJ.DWTZY.KGZZMDY,UNIT=TAPEC,
51. //            DISP=(OLD,DELETE,KEEP),
52. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
53. //            LABEL=(1,SL),VOL=(,,,REF=*.SORTKEY.KEY)
54. //SORTOUT     DD DSN=CN6972.PRJ.DWTZY.SGZZMDY,UNIT=TAPEC,
55. //            DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),VOL=(,RETAIN),
56. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
57. //SYSIN       DD *
58.   SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
59. //SYSPRINT    DD SYSOUT=A
60. //SYSOUT      DD SYSOUT=A
61. //*****
62. //* REPLACE NONNUMERIC DATA IN OPERATOR AND FIELD ID DATA FIELDS
63. //* WITH ZEROS. DONE ON EACH RECORD TYPE.
64. //*****
65. //REPLACEG    EXEC PGM=REPLACEG
66. //STEPLIB     DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
67. //AFILE       DD DSN=CN6972.PRJ.DWTZY.SGZZMDY,UNIT=TAPEC,
68. //            DISP=(OLD,DELETE,KEEP),
69. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
70. //            LABEL=(1,SL),VOL=(,,,REF=*.SORTIT.SORTOUT)
71. //LIST        DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=82,BLKSIZE=820)
72. //PRINT       DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,
73. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
74. //            LABEL=(1,SL,,,EXPDT=98180),DISP=(NEW,CATLG,DELETE)
75. //SYSOUT      DD SYSOUT=A
76. //SYSDBOUT    DD SYSOUT=A

```

DWTPROCO

```

1.  //UIDUDOZZ   JOB (6972,DAL,,15),GASCAP,REGION=1500K,TIME=(07,59)
2.  //*****
3.  /*** FOR DWIGHT OIL TAPES ONLY AND FOR SINGLE VOL TAPES ONLY.
4.  /*** CREATES A TAPE FOR USE BY THE DALLAS FIELD OFFICE.
5.  /** "DWTPROCO" FOR COPYING, WRITING SORT KEY, SORTING, AND REPLACING
6.  /** NONNUMERIC DATA IN OPERATOR AND FIELD ID DATA FIELDS AS WELL AS
7.  /** THE SORT KEY DATA FIELDS FOR EACH RECORD TYPE. CHANGES '999'
8.  /** IN LIFTING AND FLOWING WELLS TO ZEROS.
9.  //*****
10. /** COPY THE DWIGHT OIL TAPE TO AN EIA CARTRIDGE TAPE. YOU MUST PUT
11. /** THE CORRECT DWIGHTS TAPE NUMBER IN THE SYSUT1 DD STATEMENT. THE
12. /** TAPE NUMBER WILL BE SUPPLIED BY DWIGHT'S WHEN THEY SEND THE
13. /** TAPE TO THE DOE/EIA TAPE LIBRARY AND NOTIFY YOU THAT THEY HAVE.
14. //*****
15. //COPY       EXEC PGM=IEBGENER
16. //SYSUT1     DD DSN=CN6972.PRJ.DWTZY.OZZMDY,UNIT=TAPEC,DISP=OLD,
17. //            DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),LABEL=(1,NL),
18. //            VOL=SER=DC0161

```

DWTPROCO(Continued)

```

19. //SYSUT2      DD DSN=CN6972.PRJ.DWTZY.COZZMDY,UNIT=TAPEC,
20. //            DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180),
21. //            DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),VOL=(,RETAIN)
22. //SYSIN        DD DUMMY
23. //SYSPRINT     DD SYSOUT=A
24. //SYSOUT       DD SYSOUT=A
25. //*****
26. //* CREATES A NEW TAPE WITH A SORT KEY. THE SORT KEY IS CREATED BY
27. //* COPYING THE FIELD AND OPERATOR ID DATA FROM THE RECORD TO THE
28. //* FRONT OF EACH RECORD.
29. //*****
30. //SORTKEY      EXEC PGM=DWTKEY
31. //STEPLIB      DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
32. //AFILE        DD DSN=CN6972.PRJ.DWTZY.COZZMDY,UNIT=TAPEC,
33. //            DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),DISP=OLD,
34. //            LABEL=(1,SL),VOL=(,,,REF=* COPY.SYSUT2)
35. //KEY          DD DSN=CN6972.PRJ.DWTZY.KOZZMDY,UNIT=TAPEC,
36. //            DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),VOL=(,RETAIN),
37. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
38. //SYSDBOU     DD SYSOUT=A
39. //*****
40. //* SORT BY SORT KEY (FIELD-OPERATOR IDS), WELL ID, AND RECORD TYPE.
41. //*****
42. //SORTIT       EXEC PGM=SORT,PARM=('MSG=AP')
43. //SORTLIB      DD DSN=SYS1.SORTLIB,DISP=SHR
44. //SORTWK01     DD UNIT=SYSDA,SPACE=(CYL,(50,10))
45. //SORTWK02     DD UNIT=SYSDA,SPACE=(CYL,(50,10))
46. //SORTWK03     DD UNIT=SYSDA,SPACE=(CYL,(50,10))
47. //SORTWK04     DD UNIT=SYSDA,SPACE=(CYL,(50,10))
48. //SORTWK05     DD UNIT=SYSDA,SPACE=(CYL,(50,10))
49. //SORTWK06     DD UNIT=SYSDA,SPACE=(CYL,(50,10))
50. //SORTMESS     DD SYSOUT=A
51. //SORTIN       DD DSN=CN6972.PRJ.DWTZY.KOZZMDY,UNIT=TAPEC,DISP=OLD,
52. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
53. //            LABEL=(1,SL),VOL=(,,,REF=* SORTKEY.KEY)
54. //SORTOUT      DD DSN=CN6972.PRJ.DWTZY.SOZZMDY,UNIT=TAPEC,
55. //            DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
56. //            DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),VOL=(,RETAIN)
57. //SYSIN        DD *
58. SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
59. //SYSPRINT     DD SYSOUT=A
60. //SYSOUT       DD SYSOUT=A
61. //*****
62. //* REPLACE NONNUMERIC DATA IN SORT KEY, OPERATOR, AND FIELD ID DATA
63. //* FIELDS WITH ZEROS. DONE ON EACH RECORD TYPE. CHANGES ANY '999'
64. //* FOUND IN THE LIFTING AND FLOWING WELLS DATA FIELDS TO ZEROS.
65. //*****
66. //REPLACE      EXEC PGM=REPLACE
67. //STEPLIB      DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE

```

DWTPROCO (continued)

```
68. //AFILE      DD DSN=CN6972.PRJ.DWTZY.SOZZMDY,DISP=OLD,
69. //          UNIT=TAPEC,DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
70. //          LABEL=(1,SL),VOL=(,,,REF=*.SORTIT.SORTOUT)
71. //LIST       DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=82,BLKSIZE=820)
72. //WELL       DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
73. //PRINT      DD DSN=CN6972.PRJ.DWTZY.OZZMDY,UNIT=TAPEC,
74. //          DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
75. //          LABEL=(1,SL,,,EXPDT=98180),DISP=(NEW,CATLG,DELETE)
76. //SYSOUT     DD SYSOUT=A
77. //SYSDBOUT   DD SYSOUT=A
```

DWT2DOEG

```
1. //UIDUCGZZ   JOB (6972,DAL,,15),GASCAP,REGION=1200K
2. //*****
3. //* COPY THE DWIGHT GAS TAPES TO EIA CARTRIDGE TAPES. YOU MUST PUT
4. //* THE CORRECT DWIGHTS TAPE NUMBERS IN THE SYSUT1 VOL=SER. THE
5. //* TAPES NUMBERS WILL BE SUPPLIED BY DWIGHT'S WHEN THEY SEND THE
6. //* TAPES TO THE DOE/EIA TAPE LIBRARY. LIST TAPE NUMBERS IN THE SAME
7. //* SEQUENCE AS DWIGHTS AND INCLUDE ONLY TAPE NUMBERS THEY SUPPLY.
8. //*****
9. //STP1       EXEC PGM=IEBGENER,TIME=(29,00)
10. //SYSUT1    DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,DISP=OLD,
11. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),LABEL=(1,NL),
12. //          VOL=SER=(DC1431,DC1348,DC2037,DC0563)
13. //*        VOL=SER=(DC2018,DC0682)
14. //SYSUT2    DD DSN=CN6972.PRJ.DWTZY.CGZZMDY,UNIT=TAPEC,
15. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180),
16. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000)
17. //SYSIN     DD DUMMY
18. //SYSPRINT   DD SYSOUT=A
19. //SYSOUT    DD SYSOUT=A
```

DWT2DOEO

```
1. //UIDUCOZZ   JOB (6972,DAL,,15),GASCAP,REGION=1200K
2. //*****
3. //* COPY THE DWIGHT GAS TAPES TO EIA CARTRIDGE TAPES. YOU MUST PUT
4. //* THE CORRECT DWIGHTS TAPE NUMBERS IN THE SYSUT1 VOL=SER. THE
5. //* TAPES NUMBERS WILL BE SUPPLIED BY DWIGHT'S WHEN THEY SEND THE
6. //* TAPES TO THE DOE/EIA TAPE LIBRARY. LIST TAPE NUMBERS IN THE SAME
7. //* SEQUENCE AS DWIGHTS AND INCLUDE ONLY TAPE NUMBERS THEY SUPPLY.
8. //*****
9. //STP1       EXEC PGM=IEBGENER,TIME=(25,00)
10. //SYSUT1    DD DSN=CN6972.PRJ.DWTZY.OZZMDY,UNIT=TAPEC,DISP=OLD,
```

DWT2DOEO

```
11. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000),LABEL=(1,NL),
12. //*          VOL=SER=(DC0948,DC0522,DC0897,DC1807,DC1631)
13. //*          VOL=SER=(DC0576,DC0575,DC0574)
14. //          VOL=SER=(DC2018,DC0682)
15. //SYSUT2     DD DSN=CN6972.PRJ.DWTZY.COZZMDY,UNIT=TAPEC,
16. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180),
17. //          DCB=(RECFM=FB,LRECL=450,BLKSIZE=27000)
18. //SYSIN      DD DUMMY
19. //SYSPRINT   DD SYSOUT=A
20. //SYSOUT     DD SYSOUT=A
```

DWTKEYCA

```
1. //UIDUKOCA   JOB (6972,DAL,,100),GASCAP,REGION=300K
2. //*****
3. //* "DWTKEYCA" WRITE SORT KEY TO MULTI VOL CALIFORNIA OIL TAPE FILE.
4. //* AFTER YOU HAVE DONE THIS JCL, USE "DWTSRTCA" TO SORT THE NEW OIL
5. //* TAPES THAT WERE CREATED BY THIS JCL.
6. //*****
7. //STEP1      EXEC PGM=DWTKEY,TIME=(07,35)
8. //STEPLIB    DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //AFILE      DD DSN=CN6972.PRJ.DWTZY.COCAMDY,UNIT=TAPEC,DISP=OLD
10. //KEY        DD DSN=CN6972.PRJ.DWTZY.KEYOCA,UNIT=TAPEC,
11. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
12. //          DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
13. //SYSDABOUT DD SYSOUT=A
```

DWTKEYLA

```
1. //UIDUKGLA   JOB (6972,DAL,,100),GASCAP,REGION=300K
2. //*****
3. //* "DWTKEYLA" WRITE SORT KEY TO MULTI VOL LOUISIANA GAS TAPE FILE.
4. //* AFTER YOU HAVE DONE THIS JCL, USE "DWTSRTLA" TO SORT THE NEW GAS
5. //* TAPES THAT WERE CREATED BY THIS JCL.
6. //*****
7. //STEP1      EXEC PGM=DWTKEY,TIME=(07,35)
8. //STEPLIB    DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //AFILE      DD DSN=CN6972.PRJ.DWTZY.CGLAMDY,UNIT=TAPEC,DISP=OLD
10. //KEY        DD DSN=CN6972.PRJ.DWTZY.KEYGLA,UNIT=TAPEC,
11. //          DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
12. //          DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
13. //SYSDABOUT DD SYSOUT=A
```

DWTKEYOK

```
1. //UIDUKGOK JOB (6972,DAL,,100),GASCAP,REGION=300K
2. //*****
3. //* "DWTKEYOK" WRITE SORT KEY TO MULTI VOL OKLAHOMA GAS OR OIL TAPE.
4. //* FILE. AFTER YOU HAVE DONE THIS JCL, USE "DWTSRTOK" TO SORT THE
5. //* NEW GAS OR OIL TAPES THAT WERE CREATED BY THIS JCL.
6. //*****
7. //STEP1 EXEC PGM=DWTKEY,TIME=(09,00)
8. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //AFILE DD DSN=CN6972.PRJ.DWTZY.CGOKMDY,UNIT=TAPEC,DISP=OLD
10. //KEY DD DSN=CN6972.PRJ.DWTZY.KEYGOK,UNIT=TAPEC,
11. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
12. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
13. //SYSDBOU DD SYSOUT=A
```

DWTKEYTX

```
1. //UIDUDKTX JOB (6972,DAL,,100),GASCAP,REGION=1200K
2. //*****
3. //* WRITE SORT KEY TO MULTI VOL TEXAS OIL OR GAS TAPE FILES. AFTER
4. //* RUNNING THIS JCL, USE "DWTSRTXG" TO SORT THE NEW GAS TAPES THAT
5. //* WERE CREATED BY THIS JCL AND USE "DWTSRTXO" TO SORT THE NEW OIL
6. //* TAPES THAT WERE CREATED BY THIS JCL.
7. //* CHANGE # TO 'G' FOR GAS TAPES AND 'O' FOR OIL TAPES IN JCL.
8. //*****
9. //STEP1 EXEC PGM=DWTKEY,TIME=(29,00)
10. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
11. //AFILE DD DSN=CN6972.PRJ.DWTZY.C#TXMDY,UNIT=TAPEC,DISP=OLD
12. //KEY DD DSN=CN6972.PRJ.DWTZY.KEY#TX,UNIT=TAPEC,
13. // LABEL=(1,SL),DISP=(NEW,CATLG,DELETE),
14. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
15. //SYSDBOU DD SYSOUT=A
```

DWTSRTCA

```
1. //UIDUSOCA JOB (6972,DAL,,100),GASCAP,REGION=1000K
2. //*****
3. //* "DWTSRTCA" TO SORT CALIFORNIA OIL TAPE FILE. USE AFTER YOU HAVE
4. //* RUN JCL "DWTKEYCA" TO CREATE THE SORT KEY. IT IS SUGGESTED THAT
5. //* ALL SORT JOBS BE RUN IN AN OVERNIGHT CLASS OF D, > 25 MINUTES.
6. //* SORT IS BY SORT KEY (FIELD-OPERATOR IDS), LEASE ID, & RECORD TYPE.
7. //*****
8. //STEP1 EXEC PGM=SORT,PARM=('MSG=AP'),REGION=1000K,TIME=(40,00)
9. //SORTLIB DD DSN=SYS1.SORTLIB,DISP=SHR
10. //SORTWK01 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
11. //SORTWK02 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
```

DWTSRTCA (Continued)

```
12. //SORTWK03 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
13. //SORTWK04 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
14. //SORTWK05 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
15. //SORTWK06 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
16. //SORTMESS DD SYSOUT=A
17. //SORTIN DD DSN=CN6972.PRJ.DWTZY.KEYOCA,UNIT=TAPEC,DISP=OLD
18. //SORTOUT DD DSN=CN6972.PRJ.DWTZY.SOCAMDY,UNIT=TAPEC,
19. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,EXPDT=98010),
20. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
21. //SYSIN DD *
22. SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
23. //SYSPRINT DD SYSOUT=A
24. //SYSOUT DD SYSOUT=A
```

DWTSRTL

```
1. //UIDUSGLA JOB (6972,DAL,,100),GASCAP,REGION=1000K
2. //*****
3. /* "DWTSRTL" TO SORT LOUISIANA GAS TAPE FILE. USE AFTER YOU HAVE
4. /* RUN JCL "DWTKEYLA" TO CREATE THE SORT KEY. IT IS SUGGESTED THAT
5. /* ALL SORT JOBS BE RUN IN AN OVERNIGHT CLASS OF D, > 25 MINUTES.
6. /* SORT IS BY SORT KEY (FIELD-OPERATOR IDS), WELL ID, & RECORD TYPE.
7. //*****
8. //STEP1 EXEC PGM=SORT,PARM=('MSG=AP'),REGION=1000K,TIME=(25,00)
9. //SORTLIB DD DSN=SYS1.SORTLIB,DISP=SHR
10. //SORTWK01 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
11. //SORTWK02 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
12. //SORTWK03 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
13. //SORTWK04 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
14. //SORTWK05 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
15. //SORTWK06 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
16. //SORTMESS DD SYSOUT=A
17. //SORTIN DD DSN=CN6972.PRJ.DWTZY.KEYGLA,UNIT=TAPEC,DISP=OLD
18. //SORTOUT DD DSN=CN6972.PRJ.DWTZY.SGLAMDY,UNIT=TAPEC,
19. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
20. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
21. //SYSIN DD *
22. SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
23. //SYSPRINT DD SYSOUT=A
24. //SYSOUT DD SYSOUT=A
```

DWTSRTOK

```
1. //UIDUSGOK JOB (6972,DAL,,100),GASCAP,REGION=1000K
2. //*****
3. //* "DWTSRTOK" TO SORT OKLAHOMA GAS OR OIL TAPE FILE. USE AFTER YOU
4. //* RUN JCL "DWTKEYOK" TO CREATE THE SORT KEY. IT IS SUGGESTED THAT
5. //* ALL SORT JOBS BE RUN IN AN OVERNIGHT CLASS OF D, > 25 MINUTES.
6. //* SORT IS BY SORT KEY (FIELD-OPERATOR IDS), LEASE ID, & RECORD TYPE.
7. //*****
8. //STEP1 EXEC PGM=SORT,PARM=('MSG=AP'),REGION=1000K,TIME=(07,00)
9. //SORTLIB DD DSN=SYS1.SORTLIB,DISP=SHR
10. //SORTWK01 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
11. //SORTWK02 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
12. //SORTWK03 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
13. //SORTWK04 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
14. //SORTWK05 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
15. //SORTWK06 DD UNIT=SYSDA,SPACE=(CYL,(50,10))
16. //SORTMESS DD SYSOUT=A
17. //SORTIN DD DSN=CN6972.PRJ.DWTZY.KEYGOK,UNIT=TAPEC,DISP=OLD
18. //SORTOUT DD DSN=CN6972.PRJ.DWTZY.SGOKMDY,UNIT=TAPEC,
19. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
20. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
21. //SYSIN DD *
22. SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
23. //SYSPRINT DD SYSOUT=A
24. //SYSOUT DD SYSOUT=A
```

DWTSRTXG

```
1. //UIDUSGTX JOB (6972,DAL,,100),GASCAP,REGION=1000K
2. //*****
3. //* "DWTSRTXG" TO SORT TEXAS GAS TAPE FILE. USE AFTER YOU HAVE RUN
4. //* JCL "DWTKEYTX" TO CREATE THE SORT KEY. IT IS SUGGESTED THAT ALL
5. //* SORT JOBS BE RUN IN CLASS D (OVERNIGHT), TIME > 25 MINUTES.
6. //* SORT IS BY SORT KEY (FIELD-OPERATOR IDS), WELL ID & RECORD TYPE.
7. //*****
8. //STEP1 EXEC PGM=SORT,PARM=('MSG=AP'),REGION=1000K,TIME=(55,00)
9. //SORTLIB DD DSN=SYS1.SORTLIB,DISP=SHR
10. //SORTWK01 DD UNIT=WORK80,SPACE=(CYL,(100,40))
11. //SORTWK02 DD UNIT=WORK80,SPACE=(CYL,(100,40))
12. //SORTWK03 DD UNIT=WORK80,SPACE=(CYL,(100,40))
13. //SORTWK04 DD UNIT=WORK80,SPACE=(CYL,(100,40))
14. //SORTWK05 DD UNIT=WORK80,SPACE=(CYL,(100,40))
15. //SORTWK06 DD UNIT=WORK80,SPACE=(CYL,(100,40))
16. //SORTMESS DD SYSOUT=A
17. //SORTIN DD DSN=CN6972.PRJ.DWTZY.KEYGTX,UNIT=TAPEC,DISP=OLD
18. //SORTOUT DD DSN=CN6972.PRJ.DWTZY.SGTXMDY,UNIT=TAPEC,
19. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
20. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
21. //SYSIN DD *
22. SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
23. //SYSPRINT DD SYSOUT=A
24. //SYSOUT DD SYSOUT=A
```


DWTSRTXO

```

1. //UIDUSOTX JOB (6972,DAL,,100),GASCAP,REGION=1000K
2. //*****
3. /* DWTSRTXO" TO SORT TEXAS OIL TAPE FILE. USE AFTER YOU HAVE RUN
4. /* JCL "DWTKEYTX" TO CREATE THE SORT KEY. IT IS SUGGESTED THAT ALL
5. /* SORT JOBS BE RUN IN CLASS D (OVERNIGHT), TIME > 25 MINUTES.
6. /*** SORT IS BY SORT KEY (FIELD-OPERATOR IDS), LEASE ID, & RECORD TYPE.
7. //*****
8. //STEP1 EXEC PGM=SORT,PARM=('MSG=AP'),REGION=1000K,TIME=(99,00)
9. //SORTLIB DD DSN=SYS1.SORTLIB,DISP=SHR
10. //SORTWK01 DD UNIT=SYSDA,SPACE=(CYL,(300,40))
11. //SORTWK02 DD UNIT=SYSDA,SPACE=(CYL,(300,40))
12. //SORTWK03 DD UNIT=SYSDA,SPACE=(CYL,(300,40))
13. //SORTWK04 DD UNIT=SYSDA,SPACE=(CYL,(300,40))
14. //SORTWK05 DD UNIT=SYSDA,SPACE=(CYL,(300,40))
15. //SORTMESS DD SYSOUT=A
16. //SORTIN DD DSN=CN6972.PRJ.DWTZY.KEYOTX,UNIT=TAPEC,DISP=OLD
17. //SORTOUT DD DSN=CN6972.PRJ.DWTZY.SOTXMDY,UNIT=TAPEC,
18. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL),
19. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960)
20. //SYSIN DD *
21. SORT FIELDS=(1,16,A,22,11,A,33,2,A),FORMAT=CH
22. //SYSPRINT DD SYSOUT=A
23. //SYSOUT DD SYSOUT=A

```

GASEDNEW

```

1. //UIDUENZZ JOB (6972,DAL,,999),GASCAP
2. //*****
3. /* "GASEDNEW" FOR SINGLE VOLUME TAPES ONLY BECAUSE OF RETAIN STMT.
4. /* FOR MULTI VOLUME TAPES, RUN JCL DWTEGAS AND THEN JCL NEWREC.
5. /* EDIT GAS PRODUCTION RECORDS AND CONSOLIDATE SAME.
6. /* WRITE NEW TAPE WITH EDITED GAS PRODUCTION RECORDS.
7. //*****
8. //EDITRECS EXEC PGM=DWTEGAS,TIME=(03,39),REGION=1200K
9. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
10. //INDWT DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,DISP=OLD
11. //DWTMOD DD DSN=CN6972.PRJ.DWTZY.GZZMDYE,UNIT=TAPEC,
12. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),VOL=(,RETAIN),
13. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
14. //DWTFET DD SYSOUT=A,DCB=(RECFM=FA,LRECL=38,BLKSIZE=380)
15. //SYSDABOUT DD SYSOUT=A
16. //SYSOUT DD SYSOUT=A
17. //*****
18. /* WRITE EDITED FILE WITH PRODUCTION RECORDS ONLY AND THE FIRST
19. /* PRODUCTION RECORD FOR A WELL WILL HAVE THE GCUM IF ONE WAS
20. /* AVAILABLE ON THE ID RECORD TO BEGIN WITH. IF NOT, ZEROS ARE
21. /* WRITTEN TO THIS DATA POSITION. AN 'N' IS ALSO WRITTEN TO THIS
22. /* FIRST RECORD IN COL 1 AND AN 'A' IS WRITTEN TO EACH ADDITIONAL
23. /* RECORD FOR A WELL IN COL 1.
24. //*****

```

GASEDNEW (Continued)

```
25. //NEWRECS EXEC PGM=NEWREC,TIME=(03,00),REGION=1200K
26. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
27. //INDWT DD DSN=CN6972.PRJ.DWTZY.GZZMDYE,DISP=OLD,
28. // UNIT=TAPEC,VOL=(,,,REF=*.EDITRECS.DWTMOD)
29. //DWTMOD DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,
30. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
31. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
32. //SYSDBOU DD SYSOUT=A
33. //SYSOUT DD SYSOUT=A
```

DWTEGAS

```
1. //UIDUEGZZ JOB (6972,DAL,,999),GASCAP
2. //*****
3. /* FOR MULTI VOLUME TAPES, RUN JCL DWTEGAS AND THEN JCL NEWREC.
4. /* EDIT GAS PRODUCTION RECORDS AND CONSOLIDATE SAME.
5. /* WRITE NEW TAPE WITH EDITED GAS PRODUCTION RECORDS.
6. //*****
7. //EDITRECS EXEC PGM=DWTEGAS,TIME=(03,39),REGION=1200K
8. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //INDWT DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,DISP=OLD
10. //DWTMOD DD DSN=CN6972.PRJ.DWTZY.GZZMDYE,UNIT=TAPEC,
11. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),VOL=(,RETAIN),
12. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
13. //DWTSET DD SYSOUT=A,DCB=(RECFM=FA,LRECL=38,BLKSIZE=380)
14. //SYSDBOU DD SYSOUT=A
15. //SYSOUT DD SYSOUT=A
```

NEWREC

```
1. //UIDUEGZZ JOB (6972,DAL,,999),GASCAP
2. //*****
3. /* FOR MULTI VOLUME TAPES, RUN JCL DWTEGAS AND THEN JCL NEWREC.
4. //*****
5. /* FOR MULTI VOLUME TAPES, RUN JCL DWTEGAS FIRST, THEN THIS JCL.
6. /* WRITE EDITED FILE WITH PRODUCTION RECORDS ONLY AND THE FIRST
7. /* PRODUCTION RECORD FOR A WELL WILL HAVE THE GCUM IF ONE WAS
8. /* AVAILABLE ON THE ID RECORD TO BEGIN WITH. IF NOT, ZEROS ARE
9. /* WRITTEN TO THIS DATA POSITION. AN 'N' IS ALSO WRITTEN TO THIS
10. /* FIRST RECORD IN COL 1 AND AN 'A' IS WRITTEN TO EACH ADDITIONAL
11. /* RECORD FOR A WELL IN COL 1.
12. //*****
13. //NEWRECS EXEC PGM=NEWREC,TIME=(03,00),REGION=1200K
14. //STEPLIB DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
15. //INDWT DD DSN=CN6972.PRJ.DWTZY.GZZMDYE,DISP=OLD,
16. // UNIT=TAPEC,VOL=(,,,REF=*.EDITRECS.DWTMOD)
17. //DWTMOD DD DSN=CN6972.PRJ.DWTZY.GZZMDY,UNIT=TAPEC,
18. // DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
19. // DISP=(NEW,CATLG,DELETE),LABEL=(1,SL,,,EXPDT=98180)
20. //SYSDBOU DD SYSOUT=A
21. //SYSOUT DD SYSOUT=A
```

REPLACE

```
1. //UIDUROZZ      JOB (6972,DAL,,999),GASCAP,REGION=300K
2. //*****
3. /* FOR OIL TAPES ONLY. NONNUMERIC DATA IN OPERATOR AND FIELD ID DATA
4. /* FIELDS AS WELL AS THE SORT KEY DATA FIELD ARE REPLACED WITH ZEROS
5. /* FOR EACH RECORD TYPE.
6. //*****
7. //STEP1          EXEC PGM=REPLACE,TIME=(28,00)
8. //STEPLIB        DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //AFILE          DD DSN=CN6972.PRJ.DWTZY.SOZZMDY,UNIT=TAPEC,DISP=OLD
10. //LIST           DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=82,BLKSIZE=820)
11. //WELL           DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=1330)
12. //PRINT          DD DSN=CN6972.PRJ.DWTZY.OZZMDY,UNIT=TAPEC,
13. //              DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
14. //              LABEL=(1,SL,,,EXPDT=98180),DISP=(NEW,CATLG,DELETE)
15. //SYSOUT          DD SYSOUT=A
16. //SYSDBOU        DD SYSOUT=A
```

REPLACEG

```
1. //UIDURGZZ      JOB (6972,DAL,,999),GASCAP,REGION=300K
2. //*****
3. /* FOR GAS TAPES ONLY. NONNUMERIC DATA IN OPERATOR AND FIELD ID
4. /* DATA FIELDS AS WELL AS THE SORT KEY DATA FIELD ARE REPLACED WITH
5. /* ZEROS FOR EACH RECORD TYPE.
6. //*****
7. //STEP1          EXEC PGM=REPLACEG,TIME=(28,00)
8. //STEPLIB        DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
9. //AFILE          DD DSN=CN6972.PRJ.DWT91.SGZZMDY,UNIT=TAPEC,DISP=OLD
10. //LIST           DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=82,BLKSIZE=820)
11. //PRINT          DD DSN=CN6972.PRJ.DWT91.GZZMDY,UNIT=TAPEC,
12. //              DCB=(RECFM=FB,LRECL=466,BLKSIZE=27960),
13. //              LABEL=(1,SL,,,EXPDT=98180),DISP=(NEW,CATLG,DELETE)
14. //SYSOUT          DD SYSOUT=A
15. //SYSDBOU        DD SYSOUT=A
```

VINTPEAK

```
1. //UIDUVPZZ      JOB (6972,DAL,,999),VINTPEAK
2. //STEP1          EXEC PGM=VINTPEAK,TIME=(216,00),REGION=1200K
3. //STEPLIB        DD DSN=CN6972.PRJ.GASCAP92.LOAD,DISP=SHARE
4. //FT01F001       DD *
5. STPB=14.650 0
6. /*
7. //FT03F001       DD DSN=CN6972.PRJ.DWT92PE.GZZMY,DISP=OLD
8. //FT04F001       DD DUMMY
9. //FT05F001       DD DSN=CN6972.PRJ.RAWDATA.ZZMMYYE,UNIT=DASD,
10. //              DISP=(NEW,CATLG,DELETE),SPACE=(TRK,(15,5),RLSE),
11. //              DCB=(RECFM=FB,LRECL=205,BLKSIZE=6150)
12. //FT06F001       DD SYSOUT=A
13. //FT09F001       DD SYSOUT=A
14. //FT12F001       DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=240,BLKSIZE=24000)
15. //FT15F001       DD SYSOUT=A
16. //FT16F001       DD SYSOUT=A,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=13300)
17. //FT18F001       DD SYSOUT=A
```

Table B3. SAS Program Listing for ATMLPZZ

```

1  //uidUARJJ JOB (acct,DAL,,999),NAME,REGION=600K,TIME=(00,20),
2  //      MSGCLASS=A
3  /*PHOLD
4  /**
5  /*******
6  /**
7  /**      ATMLPZZ BY VELTON FUNK
8  /**      MODIFIED BY LESTER J. WALTERS JR. 3/24/92
9  /**
10 /**      SAS JCL TO READ GAS PRODUCTION DATA OUTPUT BY DWTFORT
11 /**
12 /**
13 /**      EDIT CHANGES TO STATE SPECIFIC PROGRAMS
14 /**
15 /**      1. CH 'JJ'   TO STATE ABBREVIATION EG. NM OK TX RM...
16 /**      2. CH 'ZZZ' TO STATE ID DATE CODE IE CA0592E
17 /**      3. CH '$$$' TO STATE NAME IE 'NEW MEXICO'
18 /**      4. CH 'uid'  TO USER ID EG PKF
19 /**      5. CH 'NAME' TO USER NAME EG KASULIS
20 /**
21 /*******
22 /**
23 //STEP1  EXEC SAS,REGION=600K,TIME=(00,20)
24 /**
25 //IN1  DD DSN=CNacct.PRJ.GASCAP92.RAWDATA(ZZZ),DISP=SHR
26 /**
27 /** UNIT 22 CONTAINS OUTPUT FROM THE PROC CONTENTS FOR EACH OF
28 /** THE SAS DATA SETS IN THE PROGRAM.  THIS OUTPUT IS INCLUDED
29 /** FOR DEBUGGING AND DOCUMENTATION PURPOSES ONLY.
30 /**
31 /** FT22F001 DD SYSOUT=A
32 /**
33 //OUT1 DD DSN=CNacct.PRJ.AREAD.DATA.ZZZ,
34 /**   UNIT=DASD,DISP=(NEW,CATLG,DELETE),
35 /**   SPACE=(TRK,(10,5),RLSE)
36 /**   DISP=OLD
37 //OUT2 DD DSN=CNacct.PRJ.AREAD.CUMS.ZZZ,
38 /**   UNIT=DASD,DISP=(NEW,CATLG,DELETE),
39 /**   SPACE=(TRK,(10,5),RLSE)
40 /**   DISP=OLD
41 //OUT3 DD DSN=CNacct.PRJ.AREAD.CDATA.ZZZ,
42 /**   UNIT=DASD,DISP=(NEW,CATLG,DELETE),
43 /**   SPACE=(TRK,(10,5),RLSE)
44 /**   DISP=OLD
45 //OUT4 DD DSN=CNacct.PRJ.AREAD.MONTH.ZZZ,
46 /**   UNIT=DASD,DISP=(NEW,CATLG,DELETE),
47 /**   SPACE=(TRK,(10,5),RLSE)
48 /**   DISP=OLD
49 //OUT5 DD DSN=CNacct.PRJ.AREAD.ANN.ZZZ,
50 /**   UNIT=DASD,DISP=(NEW,CATLG,DELETE),
51 /**   SPACE=(TRK,(75,5),RLSE),
52 /**   DCB=(RECFM=FB,LRECL=260,BLKSIZE=6240,DSORG=PS)
53 /**   DISP=OLD
54 //FT20F001 DD SYSOUT=A
55 /**
56 //SYSIN DD *
57
58 *** ATMLPZZ *****;
59
60 /*****
61 *
62 * THIS PROGRAM READS THE SEQUENTIAL DATA FILES FROM THE FORTRAN
63 * PROGRAM WHICH CALCULATES CUMULATIVE PRODUCTION AND PEAK
64 * PRODUCTION RATES.  THIS PROGRAM APPLIES SEVERAL TEST SCREENS
65 * TO THE DATA, AND SYMBOLS ARE ASSIGNED TO EACH DATA POINT TO
66 * INDICATE WHETHER OR NOT THE POINT WILL BE KEPT.
67 * PROGRAMS IN THIS SERIES ARE EXECUTED SUCCESSIVELY UNTIL ALL
68 * OF THE FILES FROM THE EDITED DWIGHT'S ENERGY DATA TAPES HAVE
69 * BEEN PROCESSED.
70 *
71 * VALUES OF GPM FOR SOME OF THE VINTAGES ARE QUESTIONABLE.
72 * SOME NON-ZERO VALUES FOR GPM FOR PRODUCTION YEARS PRIOR TO
73 * THE VINTAGE YEAR ARE CONTAINED IN THE RAW DATA FILES USED BY
74 * THIS PROGRAM.  THESE RAW DATA FILES WERE PRODUCED BY PROGRAM
75 * VINTPKZZ.
76 *
77 *

```

Table B3. SAS Program Listing for ATMPLZZ (Continued)

```

78 * INPUT DATA FILE
79 *
80 *   IN1           - RAW DATA FOR STATE ZZ
81 *
82 * OUTPUT DATA SETS
83 *
84 *   OUT1.SORTED   - PEAK RATES AND CORRESPONDING CUMULATIVE
85 *                   GAS PRODUCTIONS
86 *   VARIABLES     - ST, VINTAGE, YR, GPM, RATE, PPERC, TEST,
87 *                   LOWPRATE, LOWTRATE, PRATE, SYM
88 *
89 *   OUT2.CUMS     - MID MONTH CUMULATIVE GAS PRODUCTIONS
90 *   VARIABLES     - VINTAGE, YR, ST, MONTH, GPM
91 *
92 *   OUT3.YECUMS   - YEAR-END CUMULATIVE PRODUCTION RATES
93 *   VARIABLES     - VINTAGE, YR, ST, YECUM
94 *
95 *   OUT4.PROD     - DAILY PRODUCTION RATES & NUMBER OF PRODUCING
96 *                   GAS WELLS
97 *   VARIABLES     - VINTAGE, YR, ST, ORATE, MONTH, GWELLS
98 *
99 *   OUT5          - ANNUAL PRODUCTION RATES
100 *   VARIABLES     - YR, VINT69-VINT91, ANN
101 *
102 *
103 * VARIABLES USED IN THIS PROGRAM:
104 *
105 *   VARIABLE USAGE CODES:
106 *       I - INPUT VARIABLES
107 *       O - OUTPUT VARIABLES
108 *       I/O - INPUT & OUTPUT VARIABLES
109 *
110 *
111 *   RECTYP   (I)   - TYPE OF INPUT DATA
112 *
113 *   PRGPM    (I)   - GPM CORRESPONDING TO PEAK RATE (PRATE)
114 *                   BY VINTAGE YEAR, MCF
115 *
116 *   VINTAGE  (I/O) - FIRST YEAR OF PRODUCTION
117 *
118 *   YR       (I/O) - PRODUCTION YEAR
119 *
120 *   ORATE    (I/O) - DAILY PRODUCTION RATE EACH MONTH, MCF/DAY
121 *
122 *   MONTH    (I/O) - PRODUCTION MONTH
123 *
124 *   YECUM    (I/O) - YEAR-END CUMULATIVE PRODUCTION, MCF
125 *
126 *   GPM      (I/O) - CUMULATIVE GAS PRODUCTION AT MID MONTH, MCF
127 *
128 *   RATE     (I/O) - PEAK DAILY PRODUCTION RATE (AVERAGE)
129 *                   BY VINTAGE YEAR, MCF/DAY
130 *
131 *   GWELLS   (I/O) - NUMBER OF GAS WELLS
132 *
133 *   LOWPRATE (O)   - PRODUCTION RATE THAT FAILED THE DECREASING
134 *                   RATE TEST, MCF/DAY
135 *
136 *   LOWTRATE (O)   - PRODUCTION RATE DATA POINT THAT FAILED THE
137 *                   STRAIGHT LINE PRODUCTION TEST, MCF/DAY
138 *
139 *   PPERC    (O)   - PERCENTAGE CHANGE IN PRODUCTION
140 *
141 *   PRATE     (O)  - PEAK DAILY PRODUCTION RATE (SET EQUAL TO
142 *                   "RATE" WHEN "RATE" PASSES ALL PRODUCTION
143 *                   TESTS), MCF/DAY
144 *
145 *   SYM       (O)  - SYMBOL ASSIGNED TO DATA TO DECIDE WHETHER
146 *                   OR NOT IT IS KEPT; ONLY GOOD DATA IS KEPT.
147 *                   'O': NON-DECLINING DATA
148 *                   'X': GOOD DATA
149 *
150 *   TEST      (O)  - CALCULATED VALUE FROM A STRAIGHT LINE
151 *                   PROJECTION USING LAST AND 4TH DATA POINTS
152 *                   TO CHECK FOR 2ND AND 3RD DATA POINTS, MCF/DAY
153 *
154 *   ST        (O)  - STATE OR AREA CODE

```

Table B3. SAS Program Listing for ATMLPZZ (Continued)

```

155 *
156 * ANN (O) - SUMMATION OF PEAK DAILY PRODUCTION RATE
157 * FOR ALL VINTAGE YEARS, MCF/DAY
158 *
159 * VINT69 (O) - PEAK DAILY PRODUCTION RATE FOR 1969, MCF/DAY
160 *
161 * VINT70 (O) - PEAK DAILY PRODUCTION RATE FOR 1970, MCF/DAY
162 *
163 * VINT71 (O) - PEAK DAILY PRODUCTION RATE FOR 1971, MCF/DAY
164 *
165 * VINT72 (O) - PEAK DAILY PRODUCTION RATE FOR 1972, MCF/DAY
166 *
167 * VINT73 (O) - PEAK DAILY PRODUCTION RATE FOR 1973, MCF/DAY
168 *
169 * VINT74 (O) - PEAK DAILY PRODUCTION RATE FOR 1974, MCF/DAY
170 *
171 * VINT75 (O) - PEAK DAILY PRODUCTION RATE FOR 1975, MCF/DAY
172 *
173 * VINT76 (O) - PEAK DAILY PRODUCTION RATE FOR 1976, MCF/DAY
174 *
175 * VINT77 (O) - PEAK DAILY PRODUCTION RATE FOR 1977, MCF/DAY
176 *
177 * VINT78 (O) - PEAK DAILY PRODUCTION RATE FOR 1978, MCF/DAY
178 *
179 * VINT79 (O) - PEAK DAILY PRODUCTION RATE FOR 1979, MCF/DAY
180 *
181 * VINT80 (O) - PEAK DAILY PRODUCTION RATE FOR 1980, MCF/DAY
182 *
183 * VINT81 (O) - PEAK DAILY PRODUCTION RATE FOR 1981, MCF/DAY
184 *
185 * VINT82 (O) - PEAK DAILY PRODUCTION RATE FOR 1982, MCF/DAY
186 *
187 * VINT83 (O) - PEAK DAILY PRODUCTION RATE FOR 1983, MCF/DAY
188 *
189 * VINT84 (O) - PEAK DAILY PRODUCTION RATE FOR 1984, MCF/DAY
190 *
191 * VINT85 (O) - PEAK DAILY PRODUCTION RATE FOR 1985, MCF/DAY
192 *
193 * VINT86 (O) - PEAK DAILY PRODUCTION RATE FOR 1986, MCF/DAY
194 *
195 * VINT87 (O) - PEAK DAILY PRODUCTION RATE FOR 1987, MCF/DAY
196 *
197 * VINT88 (O) - PEAK DAILY PRODUCTION RATE FOR 1988, MCF/DAY
198 *
199 * VINT89 (O) - PEAK DAILY PRODUCTION RATE FOR 1989, MCF/DAY
200 *
201 * VINT90 (O) - PEAK DAILY PRODUCTION RATE FOR 1990, MCF/DAY
202 *
203 * VINT91 (O) - PEAK DAILY PRODUCTION RATE FOR 1991, MCF/DAY
204 *
205 *
206 *****/;
207
208 /*****
209 * INPUT DATA FOR PROCESSING *
210 *****/;
211 DATA DAT1 DAT2 DAT3 DAT4 DAT5;
212 INFILE IN1;
213 RETAIN VINTAGE;
214
215 *** VINTAGE YEAR, RECORD TYPE, CURRENT PRODUCTION YEAR;
216 INPUT VINTAGE 3-4 RECTYP 6 YR 8-9 ;
217
218 *** ELIMINATE MONTHLY DATA PRIOR TO RECORD FOR THE FEDERAL OFFSHORE;
219 IF (VINTAGE LE 70) AND (ST EQ 'FO') THEN DO;
220 DELETE;
221 INPUT;
222 DELETE;
223 INPUT;
224 DELETE;
225 INPUT;
226 DELETE;
227 INPUT;
228 DELETE;
229 END;
230
231 YR = YR + 1900;

```

Table B3. SAS Program Listing for ATMPZZ (Continued)

```

232     ST = 'ZZZ';
233
234     *** DAILY PRODUCTION RATE EACH MONTH;
235     INPUT ORATE 11-25 @@; MONTH=1 ; OUTPUT DAT5;
236     INPUT ORATE 26-40 @@; MONTH=2 ; OUTPUT DAT5;
237     INPUT ORATE 41-55 @@; MONTH=3 ; OUTPUT DAT5;
238     INPUT ORATE 56-70 @@; MONTH=4 ; OUTPUT DAT5;
239     INPUT ORATE 71-85 @@; MONTH=5 ; OUTPUT DAT5;
240     INPUT ORATE 86-100 @@; MONTH=6 ; OUTPUT DAT5;
241     INPUT ORATE 101-115 @@; MONTH=7 ; OUTPUT DAT5;
242     INPUT ORATE 116-130 @@; MONTH=8 ; OUTPUT DAT5;
243     INPUT ORATE 131-145 @@; MONTH=9 ; OUTPUT DAT5;
244     INPUT ORATE 146-160 @@; MONTH=10; OUTPUT DAT5;
245     INPUT ORATE 161-175 @@; MONTH=11; OUTPUT DAT5;
246     INPUT ORATE 176-190 @@; MONTH=12; OUTPUT DAT5;
247     *** PEAK DAILY PRODUCTION RATE;
248     INPUT RATE 191-205 ;
249
250     *** CUMULATIVE GAS PRODUCTION AT MID-MONTH;
251     INPUT GPM 11-25 @@; MONTH=1 ; OUTPUT DAT2;
252     INPUT GPM 26-40 @@; MONTH=2 ; OUTPUT DAT2;
253     INPUT GPM 41-55 @@; MONTH=3 ; OUTPUT DAT2;
254     INPUT GPM 56-70 @@; MONTH=4 ; OUTPUT DAT2;
255     INPUT GPM 71-85 @@; MONTH=5 ; OUTPUT DAT2;
256     INPUT GPM 86-100 @@; MONTH=6 ; OUTPUT DAT2;
257     INPUT GPM 101-115 @@; MONTH=7 ; OUTPUT DAT2;
258     INPUT GPM 116-130 @@; MONTH=8 ; OUTPUT DAT2;
259     INPUT GPM 131-145 @@; MONTH=9 ; OUTPUT DAT2;
260     INPUT GPM 146-160 @@; MONTH=10; OUTPUT DAT2;
261     INPUT GPM 161-175 @@; MONTH=11; OUTPUT DAT2;
262     INPUT GPM 176-190 @@; MONTH=12; OUTPUT DAT2;
263     *** GPM CORRESPONDING TO PEAK RATE MONTH;
264     INPUT PRGPM 191-205 ; MONTH= . ; OUTPUT DAT1;
265
266     *** YEAR-END CUMULATIVE PRODUCTION;
267     INPUT YECUM 176-190 ; OUTPUT DAT3;
268
269     *** NUMBER OF GAS WELLS PRODUCING IN EACH MONTH;
270     INPUT GWELLS 11-25 @@; MONTH=1 ; OUTPUT DAT4;
271     INPUT GWELLS 26-40 @@; MONTH=2 ; OUTPUT DAT4;
272     INPUT GWELLS 41-55 @@; MONTH=3 ; OUTPUT DAT4;
273     INPUT GWELLS 56-70 @@; MONTH=4 ; OUTPUT DAT4;
274     INPUT GWELLS 71-85 @@; MONTH=5 ; OUTPUT DAT4;
275     INPUT GWELLS 86-100 @@; MONTH=6 ; OUTPUT DAT4;
276     INPUT GWELLS 101-115 @@; MONTH=7 ; OUTPUT DAT4;
277     INPUT GWELLS 116-130 @@; MONTH=8 ; OUTPUT DAT4;
278     INPUT GWELLS 131-145 @@; MONTH=9 ; OUTPUT DAT4;
279     INPUT GWELLS 146-160 @@; MONTH=10; OUTPUT DAT4;
280     INPUT GWELLS 161-175 @@; MONTH=11; OUTPUT DAT4;
281     INPUT GWELLS 176-190 ; MONTH=12; OUTPUT DAT4;
282
283     DELETE;
284
285     /*****
286     * SORT NUMBER OF GAS WELLS FOR EACH *
287     * MONTH BY VINTAGE AND PRODUCTION *
288     * YEAR. *
289     *****/;
290     PROC SORT DATA=DAT4; BY VINTAGE YR;
291
292     /*****
293     * ELIMINATE RECORDS WITH NUMBER OF *
294     * GAS WELLS BEING ZERO OR HAVING NO *
295     * VALUE. *
296     *****/;
297     DATA DELMISSNG;
298     SET DAT4;
299
300     IF GWELLS = . THEN DELETE;
301     IF GWELLS = 0 THEN DELETE;
302
303     /*****
304     * GET LAST MONTH VALUE FOR EACH *
305     * VINTAGE AND PRODUCTION YEAR THAT *
306     * HAS GREATER THAN ZERO NUMBER OF *
307     * PRODUCING GAS WELLS. *
308     *****/;

```

Table B3. SAS Program Listing for ATMPLZZ (Continued)

```

309 PROC MEANS DATA=DELMISNG NOPRINT;
310   VAR MONTH;
311   TITLE 'MAXIMUM MONTH WITH VALID VALUES OF GWELLS';
312   OUTPUT OUT=MAXMO MAX=MAXMO;
313   BY VINTAGE YR;
314
315   /*****
316   * GET THE FIRST AND LAST YEARS OF      *
317   * PRODUCTION DATA.                    *
318   *****/;
319 PROC MEANS DATA=DAT1 NOPRINT;
320   VAR VINTAGE;
321   OUTPUT OUT=IDRANGE MIN=MINID MAX=MAXID;
322
323   /*****
324   * SET UP A MATRIX OF VINTAGE YEARS      *
325   * WHERE THE VINTAGE VARIABLE GOES       *
326   * FROM THE FIRST TO THE LAST           *
327   * PRODUCTION YEAR.                    *
328   *****/;
329 DATA VINTRNGE;
330   SET IDRANGE;
331
332   DO VINTAGE = MINID TO MAXID;
333     OUTPUT;
334   END;
335
336   /*****
337   * SORT THE GPM VALUES CORRESPONDING    *
338   * TO THE PEAK RATE MONTH (FOR EACH     *
339   * VINTAGE YEAR).                      *
340   *****/;
341 PROC SORT DATA=DAT1; BY VINTAGE;
342
343   /*****
344   * GET THE LAST PRODUCTION YEAR PER      *
345   * VINTAGE FOR THE GPM VALUES           *
346   * CORRESPONDING TO THE PEAK RATE       *
347   * MONTH.                               *
348   *****/;
349 PROC MEANS NOPRINT;
350   VAR YR;
351   TITLE 'MAXIMUM VINTAGE YEAR (VINTAGE) IN DATA SET DAT1';
352   OUTPUT OUT=MAXYR MAX=MAXYR;
353   BY VINTAGE;
354
355   /*****
356   * SORT VINTAGE MATRIX BY VINTAGE.      *
357   *****/;
358 PROC SORT DATA=VINTRNGE; BY VINTAGE;
359
360   /*****
361   * ADD THE LAST VINTAGE PRODUCTION       *
362   * YEAR TO THE VINTAGE MATRIX CREATED    *
363   * ABOVE. ALSO CONVERTS 2 DIGIT FIRST    *
364   * AND LAST PRODUCTION YEARS TO 4       *
365   * DIGITS VALUES AND SETS UP A VINTAGE *
366   * MATRIX BY PRODUCTION YEAR.           *
367   *****/;
368 DATA ADDYR;
369   MERGE MAXYR VINTRNGE; BY VINTAGE;
370
371   YRLOW = MINID + 1900;
372   YRHIGH = MAXID + 1900;
373   DO YR = YRLOW TO YRHIGH;
374     OUTPUT;
375   END;
376
377   /*****
378   * SORT PRODUCTION YEAR MATRIX BY       *
379   * VINTAGE AND PRODUCTION YEAR (YR).     *
380   *****/;
381 PROC SORT DATA=ADDYR; BY VINTAGE YR;
382

```


Table B3. SAS Program Listing for ATMLPZZ (Continued)

```

383 /*****
384 * FIND THE LAST PRODUCTION MONTH *
385 * FOR EACH VINTAGE YEAR. IF LAST *
386 * MONTH NOT EQUAL 12 (LAST YEAR WAS *
387 * WAS NOT A FULL YEAR) THEN DELETE *
388 * THE LAST YEAR OF PRODUCTION (EG. *
389 * IF VINTAGE HAD PRODUCTION FOR JAN *
390 * 2 FEB, 1993 THEN 1992 IS SET TO *
391 * MAXYR AND 1993 DATA IS OMITTED). *
392 *****/;
393 DATA ADDMONTH;
394 MERGE ADDYR MAXMO; BY VINTAGE YR;
395
396 IF YR NE MAXYR THEN DELETE;
397 *** DETERMINES THE LAST YEAR OF COMPLETE DATA;
398 IF MAXMO NE 12 THEN MAXYR = MAXYR - 1;
399
400 TITLE 'MAXIMUM MONTH CONTAINING PRODUCTION FOR EACH VINTAGE YEAR';
401
402 /*****
403 * FOR DEBUGGING PURPOSES *
404 *****/;
405 /*
406 PROC PRINT DATA=ADDMONTH;
407 */;
408
409 /*****
410 * KEEP ONLY THE VINTAGE AND THE LAST *
411 * PRODUCTION YEAR. *
412 *****/;
413 DATA FIXYEAR;
414 SET ADDMONTH;
415
416 KEEP VINTAGE MAXYR;
417
418 /*****
419 * SORT VINTAGE MATRIX BY VINTAGE. *
420 *****/;
421 PROC SORT DATA=FIXYEAR; BY VINTAGE;
422
423 /*****
424 * ADD THE LAST PRODUCTION YEAR PER *
425 * VINTAGE DATA TO GPM CORRESPONDING *
426 * TO PEAK RATE MONTH DATA. *
427 *****/;
428 DATA DAT1A;
429 MERGE DAT1 FIXYEAR; BY VINTAGE;
430
431 *** ELIMINATES LAST YEAR OF DATA IF IT HAS PARTIAL DATA;
432 IF YR GT MAXYR THEN DELETE;
433
434 /*****
435 * SORT BY VINTAGE AND DESCENDING *
436 * PRODUCTION YEAR. *
437 *****/;
438 PROC SORT DATA=DAT1A; BY VINTAGE DESCENDING YR ;
439
440 /*****
441 * CALCULATE A TEST PRODUCTION RATE *
442 * VALUE FROM A STRAIGHT LINE *
443 * PROJECTION USING THE LAST AND THE *
444 * 4TH PRODUCTION RATE DATA POINTS TO *
445 * CHECK THE 2ND AND 3RD DATA POINTS. *
446 *****/;
447 DATA DAT1B;
448 SET DAT1A;
449
450 /* THIS RETAIN STATEMENT INITIALIZES IDL=0 AND LPRATE=0,
451 * AND CAUSES ANY VALUES SET BY ASSIGNMENT STATEMENTS FOR A
452 * PREVIOUS RECORD TO BE RETAINED
453 */;
454
455 RETAIN IDL 0 LPRATE 0 LCUM CUML RATEL ;
456 KEEP ST VINTAGE YR GPM RATE PRATE LOWPRATE LOWTRATE TEST SYM;
457 GPM=PRGPM;
458 SYM='X';
459

```

Table B3. SAS Program Listing for ATMLZZ (Continued)

```

460 /* IDL=0 FOR THE FIRST RECORD THEN ID=IDL FOR ALL RECORDS IN A
461 * VINTAGE YEAR. LOOP NO. 1 IS SKIPPED FOR THE FIRST RECORD OF
462 * EACH VINTAGE YEAR. TEST IS A LINEAR PROJECTION VALUE BASED ON
463 * THE MOST RECENT PRODUCTION RATE DATA AND THE FOURTH YEAR DATA
464 * FOR EACH VINTAGE YEAR. THE FIRST THREE DATA POINTS ARE TESTED.
465 * TEST IS MISSING IF THESE POINTS ARE GREATER THAN THE PROJECTED
466 * VALUE, OTHERWISE IT IS SET TO THE PROJECTED VALUE.
467 */;
468
469 * LOOP NO. 1;
470
471 IF VINTAGE EQ IDL THEN DO;
472 *** PRODUCTION RATE TEST;
473 IF RATE LE LPRATE THEN DO;
474     LOWPRATE = RATE;
475     PRATE    = RATE;
476     SYM      = 'O';
477     OUTPUT DAT1B;
478     DELETE;
479 END;
480 *** STRAIGHT LINE DECLINING TEST;
481 IF VINTAGE LT (MAXYR -1900 -5) THEN DO;
482     IF YR LE (1900 + VINTAGE + 2) THEN DO;
483         TEST = ((LPRATE-RATEL)/(LCUM-CUML))*(GPM-CUML);
484         IF RATE GE TEST THEN DO;
485             PRATE = RATE;
486             LPRATE = RATE;
487             LCUM= GPM;
488         END;
489         IF RATE LT TEST THEN LOWTRATE= RATE;
490 *** OMITS 1ST YEAR'S PRATE FROM THE REGRESSION ROUTINE;
491     IF (1900 + VINTAGE) EQ YR THEN DO;
492         PRATE = RATE;
493         SYM   = 'O';
494     END;
495     OUTPUT DAT1B;
496     DELETE;
497 END;
498 END;
499 IF RATE GT LPRATE THEN DO;
500     PRATE = RATE;
501 /* OMIT FIRST DATA POINT FROM CURVE SINCE NOT ALL
502 * THE WELLS WERE CAPABLE OF PRODUCING FOR A FULL YEAR.
503 */;
504     IF (1900 + VINTAGE) EQ YR THEN DO;
505         PRATE = RATE;
506         SYM   = 'O';
507     END;
508     LPRATE = RATE;
509     LCUM   = GPM;
510 END;
511 OUTPUT DAT1B;
512 DELETE;
513 END;
514
515 *** SET THESE VALUES FOR THE FIRST RECORD IN EACH VINTAGE YEAR;
516
517 * LOOP NO. 2;
518
519 IF VINTAGE NE IDL THEN DO;
520     IDL    = VINTAGE;
521     CUML   = GPM;
522     RATEL  = RATE;
523     PRATE  = RATE;
524     LPRATE = RATE;
525     OUTPUT DAT1B;
526     DELETE;
527 END;
528
529 /* THE KEEP STATEMENT ABOVE MUST BE COMMENTED OUT TO ALLOW THE
530 * FOLLOWING PRINT STATEMENT TO EXECUTE PROPERLY
531 */;
532
533 /******
534 * FOR DEBUGGING PURPOSES
535 *****/;
536 /*

```

Table B3. SAS Program Listing for ATMPZZ (Continued)

```

537 PROC PRINT;
538   TITLE 'LISTING OF DAT1B';
539   VAR VINTAGE IDL MAXYR YR RATE LPRATE LOWPRATE TEST RATEL LCUM CUML
540       GPM PRATE;
541   /*;
542
543   /*****
544   * SORT SCREENED DATA BY VINTAGE AND *
545   * PRODUCTION YEAR. *
546   *****/;
547 PROC SORT DATA=DAT1B; BY VINTAGE YR ;
548
549   /*****
550   * CALCULATE THE PERCENT CHANGE IN *
551   * PRODUCTION RATE (PPERC). *
552   *****/;
553 DATA DAT1C;
554   SET DAT1B;
555
556   RETAIN IDL LRATE;
557   KEEP ST VINTAGE YR GPM RATE PRATE LOWPRATE LOWTRATE TEST PPERC SYM;
558
559   IF VINTAGE EQ IDL THEN DO;
560     IF LRATE GT 0 THEN PPERC=100*(RATE/LRATE -1);
561     LRATE = RATE;
562     OUTPUT DAT1C;
563     DELETE;
564   END;
565
566   IF VINTAGE NE IDL THEN DO;
567     IDL = VINTAGE;
568     LRATE = RATE;
569     OUTPUT DAT1C;
570     DELETE;
571   END;
572
573   /*****
574   * FOR DEBUGGING PURPOSES *
575   *****/;
576   /*
577 PROC PRINT DATA=DAT1C;
578   VAR YR VINTAGE GPM RATE PPERC LOWPRATE TEST LOWTRATE PRATE SYM YR;
579   TITLE1 'PEAK PRODUCTION DATA FOR $$$';
580   TITLE2 'MID MONTH CUMULATIVE PROD. (GPM), PEAK DAILY PROD. (RATE, PRATE)';
581   TITLE3 'WITH SCREENING PARAMETERS (PPERC, LOWPRATE, TEST, LOWTRATE)';
582   FORMAT GPM 15. YR 4. RATE LOWPRATE LOWTRATE TEST PRATE 12.
583           PPERC 5.1;
584   BY VINTAGE;
585   /*;
586
587   /*****
588   * OUTPUT FILE OF PEAK RATES AND *
589   * CORRESPONDING CUMMULATIVE GAS *
590   * PRODUCTIONS. *
591   *****/;
592 DATA OUT1.SORTED;
593   SET DAT1C;
594   OUTPUT;
595
596   /*****
597   * OUTPUT FILE OF MID MONTH *
598   * CUMMULATIVE GAS PRODUCTIONS. *
599   *****/;
600 DATA OUT2.CUMS;
601   SET DAT2;
602   OUTPUT;
603   KEEP ST VINTAGE YR MONTH GPM ;
604
605   /*****
606   * SORT CUMMULATIVE GAS PRODUCTIONS *
607   * BY VINTAGE, PRODUCTION YEAR AND *
608   * MONTH. *
609   *****/;
610 PROC SORT DATA=OUT2.CUMS ; BY VINTAGE YR MONTH;
611

```

Table B3. SAS Program Listing for ATMPLZZ (Continued)

```

612 /*****
613 * OUTPUT FILE OF YEAR-END CUMULATIVE *
614 * PRODUCTION RATES. *
615 *****/;
616 DATA OUT3.YECUMS;
617 SET DAT3;
618 OUTPUT;
619 KEEP ST VINTAGE YR YECUM;
620
621 /*****
622 * NUMBER OF PRODUCING GAS WELLS *
623 *****/;
624 DATA DAT4A;
625 SET DAT4;
626 KEEP ST VINTAGE YR MONTH GWELLS;
627
628 /*****
629 * DAILY PRODUCTION RATES *
630 *****/;
631 DATA DAT5A;
632 SET DAT5;
633 KEEP ST VINTAGE YR MONTH ORATE;
634
635 /*****
636 * SORT NUMBER OF PRODUCING GAS WELLS *
637 * AND SORT DAILY PRODUCTION RATES BY *
638 * STATE CODE, VINTAGE, PRODUCTION *
639 * YEAR, AND PRODUCTIN MONTH. *
640 *****/;
641 PROC SORT DATA=DAT4A,BY ST VINTAGE YR MONTH;
642 PROC SORT DATA=DAT5A,BY ST VINTAGE YR MONTH;
643
644 /*****
645 * MERGE DAILY PRODUCTION RATES FOR *
646 * EACH MONTH WITH NUMBER OF GAS WELLS *
647 *****/;
648 DATA DAT4B;
649 MERGE DAT5A DAT4A,BY ST VINTAGE YR MONTH;
650
651 /*****
652 * OUTPUT FILE OF THE DAILY PRODUCTION *
653 * RATES AND THE NUMBER OF PRODUCING *
654 * GAS WELLS PER VINTAGE. *
655 *****/;
656 DATA OUT4.PROD;
657 SET DAT4B;
658 OUTPUT;
659 KEEP ST VINTAGE YR MONTH ORATE GWELLS;
660
661 /*****
662 * KEEP THE FIRST 2 YEARS OF *
663 * PRODUCTION TO CALCULATE FIRST YEAR *
664 * OF PRODUCTION FOR NEW VINTAGE. *
665 *****/;
666 DATA DAT4C;
667 SET DAT4B;
668
669 IF YR EQ (1900 + VINTAGE) OR YR EQ (1901 + VINTAGE) THEN OUTPUT;
670 DELETE;
671 /*****
672 * FOR DEBUGGING PURPOSES *
673 *****/;
674 /*
675 PROC PRINT DATA=DAT4C;
676 VAR YR MONTH ORATE GWELLS;
677 FORMAT WELLS ORATE 15. YR 4. VINTAGE MONTH 2. ;
678 TITLE1 'MONTHLY PRODUCTION IN $$$ FOR';
679 TITLE2 'FIRST TWO YEARS OF EACH EACH VINTAGE';
680 BY ST VINTAGE;
681 *//;
682
683 *** RDANNZZ*****,
684 /*****
685 * ANNUAL PRODUCTION DATA FOR STATE JJ *
686 *****/;
687 DATA DAT1ANN ;
688 INFILE IN1;

```

Table B3. SAS Program Listing for ATMLPZZ (Continued)

```

689 INPUT VINTAGE 3-4 RECTYP 6 YR 8-9 @ ;
690 IF RECTYP NE 1 THEN DO;
691 INPUT;
692 DELETE;
693 END;
694 INPUT RATE 191-205;
695
696 YR = YR + 1900;
697 ST = 'ZZZ';
698 OUTPUT DAT1ANN;
699
700 /* THE FOLLOWING LOOP ADDS A RECORD THAT HAS A VINTAGE BEYOND THOSE
701 * IN THE DATA SO THAT THE RETAIN STATEMENT IN DAT2ANN BELOW WILL
702 * FUNCTION PROPERLY -- CREATES A BLANK RECORD.
703 */;
704
705 IF VINTAGE EQ 89 THEN DO;
706 VINTAGE=99;
707 YR=1999;
708 RATE= .;
709 OUTPUT DAT1ANN;
710 END;
711 DELETE;
712
713 /*****
714 * SORT ANNUAL PRODUCTION DATA BY *
715 * VINTAGE. *
716 *****/;
717 PROC SORT;BY ST YR VINTAGE;
718
719 /*****
720 * CALCULATE ANNUAL PRODUCTION RATE *
721 *****/;
722 DATA DAT2ANN;
723 SET DAT1ANN;
724
725 RETAIN LYR VINT69-VINT91 ANN;
726 KEEP ST YR VINT69-VINT91 ANN;
727
728 IF YR NE LYR THEN DO;
729 IDL=YR;
730 YR=LYR;
731 IF YR GT 0 THEN DO;
732 *** ANNUAL PRODUCTION RATE;
733 ANN=VINT69 + VINT70 + VINT71 + VINT72 + VINT73 + VINT74 +
734 VINT75 + VINT76 + VINT77 + VINT78 + VINT79 + VINT80 +
735 VINT81 + VINT82 + VINT83 + VINT84 + VINT85 + VINT86 +
736 VINT87 + VINT88 + VINT89 + VINT90 + VINT91;
737
738 OUTPUT DAT2ANN;
739 END;
740 YR=IDL;
741 LYR=YR;
742 VINT69= 0;
743 VINT70= 0;
744 VINT71= 0;
745 VINT72= 0;
746 VINT73= 0;
747 VINT74= 0;
748 VINT75= 0;
749 VINT76= 0;
750 VINT77= 0;
751 VINT78= 0;
752 VINT79= 0;
753 VINT80= 0;
754 VINT81= 0;
755 VINT82= 0;
756 VINT83= 0;
757 VINT84= 0;
758 VINT85= 0;
759 VINT86= 0;
760 VINT87= 0;
761 VINT88= 0;
762 VINT89= 0;
763 VINT90= 0;
764 VINT91= 0;
765

```

Table B3. SAS Program Listing for ATMPLZZ (Continued)

```

766     END;
767
768     /* SET THE PROPER PRODUCTION RATE VARIABLE,
769     * DEPENDING ON THE YEAR.
770     */;
771     IF VINTAGE EQ 69 THEN VINT69=RATE;
772     IF VINTAGE EQ 70 THEN VINT70=RATE;
773     IF VINTAGE EQ 71 THEN VINT71=RATE;
774     IF VINTAGE EQ 72 THEN VINT72=RATE;
775     IF VINTAGE EQ 73 THEN VINT73=RATE;
776     IF VINTAGE EQ 74 THEN VINT74=RATE;
777     IF VINTAGE EQ 75 THEN VINT75=RATE;
778     IF VINTAGE EQ 76 THEN VINT76=RATE;
779     IF VINTAGE EQ 77 THEN VINT77=RATE;
780     IF VINTAGE EQ 78 THEN VINT78=RATE;
781     IF VINTAGE EQ 79 THEN VINT79=RATE;
782     IF VINTAGE EQ 80 THEN VINT80=RATE;
783     IF VINTAGE EQ 81 THEN VINT81=RATE;
784     IF VINTAGE EQ 82 THEN VINT82=RATE;
785     IF VINTAGE EQ 83 THEN VINT83=RATE;
786     IF VINTAGE EQ 84 THEN VINT84=RATE;
787     IF VINTAGE EQ 85 THEN VINT85=RATE;
788     IF VINTAGE EQ 86 THEN VINT86=RATE;
789     IF VINTAGE EQ 87 THEN VINT87=RATE;
790     IF VINTAGE EQ 88 THEN VINT88=RATE;
791     IF VINTAGE EQ 89 THEN VINT89=RATE;
792     IF VINTAGE EQ 90 THEN VINT90=RATE;
793     IF VINTAGE EQ 91 THEN VINT91=RATE;
794
795     LYR=YR;
796     DELETE;
797
798     TITLE1 'ANNUAL VINTAGE PRODUCTION VOLUMES FOR $$$';
799
800     /*****
801     * DELETE DAT1ANN SAS DATASET.
802     *****/;
803     PROC DELETE DATA=DAT1ANN;
804
805     /*****
806     * SORT ANNUAL PRODUCTION RATE BY
807     * STATE CODE.
808     *****/;
809     PROC SORT;BY ST;
810
811     /*****
812     * FOR DEBUGGING PURPOSES
813     *****/;
814     /*
815     PROC PRINT;
816     VAR VINT69-VINT91 ANN;
817     ID YR;
818     FORMAT VINTAGE 2. VINT69-VINT91 12. ANN 14.;
819     SUM VINT69-VINT91 ANN;
820     BY ST;
821     */;
822
823     /*****
824     * PRINT ANNUAL PRODUCTION RATE
825     * INFORMATION TO A FILE.
826     *****/;
827     DATA _NULL_;
828     SET DAT2ANN;
829     YR=YR - 1900;
830     FILE OUT5;
831     PUT ST $1-4 YR 6-7 VINT69 F14.0 VINT70 F10.0 VINT71 F10.0
832     VINT72 F10.0 VINT73 F10.0 VINT74 F10.0 VINT75 F10.0
833     VINT76 F10.0 VINT77 F10.0 VINT78 F10.0 VINT79 F10.0
834     VINT80 F10.0 VINT81 F10.0 VINT82 F10.0 VINT83 F10.0
835     VINT84 F10.0 VINT85 F10.0 VINT86 F10.0 VINT87 F10.0
836     VINT88 F10.0 VINT89 F10.0 VINT90 F10.0 VINT91 F10.0
837     ANN F14.0;
838
839     /*****
840     * THE FOLLOWING CODE IS ONLY NEEDED
841     * TO FIND THE VARIABLE NAMES IN THIS
842     * PROGRAM. LEAVE COMMENTED OUT WHEN

```

Table B3. SAS Program Listing for ATMPLZZ (Continued)

```

843      * NOT NEEDED.                                *
844      *****/
845      /*
846      PROC PRINTTO UNIT=22 NEW;
847
848      PROC CONTENTS DATA=ADDMONTH;
849      PROC CONTENTS DATA=ADDYR;
850      PROC CONTENTS DATA=DAT1;
851      PROC CONTENTS DATA=DAT1A;
852      PROC CONTENTS DATA=DAT1ANN;
853      PROC CONTENTS DATA=DAT1B;
854      PROC CONTENTS DATA=DAT1C;
855      PROC CONTENTS DATA=DAT2;
856      PROC CONTENTS DATA=DAT2ANN;
857      PROC CONTENTS DATA=DAT3;
858      PROC CONTENTS DATA=DAT4;
859      PROC CONTENTS DATA=DAT4A;
860      PROC CONTENTS DATA=DAT4B;
861      PROC CONTENTS DATA=DAT4C;
862      PROC CONTENTS DATA=DAT5;
863      PROC CONTENTS DATA=DAT5A;
864      PROC CONTENTS DATA=DELMISNG;
865      PROC CONTENTS DATA=FIXYEAR;
866      PROC CONTENTS DATA=IDRANGE;
867      PROC CONTENTS DATA=MAXMO;
868      PROC CONTENTS DATA=MAXYR;
869      PROC CONTENTS DATA=OUT1.SORTED;
870      PROC CONTENTS DATA=OUT2.CUMS;
871      PROC CONTENTS DATA=OUT3.YECUMS;
872      PROC CONTENTS DATA=OUT4.PROD;
873      PROC CONTENTS DATA=OUT5;
874      PROC CONTENTS DATA=VINTRNGE;
875      */;
876      /*
877      //

```

Table B4. SAS Program Listing for BSASTMPL

```

1  //uidUARJJ JOB (acct,DAL,,999),NAME,REGION=600K,TIME=(00,59),
2  //      MSGCLASS=A
3  /*PHOLD
4  /*******
5  /**
6  /**      BSASTMPL BY LESTER J. WALTERS JR. 3/24/92
7  /**
8  /**      SAS PROGRAM TO COMBINE THE 36 DATA SETS OUTPUT BY
9  /**      THE AREAD PROGRAMS INTO 4 SAS DATA SETS
10 /**
11 /*******      EDIT CHANGES TO BE MADE      *****
12 /**
13 /**      1. CH 'JJ'   TO JOB CARD CODE EG. '2E' OR
14 /**                  1U FOR 1991 UNEDITED) 1E FOR 1991 EDITED
15 /**                  2U FOR 1992 UNEDITED) 2E FOR 1992 EDITED, ETC
16 /**
17 /**      2. CH 'KKK' TO STATE ID DATE CODE FOR CA IE CA0592E
18 /**      3. CH 'LLL' TO STATE ID DATE CODE FOR FO IE FO0492E
19 /**      4. CH 'MMM' TO STATE ID DATE CODE FOR KS IE KS0692E
20 /**      5. CH 'NNN' TO STATE ID DATE CODE FOR LA IE LS0592E
21 /**      6. CH 'PPP' TO STATE ID DATE CODE FOR NM IE NM0592E
22 /**      7. CH 'QQQ' TO STATE ID DATE CODE FOR OK IE OK0592E
23 /**      8. CH 'RRR' TO STATE ID DATE CODE FOR RM IE RM0592E
24 /**      9. CH 'SSS' TO STATE ID DATE CODE FOR SE IE SE0492E
25 /**     10. CH 'TTT' TO STATE ID DATE CODE FOR TX IE TX0692E
26 /**     11. CH 'uid' TO 3-DIGIT USER ID
27 /**
28 /*******
29 /**
30 //STEP1  EXEC SAS,REGION=600K,TIME=(00,59)
31 /**
32 /**
33 //IN1CA DD DSN=CNacct.PRJ.AREAD.DATA.KKK,DISP=SHR
34 //IN1FO DD DSN=CNacct.PRJ.AREAD.DATA.LLL,DISP=SHR
35 //IN1KS DD DSN=CNacct.PRJ.AREAD.DATA.MMM,DISP=SHR
36 //IN1LA DD DSN=CNacct.PRJ.AREAD.DATA.NNN,DISP=SHR
37 //IN1NM DD DSN=CNacct.PRJ.AREAD.DATA.PPP,DISP=SHR
38 //IN1OK DD DSN=CNacct.PRJ.AREAD.DATA.QQQ,DISP=SHR
39 //IN1RM DD DSN=CNacct.PRJ.AREAD.DATA.RRR,DISP=SHR
40 //IN1SE DD DSN=CNacct.PRJ.AREAD.DATA.SSS,DISP=SHR
41 //IN1TX DD DSN=CNacct.PRJ.AREAD.DATA.TTT,DISP=SHR
42 //IN2CA DD DSN=CNacct.PRJ.AREAD.CUMS.KKK,DISP=SHR
43 //IN2FO DD DSN=CNacct.PRJ.AREAD.CUMS.LLL,DISP=SHR
44 //IN2KS DD DSN=CNacct.PRJ.AREAD.CUMS.MMM,DISP=SHR
45 //IN2LA DD DSN=CNacct.PRJ.AREAD.CUMS.NNN,DISP=SHR
46 //IN2NM DD DSN=CNacct.PRJ.AREAD.CUMS.PPP,DISP=SHR
47 //IN2OK DD DSN=CNacct.PRJ.AREAD.CUMS.QQQ,DISP=SHR
48 //IN2RM DD DSN=CNacct.PRJ.AREAD.CUMS.RRR,DISP=SHR
49 //IN2SE DD DSN=CNacct.PRJ.AREAD.CUMS.SSS,DISP=SHR
50 //IN2TX DD DSN=CNacct.PRJ.AREAD.CUMS.TTT,DISP=SHR
51 //IN3CA DD DSN=CNacct.PRJ.AREAD.CDATA.KKK,DISP=SHR
52 //IN3FO DD DSN=CNacct.PRJ.AREAD.CDATA.LLL,DISP=SHR
53 //IN3KS DD DSN=CNacct.PRJ.AREAD.CDATA.MMM,DISP=SHR
54 //IN3LA DD DSN=CNacct.PRJ.AREAD.CDATA.NNN,DISP=SHR
55 //IN3NM DD DSN=CNacct.PRJ.AREAD.CDATA.PPP,DISP=SHR
56 //IN3OK DD DSN=CNacct.PRJ.AREAD.CDATA.QQQ,DISP=SHR
57 //IN3RM DD DSN=CNacct.PRJ.AREAD.CDATA.RRR,DISP=SHR
58 //IN3SE DD DSN=CNacct.PRJ.AREAD.CDATA.SSS,DISP=SHR
59 //IN3TX DD DSN=CNacct.PRJ.AREAD.CDATA.TTT,DISP=SHR
60 //IN4CA DD DSN=CNacct.PRJ.AREAD.MONTH.KKK,DISP=SHR
61 //IN4FO DD DSN=CNacct.PRJ.AREAD.MONTH.LLL,DISP=SHR
62 //IN4KS DD DSN=CNacct.PRJ.AREAD.MONTH.MMM,DISP=SHR
63 //IN4LA DD DSN=CNacct.PRJ.AREAD.MONTH.NNN,DISP=SHR
64 //IN4NM DD DSN=CNacct.PRJ.AREAD.MONTH.PPP,DISP=SHR
65 //IN4OK DD DSN=CNacct.PRJ.AREAD.MONTH.QQQ,DISP=SHR
66 //IN4RM DD DSN=CNacct.PRJ.AREAD.MONTH.RRR,DISP=SHR
67 //IN4SE DD DSN=CNacct.PRJ.AREAD.MONTH.SSS,DISP=SHR
68 //IN4TX DD DSN=CNacct.PRJ.AREAD.MONTH.TTT,DISP=SHR
69 /**
70 /**
71 /** UNIT 22 CONTAINS OUTPUT FROM THE PROC CONTENTS FOR EACH OF
72 /** THE SAS DATA SETS IN THE PROGRAM. THIS OUTPUT IS INCLUDED
73 /** FOR DEBUGGING AND DOCUMENTATION PURPOSES ONLY.
74 /**
75 //FT22F001 DD DSN=CN6972.EC3.FILECNTS(BSASTMPL),DISP=NEW
76 /**      UNIT=DASD,SPACE=(BLK,(18,52)),
77 /**      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)

```


Table B4. SAS Program Listing for BSASTMPL (Continued)

```

78 /**
79 //OUT1 DD DSN=CNacct.PRJ.BSASDS.DATA9JJ,
80 //    UNIT=DASD,DISP=(NEW,CATLG,DELETE),
81 //    SPACE=(TRK,(75,5),RLSE)
82 /**
83 //OUT2 DD DSN=CNacct.PRJ.BSASDS.CUMS9JJ,
84 //    UNIT=DASD,DISP=(NEW,CATLG,DELETE),
85 //    SPACE=(TRK,(75,5),RLSE)
86 /**
87 //OUT3 DD DSN=CNacct.PRJ.BSASDS.CDATA9JJ,
88 //    UNIT=DASD,DISP=(NEW,CATLG,DELETE),
89 //    SPACE=(TRK,(75,5),RLSE)
90 /**
91 //OUT4 DD DSN=CNacct.PRJ.BSASDS.MONTH9JJ,
92 //    UNIT=DASD,DISP=(NEW,CATLG,DELETE),
93 //    SPACE=(TRK,(75,5),RLSE)
94 /**
95 //FT20F001 DD SYSOUT=A
96 /**
97 //SYSIN      DD *
98
99 *** BSASTMPL*****,
100
101 /*****
102 *
103 * THIS PROGRAM READS THE FOUR SAS DATA SETS CREATED BY EACH OF
104 * THE NINE ATMLPZZ PROGRAMS (36 DATA SETS IN ALL) AND COMBINES
105 * THEM INTO FOUR SAS DATA SETS WHICH CONTAIN DATA FOR ALL STATES.
106 *
107 * INPUT DATA FILES
108 *
109 *   &.AREAD.DATA.ZZMMYYD - PEAK RATES AND CORRESPONDING
110 *                         CUMULATIVE GAS PRODUCTIONS FOR
111 *                         EACH STATE
112 *
113 *   &.AREAD.CUMS.ZZMMYYD - MID-MONTH CUMULATIVE GAS PRODUCTIONS
114 *                         FOR EACH STATE
115 *
116 *   &.AREAD.CDATA.ZZMMYYD - YEAR-END CUMULATIVE GAS PRODUCTION
117 *                         RATES FOR EACH STATE
118 *
119 *   &.AREAD.MONTH.ZZMMYYD - DAILY GAS PRODUCTION RATES AND
120 *                         NUMBER OF PRODUCING GAS WELLS FOR
121 *                         EACH STATE
122 *
123 * OUTPUT DATA SETS
124 *
125 *   OUT1.SORTED - PEAK RATES AND CORRESPONDING CUMULATIVE
126 *                 GAS PRODUCTIONS FOR ALL STATES
127 *   VARIABLES - ST, VINTAGE, YR, GPM, RATE, PPERC, TEST,
128 *               LOWPRATE, LOWTRATE, PRATE, SYM
129 *
130 *   OUT2.CUMS - MID-MONTH CUMULATIVE GAS PRODUCTIONS
131 *               FOR ALL STATES
132 *   VARIABLES - VINTAGE, YR, ST, MONTH, GPM
133 *
134 *   OUT3.YECUMS - YEAR-END CUMULATIVE, BY VINTAGE YEAR AND
135 *               STATE FOR ALL STATES
136 *   VARIABLES - VINTAGE, YR, ST, YECUM
137 *
138 *   OUT4.PROD - DAILY PRODUCTION RATES & NUMBER OF PRODUCING
139 *               GAS WELLS FOR ALL STATES
140 *   VARIABLES - VINTAGE, YR, ST, ORATE, MONTH, GWELLS
141 *
142 *
143 * INPUT/OUTPUT VARIABLES OF THIS PROGRAM:
144 *
145 *   LOWPRATE - PRODUCTION RATE THAT FAILED THE DECREASING RATE
146 *               TEST, MCF/DAY
147 *
148 *   LOWTRATE - PRODUCTION RATE DATA POINT THAT FAILED THE
149 *               STRAIGHT LINE PRODUCTION TEST, MCF/DAY
150 *
151 *   PPERC - PERCENTAGE CHANGE IN PRODUCTION
152 *
153 *   PRATE - PEAK DAILY PRODUCTION RATE (SAME AS "RATE" WHEN
154 *           "RATE" PASSES ALL PRODUCTION TESTS), MCF/DAY

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

155      *
156      *   RATE      -   PEAK DAILY PRODUCTION RATE, MCF/DAY
157      *
158      *   SYM       -   SYMBOL ASSIGNED TO DATA TO DECIDE WHETHER
159      *                   OR NOT IT IS KEPT;  ONLY GOOD DATA IS KEPT.
160      *                   'O': NON-DECLINING DATA
161      *                   'X': GOOD DATA
162      *
163      *   TEST      -   CALCULATED VALUE FROM A STRAIGHT LINE PROJECTION
164      *                   USING LAST AND 4TH DATA POINTS TO CHECK FOR 2ND
165      *                   AND 3RD DATA POINTS, MCF/DAY.
166      *
167      *   ST        -   STATE OR AREA CODE
168      *
169      *   VINTAGE    -   FIRST YEAR OF PRODUCTION
170      *
171      *   YR         -   PRODUCTION YEAR
172      *
173      *   GPM        -   CUMULATIVE GAS PRODUCTION AT MID-MONTH
174      *                   OR PEAK RATE CUMULATIVE GAS PRODUCTION
175      *                   (WHEN MONTH = . ), MCF
176      *
177      *   MONTH      -   PRODUCTION MONTH
178      *
179      *   YECUM      -   YEAR-END CUMULATIVE PRODUCTION, MCF
180      *
181      *   GWELLS     -   NUMBER OF GAS WELLS
182      *
183      *   ORATE      -   DAILY PRODUCTION RATE EACH MONTH, MCF/DAY
184      *
185      * *****/
186
187      /*****
188      * READ IN AND SORT (BY STATE/AREA
189      * CODE, VINTAGE, & PRODUCTION YEAR)
190      * PEAK RATES AND CORRESPONDING
191      * CUMULATIVE GAS PRODUCTION DATA.
192      *****/
193      DATA DIN1CA;
194      SET IN1CA.SORTED;
195      IF YR LT (VINTAGE + 1900) THEN DELETE;
196      PROC SORT DATA=DIN1CA; BY ST VINTAGE YR;
197
198      /*****
199      * READ IN AND SORT (BY STATE/AREA
200      * CODE, VINTAGE, & PRODUCTION YEAR)
201      * FEDERAL OFFSHORE PEAK RATES AND
202      * CORRESPONDING GAS PRODUCTION DATA.
203      *****/
204      DATA DIN1FO;
205      SET IN1FO.SORTED;
206      IF YR LT (VINTAGE + 1900) THEN DELETE;
207      PROC SORT DATA=DIN1FO; BY ST VINTAGE YR;
208
209      /*****
210      * READ IN AND SORT (BY STATE/AREA
211      * CODE, VINTAGE, & PRODUCTION YEAR)
212      * KANSAS PEAK RATES AND CORRESPONDING
213      * CUMULATIVE GAS PRODUCTION DATA.
214      *****/
215      DATA DIN1KS;
216      SET IN1KS.SORTED;
217      IF YR LT (VINTAGE + 1900) THEN DELETE;
218      PROC SORT DATA=DIN1KS; BY ST VINTAGE YR;
219
220      /*****
221      * READ IN AND SORT (BY STATE/AREA
222      * CODE, VINTAGE, & PRODUCTION YEAR)
223      * LOUISIANA PEAK RATES AND
224      * CORRESPONDING CUMULATIVE GAS
225      * PRODUCTION DATA.
226      *****/
227      DATA DIN1LA;
228      SET IN1LA.SORTED;
229      IF YR LT (VINTAGE + 1900) THEN DELETE;
230      PROC SORT DATA=DIN1LA; BY ST VINTAGE YR;
231

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

232  /*****
233  * READ IN AND SORT (BY STATE/AREA      *
234  * CODE, VINTAGE, & PRODUCTION YEAR)   *
235  * NEW MEXICO PEAK RATES AND           *
236  * CORRESPONDING CUMULATIVE GAS        *
237  * PRODUCTION DATA.                  *
238  *****/;
239  DATA DIN1NM;
240  SET IN1NM.SORTED;
241  IF YR LT (VINTAGE + 1900) THEN DELETE;
242  PROC SORT DATA=DIN1NM; BY ST VINTAGE YR;
243
244  /*****
245  * READ IN AND SORT (BY STATE/AREA      *
246  * CODE, VINTAGE, & PRODUCTION YEAR)   *
247  * OKLAHOMA PEAK RATES AND             *
248  * CORRESPONDING CUMULATIVE GAS        *
249  * PRODUCTION DATA.                  *
250  *****/;
251  DATA DIN1OK;
252  SET IN1OK.SORTED;
253  IF YR LT (VINTAGE + 1900) THEN DELETE;
254  PROC SORT DATA=DIN1OK; BY ST VINTAGE YR;
255
256  /*****
257  * READ IN AND SORT (BY STATE/AREA      *
258  * CODE, VINTAGE, & PRODUCTION YEAR)   *
259  * ROCKY MOUNTAIN PEAK RATES AND       *
260  * CORRESPONDING CUMULATIVE GAS        *
261  * PRODUCTION DATA.                  *
262  *****/;
263  DATA DIN1RM;
264  SET IN1RM.SORTED;
265  IF YR LT (VINTAGE + 1900) THEN DELETE;
266  PROC SORT DATA=DIN1RM; BY ST VINTAGE YR;
267
268  /*****
269  * READ IN AND SORT (BY STATE/AREA      *
270  * CODE, VINTAGE, & PRODUCTION YEAR)   *
271  * SOUTH EASTERN PEAK RATES AND        *
272  * CORRESPONDING CUMULATIVE GAS        *
273  * PRODUCTION DATA.                  *
274  *****/;
275  DATA DIN1SE;
276  SET IN1SE.SORTED;
277  IF YR LT (VINTAGE + 1900) THEN DELETE;
278  PROC SORT DATA=DIN1SE; BY ST VINTAGE YR;
279
280  /*****
281  * READ IN AND SORT (BY STATE/AREA      *
282  * CODE, VINTAGE, & PRODUCTION YEAR)   *
283  * TEXAS PEAK RATES AND CORRESPONDING  *
284  * CUMULATIVE GAS PRODUCTION DATA.    *
285  *****/;
286  DATA DIN1TX;
287  SET IN1TX.SORTED;
288  IF YR LT (VINTAGE + 1900) THEN DELETE;
289  PROC SORT DATA=DIN1TX; BY ST VINTAGE YR;
290
291  /*****
292  * READ IN AND SORT (BY STATE/AREA      *
293  * CODE, VINTAGE, & PRODUCTION YEAR)   *
294  * CALIFORNIA MID-MONTH CUMULATIVE     *
295  * GAS PRODUCTION DATA.              *
296  *****/;
297  DATA DIN2CA;
298  SET IN2CA.CUMS;
299  IF YR LT (VINTAGE + 1900) THEN DELETE;
300  PROC SORT DATA=DIN2CA; BY ST VINTAGE YR MONTH;
301
302  /*****
303  * READ IN AND SORT (BY STATE/AREA      *
304  * CODE, VINTAGE, & PRODUCTION YEAR)   *
305  * FEDERAL OFFSHORE MID-MONTH          *
306  * CUMULATIVE GAS PRODUCTIN DATA.    *
307  *****/;
308  DATA DIN2FO;

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

309     SET IN2FO.CUMS;
310     IF YR LT (VINTAGE + 1900) THEN DELETE;
311     PROC SORT DATA=DIN2FO; BY ST VINTAGE YR MONTH;
312
313     /*****
314     * READ IN AND SORT (BY STATE/AREA      *
315     * CODE, VINTAGE, & PRODUCTION YEAR)   *
316     * KANSAS MID-MONTH CUMULATIVE GAS     *
317     * PRODUCTION DATA.                   *
318     *****/;
319     DATA DIN2KS;
320     SET IN2KS.CUMS;
321     IF YR LT (VINTAGE + 1900) THEN DELETE;
322     PROC SORT DATA=DIN2KS; BY ST VINTAGE YR MONTH;
323
324     /*****
325     * READ IN AND SORT (BY STATE/AREA      *
326     * CODE, VINTAGE, & PRODUCTION YEAR)   *
327     * LOUISIANA MID-MONTH CUMULATIVE GAS  *
328     * PRODUCTION DATA.                   *
329     *****/;
330     DATA DIN2LA;
331     SET IN2LA.CUMS;
332     IF YR LT (VINTAGE + 1900) THEN DELETE;
333     PROC SORT DATA=DIN2LA; BY ST VINTAGE YR MONTH;
334
335     /*****
336     * READ IN AND SORT (BY STATE/AREA      *
337     * CODE, VINTAGE, & PRODUCTION YEAR)   *
338     * NEW MEXICO MID-MONTH CUMULATIVE     *
339     * GAS PRODUCTION DATA.               *
340     *****/;
341     DATA DIN2NM;
342     SET IN2NM.CUMS;
343     IF YR LT (VINTAGE + 1900) THEN DELETE;
344     PROC SORT DATA=DIN2NM; BY ST VINTAGE YR MONTH;
345
346     /*****
347     * READ IN AND SORT (BY STATE/AREA      *
348     * CODE, VINTAGE, & PRODUCTION YEAR)   *
349     * OKLAHOMA MID-MONTH CUMULATIVE GAS   *
350     * PRODUCTION DATA.                   *
351     *****/;
352     DATA DIN2OK;
353     SET IN2OK.CUMS;
354     IF YR LT (VINTAGE + 1900) THEN DELETE;
355     PROC SORT DATA=DIN2OK; BY ST VINTAGE YR MONTH;
356
357     /*****
358     * READ IN AND SORT (BY STATE/AREA      *
359     * CODE, VINTAGE, & PRODUCTION YEAR)   *
360     * ROCKY MOUNTAIN MID-MONTH CUMULATIVE *
361     * GAS PRODUCTION DATA.               *
362     *****/;
363     DATA DIN2RM;
364     SET IN2RM.CUMS;
365     IF YR LT (VINTAGE + 1900) THEN DELETE;
366     PROC SORT DATA=DIN2RM; BY ST VINTAGE YR MONTH;
367
368     /*****
369     * READ IN AND SORT (BY STATE/AREA      *
370     * CODE, VINTAGE, & PRODUCTION YEAR)   *
371     * SOUTH EASTERN MID-MONTH CUMULATIVE  *
372     * GAS PRODUCTION DATA.               *
373     *****/;
374     DATA DIN2SE;
375     SET IN2SE.CUMS;
376     IF YR LT (VINTAGE + 1900) THEN DELETE;
377     PROC SORT DATA=DIN2SE; BY ST VINTAGE YR MONTH;
378
379     /*****
380     * READ IN AND SORT (BY STATE/AREA      *
381     * CODE, VINTAGE, & PRODUCTION YEAR)   *
382     * TEXAS MID-MONTH CUMULATIVE GAS      *
383     * PRODUCTION DATA.                   *
384     *****/;
385     DATA DIN2TX;

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

386     SET IN2TX.CUMS;
387     IF YR LT (VINTAGE + 1900) THEN DELETE;
388     PROC SORT DATA=DIN2TX; BY ST VINTAGE YR MONTH;
389
390     /*****
391     * READ IN AND SORT (BY STATE/AREA
392     * CODE, VINTAGE, & PRODUCTION YEAR)
393     * CALIFORNIA YEAR-END CUMULATIVE
394     * PRODUCTION RATE DATA.
395     *****/;
396     DATA DIN3CA;
397     SET IN3CA.YECUMS;
398     IF YR LT (VINTAGE + 1900) THEN DELETE;
399     PROC SORT DATA=DIN3CA; BY ST VINTAGE YR;
400
401     /*****
402     * READ IN AND SORT (BY STATE/AREA
403     * CODE, VINTAGE, & PRODUCTION YEAR)
404     * FEDERAL OFFSHORE YEAR-END
405     * CUMULATIVE PRODUCTION RATE DATA.
406     *****/;
407     DATA DIN3FO;
408     SET IN3FO.YECUMS;
409     IF YR LT (VINTAGE + 1900) THEN DELETE;
410     PROC SORT DATA=DIN3FO; BY ST VINTAGE YR;
411
412     /*****
413     * READ IN AND SORT (BY STATE/AREA
414     * CODE, VINTAGE, & PRODUCTION YEAR)
415     * KANSAS YEAR-END CUMULATIVE
416     * PRODUCTION RATE DATA.
417     *****/;
418     DATA DIN3KS;
419     SET IN3KS.YECUMS;
420     IF YR LT (VINTAGE + 1900) THEN DELETE;
421     PROC SORT DATA=DIN3KS; BY ST VINTAGE YR;
422
423     /*****
424     * READ IN AND SORT (BY STATE/AREA
425     * CODE, VINTAGE, & PRODUCTION YEAR)
426     * LOUISIANA YEAR-END CUMULATIVE
427     * PRODUCTION RATE DATA.
428     *****/;
429     DATA DIN3LA;
430     SET IN3LA.YECUMS;
431     IF YR LT (VINTAGE + 1900) THEN DELETE;
432     PROC SORT DATA=DIN3LA; BY ST VINTAGE YR;
433
434     /*****
435     * READ IN AND SORT (BY STATE/AREA
436     * CODE, VINTAGE, & PRODUCTION YEAR)
437     * NEW MEXICO YEAR-END CUMULATIVE
438     * PRODUCTION RATE DATA.
439     *****/;
440     DATA DIN3NM;
441     SET IN3NM.YECUMS;
442     IF YR LT (VINTAGE + 1900) THEN DELETE;
443     PROC SORT DATA=DIN3NM; BY ST VINTAGE YR;
444
445     /*****
446     * READ IN AND SORT (BY STATE/AREA
447     * CODE, VINTAGE, & PRODUCTION YEAR)
448     * OKLAHOMA YEAR-END CUMULATIVE
449     * PRODUCTION RATE DATA.
450     *****/;
451     DATA DIN3OK;
452     SET IN3OK.YECUMS;
453     IF YR LT (VINTAGE + 1900) THEN DELETE;
454     PROC SORT DATA=DIN3OK; BY ST VINTAGE YR;
455
456     /*****
457     * READ IN AND SORT (BY STATE/AREA
458     * CODE, VINTAGE, & PRODUCTION YEAR)
459     * ROCKY MOUNTAIN YEAR-END CUMULATIVE
460     * PRODUCTION RATE DATA.
461     *****/;
462     DATA DIN3RM;

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

463     SET IN3RM.YECUMS;
464     IF YR LT (VINTAGE + 1900) THEN DELETE;
465     PROC SORT DATA=DIN3RM; BY ST VINTAGE YR;
466
467     /*****
468     * READ IN AND SORT (BY STATE/AREA *
469     * CODE, VINTAGE, & PRODUCTION YEAR) *
470     * SOUTH EASTERN YEAR-END CUMULATIVE *
471     * PRODUCTION RATE DATA. *
472     *****/;
473     DATA DIN3SE;
474     SET IN3SE.YECUMS;
475     IF YR LT (VINTAGE + 1900) THEN DELETE;
476     PROC SORT DATA=DIN3SE; BY ST VINTAGE YR;
477
478     /*****
479     * READ IN AND SORT (BY STATE/AREA *
480     * CODE, VINTAGE, & PRODUCTION YEAR) *
481     * TEXAS YEAR-END CUMULATIVE *
482     * PRODUCTION RATE DATA. *
483     *****/;
484     DATA DIN3TX;
485     SET IN3TX.YECUMS;
486     IF YR LT (VINTAGE + 1900) THEN DELETE;
487     PROC SORT DATA=DIN3TX; BY ST VINTAGE YR;
488
489     /*****
490     * READ IN AND SORT (BY STATE/AREA *
491     * CODE, VINTAGE, & PRODUCTION YEAR) *
492     * CALIFORNIA DAILY PRODUCTION RATE & *
493     * NUMBER OF PRODUCING GAS WELLS DATA. *
494     *****/;
495     DATA DIN4CA;
496     SET IN4CA.PROD;
497     IF YR LT (VINTAGE + 1900) THEN DELETE;
498     PROC SORT DATA=DIN4CA; BY ST VINTAGE YR MONTH;
499
500     /*****
501     * READ IN AND SORT (BY STATE/AREA *
502     * CODE, VINTAGE, & PRODUCTION YEAR) *
503     * FEDERAL OFFSHORE DAILY PRODUCTION *
504     * RATE & NUMBER OF PRODUCING GAS *
505     * DATA. *
506     *****/;
507     DATA DIN4FO;
508     SET IN4FO.PROD;
509     IF YR LT (VINTAGE + 1900) THEN DELETE;
510     PROC SORT DATA=DIN4FO; BY ST VINTAGE YR MONTH;
511
512     /*****
513     * READ IN AND SORT (BY STATE/AREA *
514     * CODE, VINTAGE, & PRODUCTION YEAR) *
515     * KANSAS DAILY PRODUCTION RATE & *
516     * NUMBER OF PRODUCING GAS WELLS DATA. *
517     *****/;
518     DATA DIN4KS;
519     SET IN4KS.PROD;
520     IF YR LT (VINTAGE + 1900) THEN DELETE;
521     PROC SORT DATA=DIN4KS; BY ST VINTAGE YR MONTH;
522
523     /*****
524     * READ IN AND SORT (BY STATE/AREA *
525     * CODE, VINTAGE, & PRODUCTION YEAR) *
526     * LOUISIANA DAILY PRODUCTION RATE & *
527     * NUMBER OF PRODUCING GAS WELLS DATA. *
528     *****/;
529     DATA DIN4LA;
530     SET IN4LA.PROD;
531     IF YR LT (VINTAGE + 1900) THEN DELETE;
532     PROC SORT DATA=DIN4LA; BY ST VINTAGE YR MONTH;
533
534     /*****
535     * READ IN AND SORT (BY STATE/AREA *
536     * CODE, VINTAGE, & PRODUCTION YEAR) *
537     * NEW MEXICO DAILY PRODUCTION RATE & *
538     * NUMBER OF PRODUCING GAS WELLS DATA. *
539     *****/;

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

540 DATA DIN4NM;
541   SET IN4NM.PROD;
542   IF YR LT (VINTAGE + 1900) THEN DELETE;
543   PROC SORT DATA=DIN4NM; BY ST VINTAGE YR MONTH;
544
545   /*****
546   * READ IN AND SORT (BY STATE/AREA
547   * CODE, VINTAGE, & PRODUCTION YEAR)
548   * OKLAHOMA DAILY PRODUCTION RATE &
549   * NUMBER OF PRODUCING GAS WELLS DATA.
550   *****/;
551 DATA DIN4OK;
552   SET IN4OK.PROD;
553   IF YR LT (VINTAGE + 1900) THEN DELETE;
554   PROC SORT DATA=DIN4OK; BY ST VINTAGE YR MONTH;
555
556   /*****
557   * READ IN AND SORT (BY STATE/AREA
558   * CODE, VINTAGE, & PRODUCTION YEAR)
559   * ROCKY MOUNTAIN DAILY PRODUCTION
560   * RATE & NUMBER OF PRODUCING GAS
561   * WELLS DATA.
562   *****/;
563 DATA DIN4RM;
564   SET IN4RM.PROD;
565   IF YR LT (VINTAGE + 1900) THEN DELETE;
566   PROC SORT DATA=DIN4RM; BY ST VINTAGE YR MONTH;
567
568   /*****
569   * READ IN AND SORT (BY STATE/AREA
570   * CODE, VINTAGE, & PRODUCTION YEAR)
571   * SOUTH EASTERN DAILY PRODUCTION RATE
572   * & NUMBER OF PRODUCING GAS WELLS
573   * DATA.
574   *****/;
575 DATA DIN4SE;
576   SET IN4SE.PROD;
577   IF YR LT (VINTAGE + 1900) THEN DELETE;
578   PROC SORT DATA=DIN4SE; BY ST VINTAGE YR MONTH;
579
580   /*****
581   * READ IN AND SORT (BY STATE/AREA
582   * CODE, VINTAGE, & PRODUCTION YEAR)
583   * TEXAS DAILY PRODUCTION RATE & NUMBER
584   * OF PRODUCING GAS WELLS DATA.
585   *****/;
586 DATA DIN4TX;
587   SET IN4TX.PROD;
588   IF YR LT (VINTAGE + 1900) THEN DELETE;
589   PROC SORT DATA=DIN4TX; BY ST VINTAGE YR MONTH;
590
591   /*****
592   * MERGE ALL PEAK RATES AND
593   * CORRESPONDING CUMULATIVE GAS
594   * PRODUCTION DATA INTO ONE DATASET.
595   *****/;
596 DATA OUT1.SORTED;
597   MERGE DIN1CA DIN1FO DIN1KS DIN1LA DIN1NM DIN1OK
598       DIN1RM DIN1SE DIN1TX; BY ST VINTAGE YR;
599
600   /*****
601   * SORT BY STATE OR AREA CODE
602   *****/;
603   PROC SORT; BY ST;
604
605   /*****
606   * SET UP TABLE WITH NUMBER OF
607   * RECORDS/OBSERVATIONS HAVING EACH OF
608   * THE STATE OR AREA CODE VALUES.
609   *****/;
610   PROC FREQ;
611     TITLE 'DATA CONTAINED IN DATA SET BSASDS.DATA9JJ';
612     TABLES ST;
613
614   /*****
615   * MERGE ALL MID-MONTH CUMULATIVE
616   * GAS PRODUCTION DATA INTO ONE

```

Table B4. SAS Program Listing for BSASTMPL (Continued)

```

617 * DATASET.
618 *****/;
619 DATA OUT2.CUMS;
620 MERGE DIN2CA DIN2FO DIN2KS DIN2LA DIN2NM DIN2OK
621 DIN2RM DIN2SE DIN2TX; BY ST VINTAGE YR MONTH;
622
623 /*****
624 * SORT BY STATE OR AREA CODE
625 *****/;
626 PROC SORT; BY ST;
627
628 /*****
629 * SET UP TABLE WITH NUMBER OF
630 * RECORDS/OBSERVATIONS HAVING EACH OF
631 * THE STATE OR AREA CODE VALUES.
632 *****/;
633 PROC FREQ;
634 TITLE 'DATA CONTAINED IN DATA SET BSASDS.CUMS9JJ';
635 TABLES ST;
636
637 /*****
638 * MERGE ALL YEAR-END CUMULATIVE
639 * PRODUCTION RATE DATA INTO ONE
640 * DATASET.
641 *****/;
642 DATA OUT3.YECUMS;
643 MERGE DIN3CA DIN3FO DIN3KS DIN3LA DIN3NM DIN3OK
644 DIN3RM DIN3SE DIN3TX; BY ST VINTAGE YR;
645
646 /*****
647 * SORT BY STATE OR AREA CODE
648 *****/;
649 PROC SORT; BY ST;
650
651 /*****
652 * SET UP TABLE WITH NUMBER OF
653 * RECORDS/OBSERVATIONS HAVING EACH OF
654 * THE STATE OR AREA CODE VALUES.
655 *****/;
656 PROC FREQ;
657 TITLE 'DATA CONTAINED IN DATA SET BSASDS.CDATA9JJ';
658 TABLES ST;
659
660 /*****
661 * MERGE ALL DAILY PRODUCTION RATE &
662 * NUMBER OF GAS WELLS DATA INTO ONE
663 * DATASET.
664 *****/;
665 DATA OUT4.PROD;
666 MERGE DIN4CA DIN4FO DIN4KS DIN4LA DIN4NM DIN4OK
667 DIN4RM DIN4SE DIN4TX; BY ST VINTAGE YR MONTH;
668
669 /*****
670 * SORT BY STATE OR AREA CODE
671 *****/;
672 PROC SORT; BY ST;
673
674 /*****
675 * SET UP TABLE WITH NUMBER OF
676 * RECORDS/OBSERVATIONS HAVING EACH OF
677 * THE STATE OR AREA CODE VALUES.
678 *****/;
679 PROC FREQ;
680 TITLE 'DATA CONTAINED IN DATA SET BSASDS.MONTH9JJ';
681 TABLES ST;
682
683 /*****
684 * THE FOLLOWING CODE IS ONLY NEEDED
685 * TO FIND THE VARIABLE NAMES IN THIS
686 * PROGRAM. LEAVE COMMENTED OUT WHEN
687 * NOT NEEDED.
688 *****/;
689 /*
690 PROC PRINTTO UNIT=22 NEW;
691 PROC CONTENTS DATA=DIN1CA;
692 PROC CONTENTS DATA=DIN1FO;

```


Table B4. SAS Program Listing for BSASTMPL (Continued)

```

694 PROC CONTENTS DATA=DIN1KS;
695 PROC CONTENTS DATA=DIN1LA;
696 PROC CONTENTS DATA=DIN1NM;
697 PROC CONTENTS DATA=DIN1OK;
698 PROC CONTENTS DATA=DIN1RM;
699 PROC CONTENTS DATA=DIN1SE;
700 PROC CONTENTS DATA=DIN1TX;
701 PROC CONTENTS DATA=DIN2CA;
702 PROC CONTENTS DATA=DIN2FO;
703 PROC CONTENTS DATA=DIN2KS;
704 PROC CONTENTS DATA=DIN2LA;
705 PROC CONTENTS DATA=DIN2NM;
706 PROC CONTENTS DATA=DIN2OK;
707 PROC CONTENTS DATA=DIN2RM;
708 PROC CONTENTS DATA=DIN2SE;
709 PROC CONTENTS DATA=DIN2TX;
710 PROC CONTENTS DATA=DIN3CA;
711 PROC CONTENTS DATA=DIN3FO;
712 PROC CONTENTS DATA=DIN3KS;
713 PROC CONTENTS DATA=DIN3LA;
714 PROC CONTENTS DATA=DIN3NM;
715 PROC CONTENTS DATA=DIN3OK;
716 PROC CONTENTS DATA=DIN3RM;
717 PROC CONTENTS DATA=DIN3SE;
718 PROC CONTENTS DATA=DIN3TX;
719 PROC CONTENTS DATA=DIN4CA;
720 PROC CONTENTS DATA=DIN4FO;
721 PROC CONTENTS DATA=DIN4KS;
722 PROC CONTENTS DATA=DIN4LA;
723 PROC CONTENTS DATA=DIN4NM;
724 PROC CONTENTS DATA=DIN4OK;
725 PROC CONTENTS DATA=DIN4RM;
726 PROC CONTENTS DATA=DIN4SE;
727 PROC CONTENTS DATA=DIN4TX;
728 PROC CONTENTS DATA=OUT1.SORTED;
729 PROC CONTENTS DATA=OUT2.CUMS;
730 PROC CONTENTS DATA=OUT3.YECUMS;
731 PROC CONTENTS DATA=OUT4.PROD;
732 /*;
733 /*
734 /**

```

Table B5. SAS Program Listing for CHYP9TMP

```

1 //uidUHYJJ JOB (acct,DAL,,999),NAME,REGION=1536K,TIME=(05,00),
2 //      MSGCLASS=A
3 /*PHOLD
4 /*******
5 /**
6 /**      PROGRAM CHYP9TMP - FOR FITTING HYPERBOLIC DECLINE
7 /**      CURVES TO THE PEAK RATE DATA
8 /**
9 /**      WRITTEN BY LESTER J. WALTERS JR. 6 MARCH 1992
10 /**      FOR THE ORKAND CORPORATION
11 /**      ***** UNITS ARE IN MCF OR MCF/DAY *****
12 /**      THIS PROGRAM PROCESSES ALL NINE STATES AND AREAS.
13 /**      ONLY ONE STATE CAN BE PLOTTED ON THE ZETA PLOTTER
14 /**      USING THE PROC TAG STATEMENTS AT THE END OF THE PROGRAM.
15 /**
16 /**      EDIT CHANGES FOR STATE SELECTION
17 /**
18 /**      1. CH 'JJ'   TO JOB CARD CODE EG. 0U FOR 1990 UNEDITED
19 /**                  1E FOR 1991 EDITED , ETC
20 /**      2. CH 'uid' TO USER ID CODE EG PKF
21 /**      4. CH 'ZZZ' TO STATE ID DATE CODE FOR PLOT EG 'TX1290D'
22 /**      5. CH 'YYY' TO YEAR CODE FOR DATA SETS EG.
23 /**                  U1990 FOR 1990 UNEDITED
24 /**                  E1991 FOR 1991 EDITED, ETC
25 /**      6. LOOK FOR '##' FOR FURTHER CHANGES
26 /*******
27 /**
28 //STEP1 EXEC SAS,TAGDSN='CNacct.PRJ.CHYP9.YYY.ZETAPLOT',
29 //      TIME=(05,00),REGION=1536K,OPTIONS='ERRORS=01'
30 /**
31 /**
32 //IN1 DD DSN=CNacct.PRJ.BSASDS.DATA9JJ,DISP=SHR
33 //IN2 DD DSN=CNacct.PRJ.BSASDS.CUMS9JJ,DISP=SHR
34 //IN3 DD DSN=CNacct.PRJ.BSASDS.CDATA9JJ,DISP=SHR
35 //IN4 DD DSN=CNacct.PRJ.BSASDS.MONTH9JJ,DISP=SHR
36 /**
37 /** THE FOLLOWING UNITS (16 - 21) ARE INTERMEDIATE PRINTOUTS
38 /** FROM PASS 1, PASS 2, AND PASS 3. THEY DO NOT HAVE TO BE
39 /** PRINTED UNLESS YOU WANT TO PERFORM A DETAILED CHECK OF THE
40 /** RESULTS. THEY WERE PRINTED WITH CARRIAGE CONTROL.
41 /**
42 //FT16F001 DD DSN=CNacct.PRJ.CHYP9.YYY.PASS1MOD,
43 //      UNIT=DASD,SPACE=(TRK,(198,52)),DISP=(NEW,CATLG,DELETE),
44 //      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
45 /**      DISP=OLD
46 /**
47 //FT17F001 DD DSN=CNacct.PRJ.CHYP9.YYY.PASS1PLT,
48 //      UNIT=DASD,SPACE=(TRK,(198,52)),DISP=(NEW,CATLG,DELETE),
49 //      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
50 /**      DISP=OLD
51 /**
52 //FT18F001 DD DSN=CNacct.PRJ.CHYP9.YYY.PASS2MOD,
53 //      UNIT=DASD,SPACE=(TRK,(144,52)),DISP=(NEW,CATLG,DELETE),
54 //      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
55 /**      DISP=OLD
56 /**
57 //FT19F001 DD DSN=CNacct.PRJ.CHYP9.YYY.PASS2PLT,
58 //      UNIT=DASD,SPACE=(TRK,(198,52)),DISP=(NEW,CATLG,DELETE),
59 //      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
60 /**      DISP=OLD
61 /**
62 //FT20F001 DD DSN=CNacct.PRJ.CHYP9.YYY.PASS3MOD,
63 //      UNIT=DASD,SPACE=(TRK,(6,3)),DISP=(NEW,CATLG,DELETE),
64 //      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
65 /**      DISP=OLD
66 /**
67 //FT21F001 DD DSN=CNacct.PRJ.CHYP9.YYY.PASS3PLT,
68 //      UNIT=DASD,SPACE=(TRK,(6,3)),DISP=(NEW,CATLG,DELETE),
69 //      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
70 /**      DISP=OLD
71 /**
72 /** UNIT 22 CONTAINS OUTPUT FROM THE PROC CONTENTS FOR EACH OF
73 /** THE SAS DATA SETS IN THE PROGRAM. THIS OUTPUT IS INCLUDED
74 /** FOR DEBUGGING PURPOSES ONLY. EXECUTION OF THE PROC CONTENTS
75 /** STATEMENTS HAS BEEN ELIMINATED BY INSERTION OF "/*" IN
76 /** COLUMNS 1 AND 2 FOLLOWING THE PROC TAG DATA STEPS.
77 /**

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

78 //FT22F001 DD DSN=CNacct.PRJ.CHYP9.YYY.FILECNTS,
79 /**      UNIT=DASD,SPACE=(TRK,(18,52)),DISP=(NEW,CATLG,DELETE),
80 /**      DCB=(RECFM=VBA,LRECL=137,BLKSIZE=6391)
81 /**      DISP=OLD
82 /**
83 /** THE FOLLOWING OUTPUT SAS DATA SETS (OUT1 - OUT4) WERE CREATED
84 /** TO PASS THE RESULTS FROM THE HYPERBOLIC FITTING PROGRAM TO
85 /** OTHER PROGRAMS IN THE SERIES.
86 /**
87 //OUT1 DD DSN=CNacct.PRJ.CHYP9.YYY.AVEWELL,DISP=OLD
88 /** UNIT=DASD,DISP=(NEW,CATLG,DELETE),
89 /** SPACE=(TRK,(75,5),RLSE)
90 /**
91 //OUT2 DD DSN=CNacct.PRJ.CHYP9.YYY.EQUAT,DISP=OLD
92 /** UNIT=DASD,DISP=(NEW,CATLG,DELETE),
93 /** SPACE=(TRK,(75,5),RLSE)
94 /**
95 //OUT3 DD DSN=CNacct.PRJ.CHYP9.YYY.ADJ,DISP=OLD
96 /** UNIT=DASD,DISP=(NEW,CATLG,DELETE),
97 /** SPACE=(TRK,(75,5),RLSE)
98 /**
99 //OUT4 DD DSN=CNacct.PRJ.CHYP9.YYY.PDATA,DISP=OLD
100 /** UNIT=DASD,DISP=(NEW,CATLG,DELETE),
101 /** SPACE=(TRK,(75,5),RLSE)
102 /**
103 //SYSIN DD *
104
105 *** CHYP9TMP ZZZ *****;
106
107
108 /*****
109 * THIS PROGRAM READS IN PEAK RATE AND CORRESPONDING
110 * CUMMULATIVE GAS PRODUCTION (CUMS), MID-MONTH CUMMULATIVE
111 * GAS PRODUCTION (MID-MONTH CUMS), AND YEAR END CUMMULATIVE
112 * GAS PRODUCTION (YEAR-END CUMS) DATA. IT THEN CALCULATES
113 * THE PARAMETERS FOR THE HYPERBOLIC DECLINE CURVE EQUATION
114 * USING NON-LINEAR LEAST SQUARES. THE PARAMETERS B1, B2, B3
115 * ARE CALCULATED IN A THREE PASS PROCESS. PASS 1 INCLUDES
116 * THREE EXECUTIONS OF THE NOI LINEAR REGRESSION PROCEDURE WHICH
117 * ARE REFERRED TO AS PARTS A, B, AND C. 3 PLOTS GET
118 * PRODUCED FROM THE RESULTING EQUATIONS. PLOT 1 REPRESENTS
119 * VINTAGE YEARS PRIOR TO 1980. PLOT 2 REPRESENTS VINTAGE
120 * YEARS FROM 1980 AND GREATER. PLOT 3 REPRESENTS THE FIRST
121 * YEAR OF PRODUCTION.
122 *
123 * THE RECORDS FOR PRODUCTION YEARS LESS THAN THE VINTAGE YEAR
124 * ARE DELETED FROM THE INPUT DATA SETS. THESE RECORDS SHOULD
125 * BE EMPTY, BUT MAY NOT BE SO DUE TO A BUG IN THE FORTRAN
126 * PROGRAM THAT WRITES THE DATA FILES USED BY THE PREVIOUS SAS
127 * PROGRAMS IN THIS SERIES.
128 *
129 * INPUT DATA FILES
130 *
131 *   &.BSASDS.DATA9JJ - PEAK RATES AND CORRESPONDING CUMMULATIVE
132 *                       GAS PRODUCTIONS FOR ALL STATES
133 *
134 *   &.BSASDS.CUMS9JJ - MID-MONTH CUMMULATIVE GAS PRODUCTIONS
135 *                       FOR ALL STATES
136 *
137 *   &.BSASDS.CDATA9JJ - YEAR-END CUMMULATIVE GAS PRODUCTIONS
138 *                       FOR ALL STATES
139 *
140 *   &.BSASDS.MONTH9JJ - DAILY GAS PRODUCTION RATES AND NUMBER OF
141 *                       PRODUCING GAS WELLS FOR ALL STATES
142 *
143 * OUTPUT DATA SETS
144 *
145 *   OUT1.AVEWELL - ESTIMATED PEAK RATE PER WELL AVERAGES
146 *   VARIABLES    - MAXDI, MINID, MGP2WELL, MPWB1, MMODWELL,
147 *                   ST, VINTAGE
148 *
149 *   OUT2.PARMS   - ESTIMATED PEAK RATE PARAMETERS
150 *   VARIABLES    - B1, B2, B3, GPM, GP1, GP2, LOWPRATE,
151 *                   LOWRATE, MAXID, MCUM, MINID, MODEL, PPERC,
152 *                   PRATE, RATE, SYM, TEST, YRHIGH, YRLOW,
153 *                   QE, YECUM, PWB2
154 *
155 */

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

155 * OUT3.SORTED - ESTIMATED PEAK RATES AND CORRESPONDING
156 * VARIABLES CUMULATIVE GAS PRODUCTIONS; WHERE DAILY PEAK
157 * RATES > 0
158 * - B3, GPM, GP1, GP2, LOWPRATE, LOWTRATE,
159 * PPERC, PRATE, RATE, ST, TEST, VINTAGE, YR
160 *
161 * OUT4.PRODDATA - ESTIMATED PRODUCTION RATES
162 * VARIABLES - GP1, GP2, MONTH, PRATE, RATE, ST, VINTAGE,
163 * YR
164 *
165 *
166 * VARIABLES USED IN THIS PROGRAM:
167 *
168 * VARIABLE USAGE CODES:
169 * I - INPUT VARIABLES
170 * O - OUTPUT VARIABLES
171 * I/O - INPUT & OUTPUT VARIABLES
172 *
173 *
174 * GWELLS (I) - NUMBER OF GAS WELLS
175 *
176 * ORATE (I) - DAILY PRODUCTION RATE EACH MONTH, MCF/DAY
177 *
178 * YECUM (I) - YEAR-END CUMULATIVE PRODUCTION, MCF
179 * (O) - SUM OF YEAR-END CUMULATIVE PRODUCTIONS OVER
180 * ALL VINTAGES (OUT2.PARMS; VINTAGE=99), MCF
181 *
182 *
183 * LOWPRATE (I/O) - PRODUCTION RATE THAT FAILED THE DECREASING
184 * RATE TEST, MCF/DAY
185 *
186 * LOWTRATE (I/O) - PRODUCTION RATE DATA POINT THAT FAILED THE
187 * STRAIGHT LINE PRODUCTION TEST, MCF/DAY
188 *
189 * PPERC (I/O) - PERCENTAGE CHANGE IN PRODUCTION
190 *
191 * PRATE (I) - PEAK DAILY PRODUCTION RATE (SAME AS "RATE"
192 * FOR "RATE" PASSING ALL PRODUCTION TESTS),
193 * MCF/DAY
194 * (O) - ESTIMATED PRODUCTION RATE BY MONTH, MCF/DAY
195 *
196 * RATE (I/O) - PEAK DAILY PRODUCTION RATE, MCF/DAY
197 *
198 * SYM (I/O) - SYMBOL ASSIGNED TO DATA TO DECIDE WHETHER
199 * OR NOT IT IS KEPT; ONLY GOOD DATA IS KEPT.
200 * 'O': NON-DECLINING DATA
201 * 'S': DELETE DATA POINTS THAT ARE AT LEAST
202 * ONE STANDARD DEVIATION LOWER THAN
203 * MODEL ESTIMATE
204 * 'F': FIX FIRST AND LAST DATA POINTS - KEPT
205 * 'W': ESTIMATED WELL PRODUCTION DATA FOR
206 * AVERAGE ESTIMATED PARAMETERS.
207 * 'X': GOOD DATA
208 *
209 * TEST (I/O) - CALCULATED VALUE FROM A STRAIGHT LINE
210 * PROJECTION USING LAST AND 4TH DATA POINTS TO
211 * CHECK FOR 2ND AND 3RD DATA POINTS, MCF/DAY
212 *
213 * ST (I/O) - STATE OR AREA CODE
214 *
215 * VINTAGE (I/O) - FIRST YEAR OF PRODUCTION
216 *
217 * YR (I/O) - PRODUCTION YEAR
218 *
219 * GPM (I/O) - CUMULATIVE GAS PRODUCTION AT MID MONTH, MCF
220 *
221 * MONTH (I/O) - PRODUCTION MONTH
222 *
223 * B1 (O) - FIXED PARAMETER EQUIVALENT TO PEAK RATE
224 * AT GP2=0, MCF/DAY
225 * - PER WELL PEAK RATE AVERAGE (OUT2.PARMS;
226 * VINTAGE=99), MCF/DAY
227 *
228 * B2 (O) - FIXED PARAMETER EQUIVALENT TO THE ULTIMATE
229 * RECOVERY
230 * - PER WELL ULTIMATE RECOVERY (OUT2.PARMS;
231 * VINTAGE=99), MCF

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

232 *
233 * B3 (O) - FIXED EXPONENT OF PEAK RATE MODEL STATEMENT *
234 *
235 * PWB2 (O) - PER WELL ULTIMATE RECOVERY (OUT2.PARMS; *
236 * VINTAGE=99), MCF/WELL *
237 *
238 * QE (O) - SUM OF YEAR-END FLOW RATES OVER ALL *
239 * VINTAGES (OUT2.PARMS; VINTAGE=99), MCF/DAY *
240 *
241 * GP1 (O) - CUMULATIVE PRODUCTION PRIOR TO FIRST YEAR *
242 * OF PRODUCTION, MCF *
243 * - SUM OF CUMULATIVE PRODUCTION PRIOR TO FIRST *
244 * YEAR OVER ALL VINTAGES (OUT2.PARMS; *
245 * VINTAGE=99), MCF *
246 *
247 * GP2 (O) - YECUM MINUS GP1 (OUT2.PARMS OUTPUT DATA *
248 * SET), MCF *
249 * (O) - CUMULATIVE PRODUCTION AFTER FIRST YEAR OF *
250 * PRODUCTION (OUT3.SORTED & OUT4.PRODDATA *
251 * DATA SETS), MCF *
252 *
253 * MAXID (O) - LAST VINTAGE YEAR *
254 *
255 * MINID (O) - FIRST VINTAGE YEAR *
256 *
257 * MCUM (O) - CUMULATIVE NUMBER OF MONTHS FROM FIRST *
258 * VINTAGE YEAR *
259 *
260 * MGP2WELL (O) - ESTIMATED AVERAGE ULTIMATE RECOVERY PER *
261 * WELL, MCF *
262 *
263 * MMODWELL (O) - ESTIMATED AVERAGE PREDICTED PEAK RATE PER *
264 * WELL, MCF/DAY/WELL *
265 *
266 * MODEL (O) - ESTIMATED PREDICTED PEAK RATE, MCF/DAY *
267 *
268 * MPWB1 (O) - ESTIMATED AVERAGE B1 PARAMETER PER WELL, *
269 * MCF/DAY/WELL *
270 *
271 * YRHIGH (O) - LAST YEAR OF PRODUCTION DATA (4 DIGIT) *
272 *
273 * YRLOW (O) - FIRST YEAR OF PRODUCTION DATA (4 DIGIT) *
274 *
275 *****/;
276
277 /*****
278 * READ IN PEAK RATES AND CORRESPONDING CUMS. *
279 *****/;
280 DATA DAT1;
281 SET IN1.SORTED;
282
283 IF (YR-1900) LT VINTAGE THEN DELETE;
284 IF GPM LE 0 THEN DELETE;
285
286 /*****
287 * READ IN MID-MONTH CUMS. *
288 *****/;
289 DATA DAT2;
290 SET IN2.CUMS;
291
292 IF (YR-1900) LT VINTAGE THEN DELETE;
293 IF GPM LE 0 THEN DELETE;
294
295 /*****
296 * READ IN YEAR-END CUMS. *
297 *****/;
298 DATA DAT2A;
299 SET IN3.YECUMS;
300
301 IF (YR-1900) LT VINTAGE THEN DELETE;
302
303 KEEP ST VINTAGE GP1;
304 IF VINTAGE GE 69 THEN DO;
305 IF (1900+VINTAGE) EQ YR THEN GP1=YECUM;
306
307 ** ##GP1 S CAN BE MODIFIED HERE. PTS CAN BE DELETED IN LINE 100 ##;
308 ** IF VINTAGE EQ 69 AND YR EQ 1969 THEN DELETE; ** EXCEPTIONS**;
```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

309 ** IF VINTAGE EQ 69 AND YR EQ 1970 THEN GP1= YBCUM;** EXCEPTIONS**;
```

```

310
```

```

311 ** IF VINTAGE EQ 72 AND YR EQ 1972 THEN GP1= . ; ** EXCEPTIONS**;
```

```

312 ** IF VINTAGE EQ 72 AND YR EQ 1973 THEN GP1= YBCUM;** EXCEPTIONS**;
```

```

313
```

```

314 IF GP1 GT 0 THEN OUTPUT;
```

```

315 END;
```

```

316 DELETE;
```

```

317
```

```

318 /*****
```

```

319 * SORT PEAK RATES AND CORRESPONDING CUMS (DAT1) BY STATE/AREA, *
```

```

320 * VINTAGE, PRODUCTION YEAR, AND MID-MONTH CUMS. *
```

```

321 * SORT MID-MONTH CUMS DATA (DAT2) BY SAME VARIABLES. *
```

```

322 *****/;
```

```

323 PROC SORT DATA=DAT1; BY ST VINTAGE YR GPM;
```

```

324 PROC SORT DATA=DAT2; BY ST VINTAGE YR GPM;
```

```

325
```

```

326 /*****
```

```

327 * MERGE MID-MONTH CUMS WITH PEAK RATES AND CORRESPONDING CUMS *
```

```

328 *****/;
```

```

329 DATA DAT3A;
```

```

330 MERGE DAT2 DAT1; BY ST VINTAGE YR GPM;
```

```

331
```

```

332 /* VARIABLES IN DAT3A RECORDS - 26616
```

```

333 VARIABLES FROM DATA SETS
```

```

334 DAT1 DAT2
```

```

335 LOWPRATE MONTH
```

```

336 LOWTRATE
```

```

337 PPERC
```

```

338 PRATE
```

```

339 RATE
```

```

340 SYM
```

```

341 TEST
```

```

342 SORT KEYS: ST VINTAGE YR GPM
```

```

343 */;
```

```

344
```

```

345 IF MONTH EQ . THEN MONTH = 13;
```

```

346
```

```

347 /*****
```

```

348 * SORT YEAR END CUMS, BY STATE/AREA. *
```

```

349 *****/;
```

```

350 PROC SORT DATA=DAT2A; BY ST;
```

```

351
```

```

352 /*****
```

```

353 * GET FIRST (MINVINT) AND LAST (MAXVINT) VINTAGE YEARS FROM *
```

```

354 * YEAR-END CUM DATA. *
```

```

355 *****/;
```

```

356 PROC MEANS DATA=DAT2A NOPRINT;
```

```

357 VAR VINTAGE;
```

```

358 OUTPUT OUT=FIX2A MAX=MAXVINT MIN=MINVINT;
```

```

359 BY ST;
```

```

360
```

```

361 /*****
```

```

362 * SET UP VINTAGE YEAR MATRICES FOR EACH STATE/AREA. *
```

```

363 *****/;
```

```

364 DATA DAT2B;
```

```

365 SET FIX2A;
```

```

366
```

```

367 DO VINTAGE = MINVINT TO MAXVINT;
```

```

368 OUTPUT;
```

```

369 END;
```

```

370
```

```

371 /*****
```

```

372 * SORT VINTAGE YEAR MATRICES BY STATE/AREA AND VINTAGE YEAR. *
```

```

373 *****/;
```

```

374 PROC SORT DATA=DAT2B; BY ST VINTAGE;
```

```

375
```

```

376 /*****
```

```

377 * MERGE VINTAGE MATRICES WITH YEAR-END CUMS. SET UP A 3-D *
```

```

378 * YEAR-END VINTAGE MATRIX FOR EACH STATE/AREA AND VINTAGE. *
```

```

379 *****/;
```

```

380 DATA DAT2C;
```

```

381 MERGE DAT2A DAT2B; BY ST VINTAGE;
```

```

382
```

```

383 YRLOW = 1900 + VINTAGE;
```

```

384 YRHIGH = 1900 + MAXVINT;
```

```

385 DO YR = YRLOW TO YRHIGH;
```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

386         DO MONTH = 1 TO 13;
387             OUTPUT;
388         END;
389     END;
390
391     DROP YRLOW YRHIGH MAXVINT MINVINT;
392
393     /*****
394     * SORT 3-D YEAR-END CUMS VINTAGE MATRICES (DAT2C) BY
395     * STATE/AREA, VINTAGE, PRODUCTION YEAR, AND PRODUCTION MONTH.
396     * SORT PEAK RATE AND MID-MONTH CUMS DATA (DAT3A) BY SAME
397     * VARIABLES.
398     *****/;
399     PROC SORT DATA=DAT2C; BY ST VINTAGE YR MONTH;
400     PROC SORT DATA=DAT3A; BY ST VINTAGE YR MONTH;
401
402     /*****
403     * MERGE MID-MONTH CUMS, AND PEAK RATES & CORRESPONDING CUMS
404     * WITH 3-D YEAR-END VINTAGE MATRICES.
405     *****/;
406     DATA DAT3;
407         MERGE DAT3A DAT2C; BY ST VINTAGE ;
408
409     /* VARIABLES IN DAT3      RECORDS - 3267
410        VARIABLES FROM DATA SETS
411        DAT3A      DAT2A
412        -----
413        GPM          GP1
414        LOWPRATE
415        LOWTRATE
416        MONTH
417        PPERC
418        PRATE
419        RATE
420        SYM
421        TEST
422        YR
423        SORT KEYS:  ST VINTAGE
424        ADDED VARS: GP2
425        */;
426
427     ** USE THE FOLLOWING STATEMENT FORMAT TO DELETE INDIVIDUAL POINTS;
428     ** ##IF ST EQ '?????' AND VINTAGE EQ ?? AND YR EQ ?? THEN SYM = 'O';
429
430     ** GP2 IS DIFFERENCE BETWEEN MID-MONTH CUM AND CUM PRIOR TO 2ND YEAR;
431
432     GP2=GPM-GP1;
433
434     IF GP2 LT 0 THEN SYM = 'O';
435
436     * DELETE THE FIRST YEARS DATA IN EACH VINTAGE;
437
438     IF VINTAGE EQ (YR - 1900) THEN SYM = 'D';
439
440     /*****
441     * SORT ABOVE DATASET BY STATE/AREA, VINTAGE, PRODUCTION YEAR,
442     * AND MID-MONTH CUMS.
443     *****/;
444     PROC SORT DATA=DAT3; BY ST VINTAGE YR GPM;
445
446     /*****
447     * PEAK RATE AND CUMMULATIVE PRODUCTION INFORMATION. TAKE OUT *
448     * MONTHLY DATA. KEEP PEAK RATE DATA.
449     *****/;
450     DATA SELECTPR;
451         SET DAT3;
452
453         IF MONTH NE 13 THEN DELETE;
454
455     /*****
456     * INITIALIZE SYMBOL FOR OMISSION OF PEAK RATES FOR REGRESSION *
457     *****/;
458     DATA INITIAL;
459         SET SELECTPR;
460
461     ** OMIT PEAK RATE POINTS WITH MISSING VALUE;
462     IF PRATE = . THEN DO;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

463     SYM      = 'O';
464     PRATE    = RATE;
465     END;
466     ** SAVE OMITTED AND DELETED PEAK RATES;
467     IF SYM EQ 'O' OR SYM EQ 'D' THEN DO;
468         PRATEO = PRATE;
469         PRATE  = .;
470     END;
471
472     DROP RATE LOWRATE TEST LOWRATE PPERC GP1 GPM MONTH;
473
474     /*****
475     * SORT ABOVE DATASET BY STATE/AREA.
476     *****/;
477     PROC SORT DATA=INITIAL; BY ST;
478
479     /*
480     PROC PRINT;
481         TITLE1 ' LISTING OF DATA SET INITIAL';
482         TITLE2 'DAILY PRODUCTION AND CUMULATIVE PRODUCTION IN MCF';
483         VAR ST VINTAGE YR SYM PRATE PRATEO GP2;
484         /*;
485
486         * WRITE THE OUTPUT FROM PROC MEANS AND REG TO UNIT 16;
487
488     PROC PRINTTO UNIT=16 NEW;
489
490     /*****
491     * GET MIN (FIRST) AND MAX (LAST) VINTAGES FOR EACH
492     * STATE/AREA.
493     *****/;
494     PROC MEANS DATA=INITIAL N MIN MAX;
495         VAR VINTAGE;
496         OUTPUT OUT=IDRANGE MIN=MINID MAX=MAXID;
497         BY ST;
498
499     /*****
500     * SORT PEAK RATE DATA BY STATE/AREA AND VINTAGE
501     *****/;
502     PROC SORT DATA=INITIAL; BY ST VINTAGE;
503
504     /*****
505     * GET MAX PEAK RATES (PRMAX), MAX CUMULATIVE PRODUCTION AFTER *
506     * FIRST YEAR OF PRODUCTION (GP2MAX), NUMBER OF PEAK RATES
507     * (NPRATE1A), AND NUMBER OF GP2'S (NGP2) FOR EACH STATE/AREA. *
508     *****/;
509     PROC MEANS DATA=INITIAL N MEAN MIN MAX;
510         VAR PRATE GP2;
511         OUTPUT OUT=NMAXP1 MAX = PRMAX    GP2MAX
512                N      = NPRATE1A NGP2;
513         TITLE1 'CALCULATION OF MIN, MAX, AND NPTS FOR PASS 1';
514         BY ST VINTAGE;
515
516     /*****
517     * SET UP VINTAGE MATRIX.
518     *****/;
519     DATA VINTRNGE;
520         SET IDRANGE;
521
522         /* THE FOLLOWING DO LOOP DUPLICATES THE MINID AND MAXID FOR EACH
523         VINTAGE IN EACH STATE */;
524
525         DO VINTAGE = MINID TO MAXID;
526             OUTPUT;
527         END;
528
529     /*****
530     * SORT VINTAGE MATRIX BY STATE/AREA AND VINTAGE.
531     *****/;
532     PROC SORT DATA=VINTRNGE; BY ST VINTAGE;
533
534     /*****
535     * MERGE PRMAX, GP2MAX, NPRATE1A, AND NGP2 WITH VINTAGE
536     * MATRIX.
537     *****/;
538     DATA VMAXP1;
539         MERGE NMAXP1 VINTRNGE; BY ST VINTAGE;

```


Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

540
541 *** OMIT MAX PEAK RATES (PRMAX) AND NUMBER OF GP2'S (NGP2);
542 DROP PRMAX NGP2;
543
544 /* VARIABLES IN VNMAXP1 RECORDS - 3267
545    VARIABLES FROM DATA SETS
546    NMAXP1      VINTRNGE
547    -----
548    PRMAX      MAXID
549    GP2MAX     MINID
550    NGP2
551    NPRATE1A
552    SORT KEYS: ST VINTAGE
553    DROP VARS: PRMAX NGP2
554    */;
555
556 /*****
557  * DUPLICATE VINTAGE MATRIX FOR EACH PRODUCTION YEAR.          *
558  *****/;
559 DATA VYRNMXP1;
560 SET VNMAXP1;
561
562 YRLOW = 1900 + VINTAGE;
563 YRHIGH = 1900 + MAXID;
564 DO YR = YRLOW TO YRHIGH;
565   OUTPUT;
566 END;
567
568 DROP MAXID MINID YRLOW YRHIGH;
569
570 /*****
571  * SORT VINTAGE MATRIX WITH GP2MAX AND NPRATE1A BY              *
572  * STATE/AREA, VINTAGE, AND PRODUCTION YEAR.                    *
573  * SORT MID-MONTH CUMS, PEAK RATE DATA, AND YEAR-END CUM      *
574  * MATRICES (PEAK RATE AND CUM DATA) BY SAME VARIABLES.       *
575  *****/;
576 PROC SORT DATA=VYRNMXP1; BY ST VINTAGE YR;
577 PROC SORT DATA=INITIAL; BY ST VINTAGE YR;
578
579 /*****
580  * MERGE ABOVE TWO SORTED DATASETS BY STATE/AREA, VINTAGE,    *
581  * AND PRODUCTION YEAR.                                         *
582  *****/;
583 DATA ESTP1;
584 MERGE INITIAL VYRNMXP1; BY ST VINTAGE YR;
585
586 /* VARIABLES IN ESTP1 RECORDS - 228
587    VARIABLES FROM DATA SETS
588    INITIAL      VYRNMXP1
589    -----
590    GP2          GP2MAX
591    NPRATE1A     NPRATE1A
592    PRATE
593    PRATEO
594    SYM
595    SORT KEYS: ST VINTAGE YR
596    ADD VARS: LGP2 LPRAT
597    */;
598
599 /* THE MODEL EQUATION IN PROC NLIN IS APPROXIMATELY LINEAR
600    IN LOG-LOG SPACE. THEREFORE, PROC REG CAN BE USED TO
601    CALCULATE ESTIMATES FOR B1 AND B3 TO BE SUBMITTED TO
602    PROC NLIN. */;
603
604 IF NPRATE1A LT 2 THEN DELETE;
605
606 IF PRATE NE . THEN LPRAT = LOG10(PRATE);
607 IF GP2 NE . THEN LGP2 = LOG10(1-GP2/(GP2MAX*5));
608
609 /*****
610  * SORT VINTAGE DATA MATRICES WITH GP2MAX, NPRATE1A, PEAK    *
611  * RATE, AND CUM INFORMATION BY STATE/AREA AND VINTAGE.       *
612  *****/;
613 PROC SORT DATA=ESTP1; BY ST VINTAGE;
614
615

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

616 /*****
617 * PERFORM LINEAR REGRESSION ON ABOVE DATASET USING LGP2 AS *
618 * THE MODEL EQUATION. DO THIS FOR EACH STATE/AREA AND *
619 * VINTAGE. *
620 *****/;
621 PROC REG OUTEST=REGESTP1;
622 MODEL LPRAT=LGP2;
623 TITLE1 'ESTIMATION OF B1 AND B3 BY LINEAR REGRESSION, PASS 1';
624 BY ST VINTAGE;
625
626 * RETURN TO THE NORMAL SYSOUT DATA SET;
627
628 PROC PRINTTO;
629
630 /*****
631 * MERGE RESULTING B1 AND B3 PARAMETERS OF ABOVE LINEAR *
632 * REGRESSION WITH VINTAGE MATRIX CONTAINING GP2MAX AND *
633 * NPRATE1A. *
634 *****/;
635 DATA STESTP1;
636 MERGE REGESTP1 VNMAXP1; BY ST VINTAGE;
637
638 /* VARIABLES IN STESTP1 RECORDS - 19
639 VARIABLES FROM DATA SETS
640 REGESTP1 VNMAXP1
641 -----
642 _DEPVAR_ GP2MAX
643 _MODEL_ MAXID
644 _SIGMA_ MINID
645 _TYPE_ NPRATE1A
646 INTERCEP
647 LGP2
648 LPRAT
649 SORT KEYS: ST VINTAGE
650 ADDED VARS: YR YRLOW YRHIGH B1START B2START B3START
651 KEEP VARS: B1START B2START B3START NPRATE1A ST VINTAGE YR
652 */;
653
654 *** INITIAL B1, B2, B3 PARAMETER VALUES FOR NONLINEAR REGRESSION;
655 B1START = 10**INTERCEP;
656 B2START = GP2MAX*5;
657 B3START = LGP2;
658
659 YRLOW = 1900 + VINTAGE;
660 YRHIGH = 1900 + MAXID;
661 DO YR = YRLOW TO YRHIGH;
662 OUTPUT;
663 END;
664
665 KEEP B1START B2START B3START NPRATE1A ST VINTAGE YR;
666
667 /*****
668 * SORT ABOVE DATASET BY VINTAGE AND PRODUCTION YEAR. *
669 *****/;
670 PROC SORT DATA=STESTP1; BY ST VINTAGE YR;
671
672 /*****
673 * MERGE THE INITIAL PEAK RATE AND CUM DATA WITH MATRIX OF *
674 * FIRST PARAMETER GUESSES. *
675 *****/;
676 DATA PARM3AP1;
677 MERGE INITIAL STESTP1 ; BY ST VINTAGE YR;
678
679 /* VARIABLES IN PARM3AP1 RECORDS - 210
680 VARIABLES FROM DATA SETS
681 INITIAL STESTP1
682 -----
683 GP2 B1START
684 PRATE B2START
685 PRATEO B3START
686 SYM NPRATE1A
687 SORT KEYS: ST VINTAGE YR
688 */;
689
690 *** OMIT RECORDS/DATA HAVING LESS THAN 5 DATA POINTS;
691 IF NPRATE1A LT 5 THEN DELETE;
692

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

693 /*****
694 * APPEND THE NONLINEAR MODELS PRINT TO UNIT 16
695 *****/;
696 PROC PRINTTO UNIT=16;
697
698 /*****
699 * SORT THE FIRST GUESS MATRIX WITH PEAK RATE AND
700 * CORRESPONDING CUM DATA BY STATE/AREA AND VINTAGE.
701 *****/;
702 PROC SORT; BY ST VINTAGE;
703
704 /*****
705 * THIS IS THE FIRST NONLINEAR REGRESSION CALCULATION OF THE
706 * THREE PARAMETER MODEL (PASS 1, PART A). THE B1, B2, B3
707 * PARAMETERS WILL BE CALCULATED FOR THOSE VINTAGE YEARS WITH
708 * AT LEAST 5 PRODUCTION YEARS OF DATA.
709 *****/;
710 PROC NLIN METHOD=MARQUARDT EFORMAT OUTEST=COEF3AP1 CONVERGE=1.E-6;
711 BOUNDS 0<B1, 0<B2, 1.001< B3 <5;
712 *** INITIALIZE PARAMETERS;
713 PARS B1 = 1.E10
714      B2 = 1.E11
715      B3 = 2.;
716
717 *** RESET INITIAL GUESSES (FOR NUMBER ITERATIONS=0 & FIRST OBSERVATION;
718 IF _ITER_ = 0 THEN IF _N_ = 1 THEN DO;
719     B1 = B1START;
720     B2 = B2START;
721     B3 = B3START;
722     IF B3 GE 5 THEN B3 = 5;
723 END;
724
725 *** CALCULATE 1ST, 2ND, AND 3RD PARTIAL DERIVATIVES (SB1, SB2, SB3);
726 A = (1 - GP2/B2);
727 IF A LE 0 THEN A = 1 - 1.E-8;
728 SB1 = A**B3;
729 SB2=B1*B3*(A**(B3-1))*(GP2/(B2*B2));
730 SB3=(B1*(A)**B3)*(LOG(A));
731
732 ** SB2=B1*B3*((1 - GP2/B2)**(B3-1))*(GP2/(B2*B2));
733 ** SB3=(B1*(1-GP2/B2)**B3)*(LOG(1-GP2/B2));
734
735 *** PREDICTION EQUATION;
736 MODEL PRATE= (B1*(1-GP2/B2)**B3);
737
738 *** SET 1ST, 2ND, AND 3RD PARTIAL DERIVATIVE VARIABLES;
739 DER.B1=SB1;
740 DER.B2=SB2;
741 DER.B3=SB3;
742
743 OUTPUT OUT=FIT3AP1 PREDICTED=YHAT1A RESIDUAL=R1A;
744
745 TITLE1 'MARQUARDT SOLUTION FOR PASS 1A';
746 TITLE2 'VINTAGE YEARS WITH 5 OR MORE DATA POINTS';
747 BY ST VINTAGE;
748
749 *** RETURN TO NORMAL SYSOUT PRINT;
750 PROC PRINTTO;
751
752 /*****
753 * GET PARAMETERS FROM NONLINEAR ESTIMATE OF PASS 1, PART A.
754 * SET UP INITIAL GUESSES FOR NONLINEAR REGRESSION OF PASS 1,
755 * PART B.
756 *****/;
757 DATA ANS3AP1;
758 SET COEF3AP1;
759
760 *** DELETE DATA THAT IS NOT CONVERGING;
761 IF _TYPE_ NE 'FINAL' THEN DELETE;
762
763 RECALC1A = 0;
764
765 *** B3 PARAMETER CAN BE NO GREATER THAN 3;
766 IF B3 GT 3 THEN DO;
767     B3 = 3;
768     RECALC1A = 1;
769 END;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

770
771 *** SAVE ESTIMATED PARAMETER VALUES AND ERROR SUM OF SQUARES      *;
772 *** OF LAST ITERATION.                                           *;
773     B1P1A = B1;
774     B2P1A = B2;
775     B3P1A = B3;
776     SSE1A = _SSE_;
777
778     DROP _NAME_ _ITER_ _TYPE_ _SSE_;
779
780 /******
781  * SORT PARAMETER INFORMATION BY STATE/AREA.                      *
782  ******
783 PROC SORT; BY ST;
784
785 /******
786  * FOR DEBUG PURPOSES.                                           *
787  ******
788 /*
789 PROC PRINT;
790     TITLE1 'CONTENTS OF DATASET COEF3AP1, PASS 1';
791     VAR VINTAGE B1 B2 B3 RECALC1A SSE1A;
792     BY ST;
793     /*;
794
795 /******
796  * MERGE REGRESSION PARAMETER INFORMATION WITH THE VINTAGE      *
797  * MATRIX. DUPLICATE MATRIX FOR EACH PRODUCTION YEAR.          *
798  ******
799 DATA YRCOEF3A;
800     MERGE ANS3AP1 VINTRNGE; BY ST VINTAGE;
801
802 /* VARIABLES IN YRCOEF3A RECORDS - 210
803     VARIABLES FROM DATA SETS
804     ANS3AP1      VINTRNGE
805     -----
806     SSE1A      MAXID
807     B1          MINID
808     B1P1A
809     B2
810     B2P1A
811     B3
812     B3P1A
813     RECALC1A
814     SORT KEYS:  ST VINTAGE
815     ADD VARS:   YR YRLOW YRHIGH B1P1A B2P1A B3P1A
816     DROP VARS:  MAXID MINID YRLOW
817     /*;
818
819     YRLOW = 1900 + VINTAGE;
820     YRHIGH = 1900 + MAXID;
821     DO YR = YRLOW TO YRHIGH;
822         OUTPUT;
823     END;
824
825     DROP MAXID MINID YRLOW;
826
827 /******
828  * FOR DEBUG PURPOSES.                                           *
829  ******
830 * TITLE 'LISTING OF YRCOEF3A';
831 * PROC PRINT;
832
833 /******
834  * SORT THE REGRESSION PARAMETER VINTAGE MATRIX WITH THE      *
835  * ESTIMATES FROM PASS 1, PART A BY STATE/AREA, VINTAGE, AND   *
836  * PRODUCTION YEAR.                                           *
837  * SORT PEAK RATE PREDICTED AND RESIDUAL VALUES FROM THE      *
838  * PASS 1, PART A REGRESSION RUN BY THE SAME VARIABLES.        *
839  ******
840 PROC SORT DATA=YRCOEF3A; BY ST VINTAGE YR;
841 PROC SORT DATA=FIT3AP1; BY ST VINTAGE YR;
842
843 /******
844  * MERGE THE REGRESSION PARAMETER VINTAGE MATRIX FROM PASS 1,  *
845  * PART A REGRESSION RUN WITH THE PEAK RATE INFORMATION FROM   *
846  * THE PASS 1, PART A REGRESSION RUN.                          *

```

2 of 4

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

847 *****/;
848 DATA ANSF3AP1;
849     MERGE YRCOEF3A FIT3AP1; BY ST VINTAGE YR;
850
851 /* VARIABLES IN YRCOEF3A RECORDS - 210
852    VARIABLES FROM DATA SETS
853    YRCOEF3A      FIT3AP1
854    -----
855    SSE1A          B1START
856    B1             B2START
857    B2             B3START
858    B3             GP2
859    RECALC1A       NPRATE1A
860    YRHIGH         PRATE
861    B1P1A          PRATEO
862    B2P1A          R1A
863    B3P1A          SYM
864                  YHAT1A
865    SORT KEYS:    ST VINTAGE YR
866    */;
867
868 /*****
869  * DELETE DATA POINTS THAT DO NOT MEET THE SIGMA (STANDARD
870  * DEVIATION) LIMITS (SETTING UP FOR REGRESSION PASS 1,
871  * PART B).
872  *****/;
873 DATA DEL3AP1;
874     SET ANSF3AP1;
875
876     RETAIN MERR1A;
877
878     IF R1A EQ . THEN R1A = PRATEO - YHAT1A;
879
880     IF SSE1A GT 0 THEN MERR1A = SQRT(SSE1A/(NPRATE1A-1));
881
882     SIGMA1A = R1A/MERR1A;
883
884 *** DELETE THE DATA POINTS THAT ARE AT LEAST 1 SIGMA *;
885 *** LOWER THAN THE MODEL ESTIMATE. *;
886 IF PRATE NE . AND R1A LT -MERR1A THEN DO;
887     PRATEO = PRATE;
888     PRATE = .;
889     SYM = 'S';
890     IF YR EQ (VINTAGE + 1901) OR YR EQ YRHIGH THEN DO;
891         PRATE = PRATEO;
892         PRATEO = .;
893         SYM = 'F';
894     END;
895 END;
896
897 *** RETAIN THE CALCULATED VALUES OF B1, B2, AND B3;
898 DROP B1 B2 B3;
899
900 /*****
901  * SORT THE REVISED PEAK RATE AND PARAMETER INFORMATION BY
902  * STATE/AREA AND VINTAGE (SETTING UP FOR PASS 1, PART B).
903  *****/;
904 PROC SORT DATA=DEL3AP1; BY ST VINTAGE;
905
906 /*****
907  * GET THE NUMBER OF PEAK RATE VALUES FOR EACH STATE/AREA AND
908  * VINTAGE.
909  *****/;
910 PROC MEANS NOPRINT;
911     VAR PRATE;
912     OUTPUT OUT=VNUMP1B N = NPRATE1B;
913     BY ST VINTAGE;
914
915 /*****
916  * MERGE NUMBER OF PEAK RATE VALUES WITH THE VINTAGE MATRIX.
917  *****/;
918 DATA VYRNMP1B;
919     MERGE VNUMP1B VINTRNGE; BY ST VINTAGE;
920
921 /* VARIABLES IN VYRNMP1B RECORDS - 210
922    VARIABLES FROM DATA SETS
923    VNUMP1B      VINTRNGE

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

924 -----
925      NPRATE1B      MAXID
926      MINID
927      SORT KEYS:   ST VINTAGE
928      ADD VARS:    YR YRLOW YRHIGH
929      KEEP VARS:   ST VINTAGE YR NPRATE1B
930      *;/
931
932      YRLOW = 1900 + VINTAGE;
933      YRHIGH = 1900 + MAXID;
934      DO YR = YRLOW TO YRHIGH;
935          OUTPUT;
936      END;
937
938      KEEP ST VINTAGE YR NPRATE1B;
939
940      /*****
941      * SORT PEAK RATE INFORMATION FOR THE REGRESSION PASS 1, PART *
942      * B BY STATE/AREA, VINTAGE, AND PRODUCTION YEAR. *
943      * SORT VINTAGE MATRIX WITH NUMBER OF PEAK RATE VALUES FOR *
944      * REGRESSION PASS 1, PART B. *
945      *****/;
946      PROC SORT DATA=DEL3AP1; BY ST VINTAGE YR;
947      PROC SORT DATA=VYRNMP1B; BY ST VINTAGE YR;
948
949      /*****
950      * MERGE PEAK RATE INFORMATION WITH THE NUMBER OF PEAK RATES *
951      * VINTAGE MATRIX. *
952      *****/;
953      DATA PARM3BP1;
954          MERGE DEL3AP1 VYRNMP1B; BY ST VINTAGE YR;
955
956      *** DELETE RECORDS WITH LESS THAN 5 DATA POINTS;
957      IF NPRATE1B LT 5 THEN DELETE;
958
959      /* VARIABLES IN PARM3AP1 RECORDS - 210
960      VARIABLES FROM DATA SETS
961      DEL3AP1      VYRNMP1B
962      -----
963      B1P1A      NPRATE1B
964      B1START
965      B2P1A
966      B2START
967      B3P1A
968      B3START
969      GP2
970      MERR1A
971      NPRATE1A
972      PRATE
973      PRATEO
974      RECALC
975      R1A
976      SIGMA1A
977      SSE1A
978      SYM
979      YHAT1A
980      YRHIGH
981      SORT KEYS: ST VINTAGE YR
982      *;/
983
984      *** APPEND THE NONLINEAR MODELS PRINT TO UNIT 16;
985      PROC PRINTTO UNIT=16;
986
987      /*****
988      * SORT PEAK RATE VINTAGE MATRICES BY STATE/AREA AND VINTAGE. *
989      *****/;
990      PROC SORT; BY ST VINTAGE;
991
992      /*****
993      * THIS IS THE SECOND CALCULATION OF THE THREE PARAMETER *
994      * MODEL. ALL OTHER CALCULATIONS WITH PROC NLIN WILL *
995      * HAVE THE B3 PARAMETER FIXED AT EITHER (1) THE VALUES *
996      * CALCULATED IN THIS STEP, (2) THE VALUES CALCULATED IN *
997      * THE PREVIOUS NLIN STEP, OR (3) THE AVERAGE OF THESE *
998      * VALUES FOR EACH STATE. AN UPPER BOUND OF 3.0 WAS USED *
999      * FOR B3. STATISTICAL ANALYSES OF B3 VALUES CALCULATED *
1000      * WITH AN UPPER BOUND OF 5.0 SHOW 56 OF 139 VALUES *

```


Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1001 * CONVERGE AT B3 = 5.0, "THE UPPER BOUND" AND 11 OF 139 *
1002 * VALUES CONVERGE AT B3 = 1.001, "THE LOWER BOUND". *
1003 * DELETION OF THE 67 VALUES THAT WERE AT THE BOUNDARY *
1004 * LIMITS RESULTED IN A DISTRIBUTION THAT WAS *
1005 * APPROXIMATELY NORMAL WITH MEAN OF 1.77628 FOR B3 USING *
1006 * A LOGNORMAL DISTRIBUTION FUNCTION. (PASS 1, PART B) *
1007 *****/;
1008 PROC NLIN METHOD=MARQUARDT EFORMAT OUTEST=COEF3BP1 CONVERGE=1.E-6;
1009 BOUNDS 0<B1, 0<B2, 1.001< B3 <5;
1010 PARMS B1 = 1.E10
1011        B2 = 1.E11
1012        B3 = 2.;
1013
1014 IF _ITER_ = 0 THEN IF _N_ = 1 THEN DO;
1015     B1 = B1START;
1016     B2 = B2START;
1017     B3 = B3START;
1018     IF B3 GE 5 THEN B3 = 5;
1019 END;
1020
1021 A = (1 - GP2/B2);
1022 IF A LE 0 THEN A = 1 - 1.E-8;
1023 SB1 = A**B3;
1024 SB2=B1*B3*(A**(B3-1))*(GP2/(B2*B2));
1025 SB3=(B1*(A)**B3)*(LOG(A));
1026
1027 ** SB2=B1*B3*((1 - GP2/B2)**(B3-1))*(GP2/(B2*B2));
1028 ** SB3=(B1*(1-GP2/B2)**B3)*(LOG(1-GP2/B2));
1029
1030 MODEL PRATE= (B1*(1-GP2/B2)**B3);
1031
1032 DER.B1=SB1;
1033 DER.B2=SB2;
1034 DER.B3=SB3;
1035
1036 OUTPUT OUT=FIT3BP1 PREDICTED=YHAT1B RESIDUAL=R1B;
1037
1038 TITLE1 'MARQUARDT SOLUTION FOR PASS 1B';
1039 TITLE2 'VINTAGE YEARS WITH 5 OR MORE DATA POINTS';
1040 BY ST VINTAGE;
1041
1042 *** RETURN TO NORMAL SYSOUT PRINT;
1043 PROC PRINTTO;
1044
1045 /*****
1046 * GET AND SAVE THE PARAMETERS FROM NONLINEAR REGRESSION *
1047 * ESTIMATE OF PASS 1, PART B. *
1048 *****/;
1049 DATA ANS3BP1;
1050 SET COEF3BP1;
1051
1052 *** DELETE DATA THAT IS NOT CONVERGING;
1053 IF _TYPE_ NE 'FINAL' THEN DELETE;
1054
1055 RECALC1B = 0;
1056 IF B3 GT 3 THEN DO;
1057     B3 = 3;
1058     RECALC1B = 1;
1059 END;
1060
1061 *** SAVE B1, B2, B3 PARAMETER VALUES AND THE ERROR SUM OF SQUARES *;
1062 *** OF THE LAST ITERATION FROM REGRESSION PASS 1, PART B *;
1063 SSE1B = _SSE_;
1064 B1P1B = B1;
1065 B2P1B = B2;
1066 B3P1B = B3;
1067
1068 DROP _NAME_ _ITER_ _TYPE_ _SSE_;
1069
1070 /*****
1071 * SORT REGRESSION PASS 1, PART B PARAMETER INFORMATION BY *
1072 * STATE/AREA. *
1073 *****/;
1074 PROC SORT; BY ST;
1075
1076 /*****
1077 * FOR DEBUG PURPOSES. *

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1078 *****/;
1079 /*
1080 PROC PRINT;
1081   VAR VINTAGE B1 B2 B3 RECALC1B;
1082   TITLE1 'CONTENTS OF DATASET COEF3BP1, PASS 1';
1083   BY ST;
1084   */;
1085
1086 /*****
1087  * MERGE PARAMETER INFORMATION WITH THE VINTAGE MATRIX.
1088  *****/;
1089 DATA YRCOEF3B;
1090   MERGE ANS3BP1 VINTRNGE; BY ST VINTAGE;
1091
1092 /* VARIABLES IN YRCOEF3B RECORDS - 210
1093    VARIABLES FROM DATA SETS
1094    ANS3BP1          VINTRNGE
1095    -----
1096           B1          MAXID
1097           B1P1B       MINID
1098           B2
1099           B2P1B
1100           B3
1101           B3P1B
1102           RECALC1B
1103           SSE1B
1104   SORT KEYS:  ST VINTAGE
1105   ADD VARS:   YR YRLOW YRHIGH
1106   DROP VARS:  MAXID MINID YRLOW YRHIGH
1107   */;
1108
1109   YRLOW  = 1900 + VINTAGE;
1110   YRHIGH = 1900 + MAXID;
1111   DO YR = YRLOW TO YRHIGH;
1112     OUTPUT;
1113   END;
1114
1115   DROP MAXID MINID YRLOW YRHIGH;
1116
1117 /*****
1118  * SORT PARAMETER VINTAGE MATRICES FROM PASS 1, PART B
1119  * REGRESSION BY STATE/AREA, VINTAGE, AND PRODUCTION YEAR.
1120  * SORT PEAK RATE INFORMATION FROM PASS 1, PART B REGRESSION
1121  * BY THE SAME VARIABLES.
1122  *****/;
1123 PROC SORT DATA=YRCOEF3B; BY ST VINTAGE YR;
1124 PROC SORT DATA=FIT3BP1;  BY ST VINTAGE YR;
1125
1126 /*****
1127  * MERGE THE PARAMETER VINTAGE MATRICES WITH THE PEAK RATE
1128  * INFORMATION.
1129  *****/;
1130 DATA ANSF3BP1;
1131   MERGE YRCOEF3B FIT3BP1; BY ST VINTAGE YR;
1132
1133   RETAIN MERR1B;
1134
1135 /* VARIABLES IN ANSF3BP1 RECORDS - 210
1136    VARIABLES FROM DATA SETS
1137    YRCOEF3B          FIT3BP1
1138           B1          B1P1A
1139           B1P1B       B1START
1140           B2          B2P1A
1141           B2P1B       B2START
1142           B3          B3P1A
1143           B3P1B       B3START
1144           RECALC1B    GP2
1145           SSE1B       MERR1A
1146                       NPRATE1A
1147                       NPRATE1B
1148                       PRATE
1149                       PRATEO
1150                       RECALC1A
1151                       R1A
1152                       R1B
1153                       SIGMA1A
1154                       SSE1A

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1155             SYM
1156             YHAT1A
1157             YHAT1B
1158             YRHIGH
1159     SORT KEYS:  ST VINTAGE
1160     ADD VARS:   MERR1B SIGMA1B YR YRLOW YRHIGH
1161     */;
1162
1163     IF B1 = . THEN DELETE;
1164
1165     IF R1B EQ . THEN R1B = PRATEO - YHAT1B;
1166     IF SSE1B GT 0 THEN MERR1B = SQRT(SSE1B/(NPRATE1B-1));
1167
1168     SIGMA1B = R1B/MERR1B;
1169
1170     /*****
1171     * FOR DEBUG PURPOSES
1172     *****/;
1173
1174     TITLE 'LISTING OF ANSF3BP1';
1175     PROC PRINT;
1176     VAR VINTAGE SSE1B B1 B2 B3 RECALC1B;
1177     */;
1178
1179     /*****
1180     * GET THE AVERAGE (MEAN) OF THE B3 PARAMETERS FROM THE
1181     * REGRESSION PASS 1, PART B BY STATE/AREA.
1182     *****/;
1183     PROC MEANS DATA=ANSF3BP1 N MEAN STD MIN MAX CV;
1184     VAR B3;
1185     TITLE1 'CALCULATION OF AVERAGE B3 FOR PASS 1';
1186     OUTPUT OUT=AVEB3P1 MEAN=B3AVE;
1187     BY ST;
1188
1189     /*****
1190     * MERGE MEAN OF B3 PARAMETERS WITH THE FIRST AND LAST VINTAGE
1191     * YEARS. SET UP VINTAGE MATRIX FOR EACH PRODUCTION YEAR.
1192     *****/;
1193     DATA DUPYEAR1;
1194     MERGE AVEB3P1 IDRANGE; BY ST;
1195
1196     /* VARIABLES IN DUPYEAR1 RECORDS - 210
1197     VARIABLES FROM DATA SETS
1198     AVEB3P1      IDRANGE
1199     -----
1200     B3AVE        MAXID
1201                MINID
1202     SORT KEYS:  ST
1203     DROP VARS:  MAXID MINID
1204     ADD VARS:   MAXIDK MINIDK YR YRLOWK YRHIGHK VINTAGE
1205     NOTE:       THIS DATA SET WILL BE USED TO ADD THE VARIABLES
1206                 MAXIDK MINIDK YRLOWK AND YRHIGHK TO THE MASTER
1207                 DATA SET BECAUSE ALL ST VINTAGE YR COMBINATIONS
1208                 ARE PRESENT
1209     */;
1210
1211     DO VINTAGE=MINID TO MAXID;
1212     MINIDK = MINID;
1213     MAXIDK = MAXID;
1214     YRLOWK = 1900 + VINTAGE;
1215     YRHIGHK = 1900 + MAXID;
1216     DO YR = YRLOWK TO YRHIGHK;
1217     OUTPUT;
1218     END;
1219     END;
1220
1221     DROP MAXID MINID;
1222
1223     /*****
1224     * SORT B3 MEAN PARAMETER VINTAGE MATRICES BY STATE/AREA,
1225     * VINTAGE, AND PRODUCTION YEAR.
1226     *****/;
1227     PROC SORT DATA=DUPYEAR1; BY ST VINTAGE YR;
1228
1229     /*****
1230     * COMBINE THE INITIAL LINEAR REGRESSION ESTIMATES, THE B3
1231     * MEAN VINTAGE MATRICES, THE PASS 1, PART A NONLINEAR

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1232 * REGRESSION PARAMETERS, THE PASS 1, PART B NONLINEAR *
1233 * REGRESSION PARAMETERS, AND THE PASS 1, PART B NONLINEAR *
1234 * REGRESSION NUMBER OF PEAK RATE VALUES INTO ONE DATASET. *
1235 *****/;
1236 DATA TRANS2P1;
1237 SET STSTEP1 DUPYEAR1 YRCOEF3A YRCOEF3B VYRNMP1B;
1238 BY ST VINTAGE YR;
1239
1240 /* VARIABLES IN TRANS2P1 RECORDS - 210
1241 VARIABLES FROM DATA SETS
1242 STSTEP1 DUPYEAR1 YRCOEF3A YRCOEF3B VYRNMP1B
1243 -----
1244 B1START B3AVE B1 B1 NPRATE1B
1245 B2START MAXIDK B1P1A B1P1B
1246 B3START MINIDK B2 B2
1247 NPRATE1A YRHIGHK B2P1A B2P1B
1248 YRLOWK B3 B3
1249 RECALC1A RECALC1B
1250 SSE1A SSE1B
1251 SORT KEYS: ST VINTAGE YR
1252 */;
1253
1254 /*****
1255 * UPDATE THE INITIAL PEAK RATE DATA WITH THE ABOVE DATASET *
1256 * PER STATE/AREA PER VINTAGE PER PRODUCTION YEAR. *
1257 * SET UP FOR THE NONLINEAR REGRESSION PASS 1, PART C. *
1258 *****/;
1259 DATA PARM2P1;
1260 UPDATE INITIAL TRANS2P1; BY ST VINTAGE YR;
1261
1262 RETAIN NPRATE1C RECALC1C 0;
1263
1264 /* VARIABLES IN PARM2P1 RECORDS - 210
1265 VARIABLES FROM DATA SETS
1266 INITIAL TRANS2P1
1267 -----
1268 GP2 B1
1269 PRATE B1P1A
1270 PRATEO B1P1B
1271 SYM B1START
1272 B2
1273 B2P1A
1274 B2P1B
1275 B2START
1276 B3
1277 B3AVE
1278 B3P1A
1279 B3P1B
1280 B3START
1281 MAXIDK
1282 MINIDK
1283 NPRATE1A
1284 NPRATE1B
1285 RECALC1A
1286 RECALC1B
1287 SSE1A
1288 SSE1B
1289 YRHIGH
1290 YRHIGHK
1291 YRLOWK
1292 SORT KEYS: ST VINTAGE YR
1293 DROP VARS: B1 B2
1294 ADD VARS: RECALC1C NPRATE1C
1295 */;
1296
1297 *** IF RECALC1A = 1, THEN HAVE HIT THE LIMIT IN PASS 1, PART A *;
1298 *** SET LIMIT FLAG FOR PASS 1, PART C TO THAT OF PASS 1, PART A *;
1299 *** SET NUMBER OF PEAK RATE VALUES TO THAT OF PASS 1, PART A *;
1300 IF RECALC1A EQ 1 THEN DO;
1301 RECALC1C = RECALC1A;
1302 NPRATE1C = NPRATE1A;
1303 END;
1304
1305 *** IF RECALC1B = 1, THEN HAVE HIT THE LIMIT IN PASS 1, PART B *;
1306 *** SET LIMIT FLAG FOR PASS 1, PART C TO THAT OF PASS 1, PART B *;
1307 *** SET NUMBER OF PEAK RATE VALUES TO THAT OF PASS 1, PART B *;
1308 IF RECALC1B EQ 1 THEN DO;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1309     RECALC1C = RECALC1B;
1310     NPRATE1C = NPRATE1B;
1311     END;
1312
1313     IF (NPRATE1B GE 5) AND (RECALC1B EQ 0) THEN DELETE;
1314     *** ARE THERE STILL AT LEAST 5 DATA POINTS LEFT AFTER PASS 1, PART B? *;
1315     *** IF NOT, THEN LIMIT HAS BEEN REACHED - SET NUMBER OF PEAK RATES *;
1316     *** FOR PASS 1, PART C TO THE NUMBER OF PEAK RATES IN PASS 1, PART A. *;
1317     IF NPRATE1C LT 5 THEN DO;
1318         RECALC1C = 1;
1319         NPRATE1C = NPRATE1A;
1320     END;
1321
1322     *** DELETE RECORD IF NUMBER OF DATA POINTS IS LESS THAN 2 (DON'T USE);
1323     IF NPRATE1A LT 2 THEN DELETE;
1324
1325     *** SET B3 FOR DATASETS LESS THAN 5 DATA POINTS;
1326     IF B3 = . THEN B3 = B3P1A;
1327     IF B3 = . THEN B3 = B3AVE;
1328
1329     DROP B1 B2;
1330
1331     *** APPEND NONLINEAR MODELS OUTPUT TO UNIT 16;
1332     PROC PRINTTO UNIT=16;
1333
1334     /*****
1335     * SORT PEAK RATE INFORMATION FOR REGRESSION RUN PASS 1, PART *
1336     * C BY STATE/AREA AND VINTAGE. *
1337     *****/;
1338     PROC SORT DATA=PARM2P1; BY ST VINTAGE;
1339
1340     /*****
1341     * THIS IS THE PASS 1, PART C RUN OF THE NONLINEAR REGRESSION *
1342     * PROCESS. THE B3 IS FIXED BASED ON THE NUMBER OF POINTS *
1343     * AVAILABLE. *
1344     *****/;
1345     PROC NLIN METHOD=MARQUARDT EFORMAT OUTEST=COEF2P1 CONVERGE=1.E-6;
1346     BOUNDS 0<B1, 0<B2;
1347     PARMs B1 = 1.E10
1348           B2 = 1.E11;
1349
1350     IF _ITER_ = 0 THEN IF _N_ = 1 THEN DO;
1351         B1 = B1START;
1352         B2 = B2START;
1353     END;
1354
1355     A = (1 - GP2/B2);
1356     IF A LE 0 THEN A = 1 - 1.E-8;
1357     SB1 = A**B3;
1358     SB2=B1*B3*(A** (B3-1))*(GP2/(B2*B2));
1359
1360     ** SB2=B1*B3*((1 - GP2/B2)** (B3-1))*(GP2/(B2*B2));
1361
1362     MODEL PRATE= (B1*(1-GP2/B2)**B3);
1363
1364     DER.B1=SB1;
1365     DER.B2=SB2;
1366
1367     OUTPUT OUT=FIT2P1 PREDICTED=YHAT1C RESIDUAL=R1C;
1368
1369     TITLE1 'MARQUARDT SOLUTION FOR PASS 1';
1370     TITLE2 'VINTAGE YEARS WITH LESS THAN 5 DATA POINTS';
1371     BY ST VINTAGE;
1372
1373     *** RETURN TO NORMAL SYSOUT PRINT UNIT;
1374     PROC PRINTTO;
1375
1376     /*****
1377     * FROM THE ESTIMATED PARAMETERS (B1,B2), DELETE THE RECORDS *
1378     * WITH THE NON-CONVERGING POINTS. *
1379     *****/;
1380     DATA ANS2P1;
1381     SET COEF2P1;
1382
1383     IF _TYPE_ NE 'FINAL' THEN DELETE;
1384
1385     SSE1C = _SSE_;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1386
1387 DROP _NAME_ _ITER_ _TYPE_ _SSE_;
1388
1389 /*****
1390 * SORT THE REMAINDER OF THE PARAMETER INFORMATION BY
1391 * STATE/AREA.
1392 *****/;
1393 PROC SORT; BY ST;
1394
1395 /*****
1396 * FOR DEBUG PURPOSES.
1397 *****/;
1398 /*
1399 PROC PRINT;
1400 VAR VINTAGE B1 B2 SSE1C;
1401 TITLE 'CONTENTS OF DATASET COEF2P1, PASS1';
1402 BY ST;
1403 */;
1404
1405 /*****
1406 * MERGE PASS 1, PART C PARAMETER INFORMATION WITH THE
1407 * VINTAGE MATRIX.
1408 *****/;
1409 DATA DUPCOEF2;
1410 MERGE ANS2P1 VINTRNGE; BY ST VINTAGE;
1411
1412 /* VARIABLES IN PARM2P1 RECORDS - 210
1413 VARIABLES FROM DATA SETS
1414 ANS2P1 VINTRNGE
1415 -----
1416 SSE1C MAXID
1417 B1 MINID
1418 B2
1419 SORT KEYS: ST VINTAGE
1420 ADD VARS: YR YRLOW YRHIGH
1421 DROP VARS: MAXID MINID YRLOW YRHIGH
1422 */;
1423
1424 YRLOW = 1900 + VINTAGE;
1425 YRHIGH = 1900 + MAXID;
1426 DO YR = YRLOW TO YRHIGH;
1427 OUTPUT;
1428 END;
1429
1430 DROP MAXID MINID YRLOW YRHIGH;
1431
1432 /*****
1433 * SORT THE PASS 1, PART C NONLINEAR REGRESSION PARAMETER
1434 * VINTAGE MATRICES BY STATE/AREA, VINTAGE, AND PRODUCTION
1435 * YEAR.
1436 * SORT THE PASS 1, PART C NONLINEAR REGRESSION PEAK RATE
1437 * INFORMATION BY THE SAME VARIABLES.
1438 *****/;
1439 PROC SORT DATA=DUPCOEF2; BY ST VINTAGE YR;
1440 PROC SORT DATA=FIT2P1; BY ST VINTAGE YR;
1441
1442 /*****
1443 * MERGE THE PASS 1, PART C NONLINEAR REGRESSION PARAMETER
1444 * VINTAGES MATRICES WITH THE PASS 1, PART C NONLINEAR
1445 * REGRESSION PEAK RATE INFORMATION.
1446 *****/;
1447 DATA ANSFT2P1;
1448 MERGE DUPCOEF2 FIT2P1; BY ST VINTAGE YR;
1449
1450 /* VARIABLES IN ANSFT2P1 RECORDS - 210
1451 VARIABLES FROM DATA SETS
1452 DUPCOEF2 FIT2P1
1453 -----
1454 SSE1C B1START
1455 B1 B2START
1456 B2 B3
1457 B3AVE
1458 B3START
1459 GP2
1460 MAXIDK
1461 MINIDK
1462 NPRATE1A

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1463             NPRATE1B
1464             PRATE
1465             PRATEO
1466             RECALC1B
1467             R1C
1468             SYM
1469             YHAT1C
1470             YRHIGHK
1471             YRLOWK
1472     SORT KEYS:  ST VINTAGE YR
1473     *;/
1474
1475     /* PREPARE THE TRANSACTION DATA SET.  RECORDS WITH MISSING B1 MUST
1476        BE DELETED. */;
1477
1478     *** DELETE RECORDS WITH MISSING B1 PARAMETER VALUES;
1479     IF B1 = . THEN DELETE;
1480
1481     /*****
1482     * COMBINE THE B3 MEAN VINTAGE MATRICES OF PASS 1, PART B, THE *
1483     * INITIAL LINEAR REGRESSION ESTIMATES, THE PARAMETER AND PEAK *
1484     * RATE INFORMATION FROM PASS 1, PART A, THE PARAMETER AND *
1485     * PEAK RATE INFORMATION FROM PASS 1, PART B, AND THE *
1486     * PARAMETER AND PEAK RATE INFORMATION FROM PASS 1, PART C ALL *
1487     * INTO ONE DATASET. *
1488     *****/;
1489 DATA TRANSP1;
1490     SET DUPEYR1 STSTEP1 DEL3AP1 ANSF3BP1 ANSFT2P1;
1491
1492     /* VARIABLES IN TRANSP1 RECORDS - 210
1493        VARIABLES FROM DATA SETS
1494        DUPEYR1      STSTEP1      DEL3AP1      ANSF3BP1      ANSFT2P1
1495        -----
1496        B3AVE        B1START      B1P1A      B1          SSE1C
1497        MAXIDK        B2START      B1START    B1P1A      B1
1498        MINIDK        B3START      B2P1A      B1P1B      B1START
1499        YRHIGHK        NPRATE1A    B2START    B1START    B2
1500        YRLOWK        B3P1A        B2         B2START
1501                   B3START      B2P1A      B3
1502                   GP2          B2P1B
1503                   MERR1A      B2START
1504                   NPRATE1A    B3         B3AVE
1505                   PRATE       B3P1A      B3START
1506                   PRATEO      B3P1B
1507                   RECALC1A    B3START    GP2
1508                   R1A         GP2          MAXIDK
1509                   SIGMA1A     MERR1A      MINIDK
1510                   SSE1A       NPRATE1A    NPRATE1A
1511                   SYM         NPRATE1B    NPRATE1B
1512                   YHAT1A      PRATE       PRATE
1513                   YRHIGH     PRATEO      PRATEO
1514                   RECALC1A    RECALC1B
1515                   RECALC1B    R1C
1516                   R1A        SYM
1517                   R1B        YHAT1C
1518                   SIGMA1A     YRHIGHK
1519                   SIGMA1B     YRLOWK
1520                   SSE1A
1521                   SSE1B
1522                   SYM
1523                   YHAT1A
1524                   YHAT1B
1525                   YRHIGH
1526     SORT KEYS:  ST VINTAGE YR
1527     DROP VARS:  YRHIGH
1528     *;/
1529
1530     DROP YRHIGH;
1531
1532     /*****
1533     * SORT THE ABOVE DATASET BY STATE/AREA, VINTAGE, AND *
1534     * PRODUCTION YEAR. *
1535     *****/;
1536 PROC SORT DATA=TRANSP1; BY ST VINTAGE YR;
1537
1538     /*****
1539     * UPDATE THE INITIAL PEAK RATE DATA WITH THE ABOVE PARAMETER *

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1540 * AND PEAK RATE INFORMATION GOTTEN FROM PASS 1, PARTS A, B, *
1541 * & C OF THE NONLINEAR REGRESSION PROCESS. *
1542 *****/;
1543 DATA PASS1END;
1544 UPDATE INITIAL TRANSP1; BY ST VINTAGE YR;
1545
1546 RETAIN MEANERR1 MERR1C RECALC 0;
1547
1548 *** CONSOLIDATE THE RESULTS FROM THE TWO THREE PARAMETER FITS AND *;
1549 *** THE TWO PARAMETER FIT INTO ONE SET OF VARIABLES *;
1550 IF YHAT1A NE . THEN DO;
1551 IF R1A EQ . THEN R1A = PRATEO - YHAT1A;
1552 R1 = R1A;
1553 YHAT1 = YHAT1A;
1554 SIGMA1 = SIGMA1A;
1555 SSE1 = SSE1A;
1556 RECALC = RECALC1A;
1557 MEANERR1 = MERR1A;
1558 END;
1559
1560 IF YHAT1B NE . THEN DO;
1561 IF R1B EQ . THEN R1B = PRATEO - YHAT1B;
1562 R1 = R1B;
1563 YHAT1 = YHAT1B;
1564 SIGMA1 = SIGMA1B;
1565 SSE1 = SSE1B;
1566 RECALC = RECALC1B;
1567 MEANERR1 = MERR1B;
1568 END;
1569
1570 IF YHAT1C NE . THEN DO;
1571 IF R1C EQ . THEN R1C = PRATEO - YHAT1C;
1572 R1 = R1C;
1573 YHAT1 = YHAT1C;
1574 IF SSE1C GT 0 THEN MERR1C = SQRT(SSE1C/(NPRATE1C-1));
1575 SIGMA1C = R1C/MERR1C;
1576 SIGMA1 = SIGMA1C;
1577 SSE1 = SSE1C;
1578 MEANERR1 = MERR1C;
1579 END;
1580
1581 PCNTRES1 = 100*R1/YHAT1;
1582 SIGMA1 = R1/MEANERR1;
1583
1584 *** DELETE THE DATA POINTS THAT ARE AT LEAST 1 SIGMA *;
1585 *** LOWER THAN THE MODEL ESTIMATE. *;
1586
1587 IF PRATE NE . AND R1 LT -MEANERR1 THEN DO;
1588 PRATEO = PRATE;
1589 PRATE = .;
1590 SYM = 'S';
1591 IF YR EQ (VINTAGE + 1901) OR YR EQ YRHIGHK THEN DO;
1592 PRATE = PRATEO;
1593 PRATEO = .;
1594 SYM = 'F';
1595 END;
1596 END;
1597
1598 *** RETAIN THE CALCULATED VALUES OF B1, B2, AND B3;
1599 B1P1 = B1;
1600 B2P1 = B2;
1601
1602 DROP B1 B2;
1603
1604 /*****
1605 * SORT THE ABOVE PEAK RATE AND PARAMETER INFORMATION FROM *
1606 * THE NONLINEAR REGRESSION PASS 1 BY STATE/AREA, AND VINTAGE. *
1607 *****/;
1608 PROC SORT; BY ST VINTAGE;
1609
1610 /*****
1611 * FOR DEBUG PURPOSES. *
1612 *****/;
1613 /*
1614 PROC PRINT;
1615 VAR VINTAGE YR B1P1 B2P1 B3 RECALC PRATE PRATEO GP2 R1 SIGMA1
1616 PCNTRES1 SYM;

```


Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1617 TITLE1 'CONTENTS OF DATASET AFTER PASS 1 CALCULATIONS';
1618 TITLE2 '-1 SIGMA USED FOR DATA DELETION CRITERIA';
1619 BY ST VINTAGE;
1620 /*;
1621
1622
1623 *** WRITE THE PASS 1 PLOTS TO UNIT 17;
1624 PROC PRINTTO UNIT=17 NEW;
1625
1626 /*****
1627  * SORT DATASET WITH PASS 1 NONLINEAR REGRESSION INFORMATION  *
1628  * BY STATE/AREA AND VINTAGE.  *
1629  *****/;
1630 PROC SORT; BY ST VINTAGE;
1631
1632 /*****
1633  * GET THE PASS 1 NONLINEAR REGRESSION INFORMATION READY FOR  *
1634  * PLOTTING.  *
1635  *****/;
1636 DATA PASS1PLT;
1637 SET PASS1END;
1638
1639 IF VINTAGE GE (MAXIDK-1) THEN DELETE;
1640 IF YR - 1900 EQ VINTAGE THEN DELETE;
1641
1642 /*****
1643  * PRINTER PLOTS OF PEAK RATE INFORMATION FROM PASS 1 OF THE  *
1644  * NONLINEAR REGRESSION PROCESS.  *
1645  *****/;
1646 PROC PLOT;
1647 PLOT PRATE *GP2 = SYM
1648 PRATEO *GP2 = SYM
1649 YHAT1 *GP2 = '*' /OVERLAY;
1650 PLOT SIGMA1 *GP2 = SYM/VREF= 0 -1;
1651 BY ST VINTAGE;
1652
1653 /*****
1654  * WRITE THE PASS 2 MEANS AND REGRESSION MODELS TO UNIT 18 *
1655  *****/;
1656 PROC PRINTTO UNIT=18 NEW;
1657
1658 /*****
1659  * GET MEAN AND NUMBER OF DATA FOR PRATE (PEAK RATE), MAXIDK  *
1660  * (LAST VINTAGE YEAR), AND MINIDK (FIRST VINTAGE YEAR).  *
1661  *****/;
1662 PROC MEANS DATA=PASS1END N MEAN MIN MAX;
1663 VAR PRATE MAXIDK MINIDK;
1664 OUTPUT OUT=MEANSTP2 N = NPRATE2 D1 D2 MEAN = D3 MAXID MINID;
1665 TITLE1 'NUMBER OF DATA POINTS FOR PASS 2';
1666 BY ST VINTAGE;
1667
1668 /*****
1669  * SET UP PRODUCTION MATRIX WITH INFORMATION FROM ABOVE PROC  *
1670  * MEANS ABOVE.  *
1671  *****/;
1672 DATA MSTP2DUP;
1673 SET MEANSTP2;
1674
1675 YRLOW = 1900 + VINTAGE;
1676 YRHIGH = 1900 + MAXID;
1677 DO YR = YRLOW TO YRHIGH;
1678 OUTPUT;
1679 END;
1680
1681 *** KEEP ONLY THE NUMBER OF PEAK RATE VALUES GOING INTO PASS2;
1682 DROP MAXID MINID YRLOW YRHIGH D1 D2 D3;
1683
1684 /*****
1685  * SORT THE NUMBER OF PEAK RATES PRODUCTION MATRICES BY  *
1686  * STATE/AREA, VINTAGE, AND PRODUCTION YEAR.  *
1687  * SORT THE PASS 1 PEAK RATE INFORMATION GOING INTO PASS 2 OF  *
1688  * THE NONLINEAR REGRESSION PROCESS BY THE SAME VARIABLES.  *
1689  *****/;
1690 PROC SORT DATA=MSTP2DUP; BY ST VINTAGE YR;
1691 PROC SORT DATA=PASS1END; BY ST VINTAGE YR;
1692

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1693 /*****
1694 * MERGE PRODUCTION MATRICES WITH THE PASS 1 PEAK RATE *
1695 * INFORMATION. *
1696 *****/;
1697 DATA PARM2P2;
1698     MERGE PASS1END MSTP2DUP; BY ST VINTAGE YR;
1699
1700 /* VARIABLES IN PARM2P2 RECORDS - 210
1701    VARIABLES FROM DATA SETS
1702    PASS1END    MSTP2DUP
1703    -----
1704            B1P1            NPRATE2
1705            B1P1A
1706            B1P1B
1707            B1START
1708            B2P1
1709            B2P1A
1710            B2P1B
1711            B2START
1712            B3
1713            B3AVE
1714            B3P1A
1715            B3P1B
1716            B3START
1717            GP2
1718            MAXIDK
1719            MEANERR1
1720            MERR1A
1721            MERR1B
1722            MERR1C
1723            MINIDK
1724            NPRATE1A
1725            NPRATE1B
1726            PCNTRES1
1727            PRATE
1728            PRATEO
1729            RECALC
1730            RECALC1A
1731            RECALC1B
1732            R1
1733            R1A
1734            R1B
1735            R1C
1736            SIGMA1
1737            SIGMA1A
1738            SIGMA1B
1739            SIGMA1C
1740            SSE1
1741            SSE1A
1742            SSE1B
1743            SSE1C
1744            SYM
1745            YHAT1
1746            YHAT1A
1747            YHAT1B
1748            YHAT1C
1749            YRHIGHK
1750            YRLOWK
1751    SORT KEYS:    ST VINTAGE YR
1752    */;
1753
1754    IF NPRATE2 LT 2 THEN DELETE;
1755
1756 /*****
1757 * SORT ABOVE DATASET BY STATE/AREA AND VINTAGE. *
1758 *****/;
1759 PROC SORT DATA=PARM2P2; BY ST VINTAGE;
1760
1761 PROC PRINTTO;
1762
1763 /*****
1764 * APPEND THE NONLINEAR MODELS OUTPUT TO UNIT 18 *
1765 *****/;
1766 PROC PRINTTO UNIT=18;
1767

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1768 /*****
1769 * NONLINEAR REGRESSION - PASS 2. CALCULATES B1 AND B2
1770 * PARAMETERS WHILE HOLDING THE B3 PARAMETER AS THE FINAL
1771 * B3 VALUE FROM PASS 1.
1772 *****/;
1773 PROC NLIN METHOD=MARQUARDT EFORMAT OUTEST=COEF2P2 CONVERGE=1.E-6;
1774 BOUNDS 0<B1, 0<B2;
1775 PARMs B1 = 1.E10
1776 B2 = 1.E11;
1777
1778 IF _ITER_ = 0 THEN IF _N_ = 1 THEN DO;
1779 B1 = B1START;
1780 B2 = B2START;
1781 END;
1782
1783 A = (1 - GP2/B2);
1784 IF A LE 0 THEN A = 1 - 1.E-8;
1785 SB1 = A**B3;
1786 SB2=B1*B3*(A**(B3-1))*(GP2/(B2*B2));
1787
1788 ** SB2=B1*B3*((1 - GP2/B2)**(B3-1))*(GP2/(B2*B2));
1789
1790 MODEL PRATE= (B1*(1-GP2/B2)**B3);
1791
1792 DER.B1=SB1;
1793 DER.B2=SB2;
1794
1795 OUTPUT OUT=FIT2P2 PREDICTED=YHAT2 RESIDUAL=R2;
1796
1797 TITLE1 'MARQUARDT SOLUTION FOR PASS 2';
1798 TITLE2 'TWO PARAMETER MODEL WITH FIXED B3';
1799 BY ST VINTAGE;
1800
1801 /*****
1802 * RETURN THE PRINT TO THE NORMAL SYSOUT DATA SET
1803 *****/;
1804 PROC PRINTO;
1805
1806 /*****
1807 * PASS 2 NONLINEAR REGRESSION B1 AND B2 PARAMETERS FOR
1808 * VINTAGE DATA POINTS THAT CONVERGED.
1809 *****/;
1810 DATA ANS2P2;
1811 SET COEF2P2;
1812
1813 *** IF NOT A FINAL ESTIMATE, THEN DELETE RECORD;
1814 IF _TYPE_ NE 'FINAL' THEN DELETE;
1815 SSE2 = _SSE_;
1816
1817 DROP _NAME_ _ITER_ _SSE_ _TYPE_;
1818
1819 /*****
1820 * FOR DEBUG PURPOSES.
1821 *****/;
1822 /*
1823 PROC PRINT;
1824 VAR VINTAGE B1 B2 SSE2;
1825 TITLE1 'CONTENTS OF DATASET COEF2P2, PASS 2';
1826 BY ST;
1827 /*;
1828
1829 /*****
1830 * MERGE THE PASS 2 PARAMETERS WITH VINTAGE MATRIX.
1831 *****/;
1832 DATA ANSALLP2;
1833 MERGE ANS2P2 VINTRNGE; BY ST VINTAGE;
1834
1835 /* VARIABLES IN ANSALLP2 RECORDS - 210
1836 VARIABLES FROM DATA SETS
1837 ANS2P2 VINTRNGE
1838 -----
1839 B1 MAXID
1840 B2 MINID
1841 SSE2
1842 SORT KEYS: ST VINTAGE
1843 ADD VARS: YRLOW YRHIGH YR
1844 DROP VARS: MAXID MINID YRLOW YRHIGH

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1845      */;
1846
1847      *** DUPLICATE FOR EACH PRODUCTION YEAR;
1848      YRLOW = 1900 + VINTAGE;
1849      YRHIGH = 1900 + MAXID;
1850      DO YR = YRLOW TO YRHIGH;
1851          OUTPUT;
1852      END;
1853
1854      DROP MAXID MINID YRLOW YRHIGH;
1855
1856      /*****
1857      * SORT THE PASS 2 PARAMETER VINTAGE MATRIX BY STATE/AREA,
1858      * VINTAGE, AND PRODUCTION YEAR.
1859      *****/;
1860      PROC SORT; BY ST VINTAGE YR;
1861
1862      /*****
1863      * KEEP ONLY PART OF THE PEAK RATE INFORMATION FROM THE PASS 2 *
1864      * REGRESSION.
1865      *****/;
1866      DATA FITALLP2;
1867          SET FIT2P2;
1868
1869      KEEP NPRATE2 ST VINTAGE YR R2 YHAT2;
1870
1871      /*****
1872      * SORT REGRESSION PEAK RATE INFORMATION BY STATE/AREA,
1873      * VINTAGE, AND PRODUCTION YEAR.
1874      *****/;
1875      PROC SORT DATA=FITALLP2; BY ST VINTAGE YR;
1876
1877      /*****
1878      * MERGE REGRESSION ESTIMATE INFORMATION FROM PASS 2 WITH
1879      * REGRESSION INFORMATION FROM PASS 1.
1880      *****/;
1881      DATA PASS2END;
1882          MERGE PASS1END FITALLP2 ANSALLP2; BY ST VINTAGE YR;
1883
1884      /* VARIABLES IN PASS2END RECORDS - 210
1885      VARIABLES FROM DATA SETS
1886      PASS1END      FITALLP2      ANSALLP2
1887      -----
1888          B1P1      NPRATE2      B1
1889          B1P1A     R2           B2
1890          B1P1B     YHAT2       SSE2
1891          B1START
1892          B2P1
1893          B2P1A
1894          B2P1B
1895          B2START
1896          B3
1897          B3AVE
1898          B3P1A
1899          B3P1B
1900          B3START
1901          GP2
1902          MAXIDK
1903          MEANERR1
1904          MERR1A
1905          MERR1B
1906          MERR1C
1907          MINIDK
1908          NPRATE1A
1909          NPRATE1B
1910          PCNTRES1
1911          PRATE
1912          PRATEO
1913          RECALC
1914          RECALC1A
1915          RECALC1B
1916          R1
1917          R1A
1918          R1B
1919          R1C
1920          SIGMA1
1921          SIGMA1A

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1922      SIGMA1B
1923      SIGMA1C
1924      SSE1
1925      SSE1A
1926      SSE1B
1927      SSE1C
1928      SYM
1929      YHAT1
1930      YHAT1A
1931      YHAT1E
1932      YHAT1C
1933      YRHIGHK
1934      YRLOWK
1935      SORT KEYS:  ST VINTAGE YR
1936      *;
1937
1938      RETAIN MEANERR2;
1939
1940      IF VINTAGE = . THEN DELETE;
1941
1942      IF R2 EQ . THEN R2 = PRATEO - YHAT2;
1943
1944      PCNTRES2 = 100*R2/YHAT2;
1945
1946      IF SSE2 GT 0 THEN MEANERR2 = SQRT(SSE2/(NPRATE2-1));
1947
1948      SIGMA2   = R2/MEANERR2;
1949
1950      ***  RETAIN THE CALCULATED VALUES OF B1, B2, AND B3;
1951
1952      B1P2 = B1;
1953      B2P2 = B2;
1954
1955      TITLE1 'CONTENTS OF DATASET PASS2END';
1956      TITLE2 'DAILY PRODUCTION AND CUMULATIVE PRODUCTION ARE IN MCF';
1957
1958      /*****
1959      * GET MEAN OF B1, B2, B3 PARAMETERS AND MEAN ERRORS.
1960      *****/;
1961
1962      PROC MEANS DATA=PASS2END NOPRINT;
1963      VAR B1 B2 B3 MEANERR1 MEANERR2;
1964      OUTPUT OUT=MODPARMA MEAN=B1 B2 B3 MEANERR1 MEANERR2;
1965      BY ST VINTAGE;
1966
1967      /*****
1968      * SORT REGRESSION INFORMATION BY STATE/AREA.
1969      *****/;
1970      PROC SORT DATA=PASS2END; BY ST;
1971
1972      /*****
1973      * FOR DEBUG PURPOSES.
1974      *****/;
1975      /*
1976      PROC PRINT DATA=PASS2END;
1977      VAR VINTAGE YR SYM NPRATE2 GP2 PRATE YHAT2
1978      R2 PCNTRES2 B1P1 B2P1 B3;
1979      BY ST;
1980      *;
1981
1982      /*****
1983      * SORT REGRESSION INFORMATION BY STATE/AREA AND VINTAGE.
1984      *****/;
1985      PROC SORT; BY ST VINTAGE;
1986
1987      /*****
1988      * WRITE THE PASS 2 PLOTS TO UNIT 19
1989      *****/;
1990      PROC PRINTTO UNIT=19 NEW;
1991
1992      /*****
1993      * GET PASS 2 REGRESSION INFORMATION READY FOR PLOTTING.
1994      *****/;
1995      DATA PASS2PLT;
1996      SET PASS2END;
1997
1998      ***  DELETE RECORDS WITH VINTAGE YEAR GREATER OR EQUAL TO *;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

1999 *** SECOND TO LAST VINTAGE YEAR. *;
2000 IF VINTAGE GE (MAXIDK-1) THEN DELETE;
2001
2002 /*****
2003 * PRINTER PLOTS FOR PASS 2 REGRESSION PEAK RATE INFORMATION. *
2004 *****/;
2005 PROC PLOT;
2006     PLOT PRATE *GP2 = SYM
2007             PRATEO *GP2 = SYM
2008             YHAT2 *GP2 = '/'OVERLAY;
2009     PLOT SIGMA2 *GP2 = SYM/VREF= 0 -1;
2010     BY ST VINTAGE;
2011
2012 PROC PRINTTO;
2013
2014 /*****
2015 * BRING IN PASS 2 REGRESSION INFORMATION. *
2016 * KEEP LAST 2 YEARS OF INFORMATION (2 DATA POINTS) FOR PASS *
2017 * NONLINEAR REGRESSION RUN. *
2018 *****/;
2019 DATA PASS3;
2020     SET PASS2END;
2021
2022     /* THE FOLLOWING SECTION PERFORMS THE SPREAD SHEET CALCULATION
2023     TO ESTIMATE B1 FOR THE LAST 2 VINTAGE YEARS BASED ON AVERAGE
2024     VALUES OF B1/PRATE FOR THE VINTAGE + 1 YEAR. B1 VALUES ARE
2025     ALSO REPLACED FOR ANY VINTAGE YEAR WITH 2 DATA POINTS. */;
2026
2027     IF (YR-1900) NE (VINTAGE + 1) THEN DELETE;
2028
2029     B1PK = B1/PRATE;
2030
2031     KEEP B1PK B1 B2 MAXIDK MINIDK PRATE VINTAGE ST NPRATE2;
2032
2033 /*****
2034 * FOR DEBUG PURPOSES. *
2035 *****/;
2036 /*
2037 PROC PRINT;
2038     TITLE1 'RATIO OF B1/2ND YEAR PRODUCTION PEAK RATE';
2039     /*;
2040
2041 /*****
2042 * SORT INFORMATION FROM PASS 3 REGRESSION RUN BY STATE/AREA *
2043 * AND VINTAGE. *
2044 *****/;
2045 PROC SORT DATA=PASS3; BY ST VINTAGE;
2046
2047 /*****
2048 * BRING IN INFORMATION FOR PASS 3 REGRESSION RUN. SET B1PK *
2049 * EQUAL TO MISSING VALUE IF: *
2050 * 1) NUMBER OF PEAK RATES FROM PASS 2 <= 2, *
2051 * 2) VINTAGE YEAR < 9 YEARS PRIOR TO LAST VINTAGE YEAR, *
2052 * 3) VINTAGE YEAR >= SECOND TO LAST VINTAGE YEAR. *
2053 *****/;
2054 DATA MEANRAT;
2055     SET PASS3;
2056
2057     IF NPRATE2 LE 2 THEN DO;
2058         REPLACE2 = 1;
2059         B1PK = .;
2060     END;
2061     IF VINTAGE LT MAXIDK-9 THEN B1PK = .;
2062     IF VINTAGE GE MAXIDK-2 THEN DO;
2063         REPLACE2 = 1;
2064         B1PK = .;
2065     END;
2066
2067     TITLE 'AVERAGE B1/2ND YEAR PEAK RATIO';
2068
2069 /*****
2070 * GET MEAN OF B1PK FOR EACH STATE/AREA. *
2071 *****/;
2072 PROC MEANS N MEAN STD MIN MAX CV;
2073     VAR B1PK;
2074     OUTPUT OUT=AVERATIO MEAN=B1PKAVE;
2075     BY ST;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2076
2077 /*****
2078 * MERGE B1PK MEANS WITH FIRST AND LAST VINTAGE YEARS.  CREATE *
2079 * VINTAGE MATRIX.
2080 *****/
2081 DATA DUPYEAR3;
2082     MERGE AVERATIO IDRANGE; BY ST;
2083
2084 /* VARIABLES IN DUPYEAR3 RECORDS - 210
2085    VARIABLES FROM DATA SETS
2086        AVERATIO      IDRANGE
2087    -----
2088        B1PKAVE      MAXID
2089                MINID
2090    SORT KEYS:  ST
2091    ADD VARS:   VINTAGE
2092    DROP VARS:  MINID MAXID
2093    */;
2094
2095 DO VINTAGE=MINID TO MAXID;
2096     OUTPUT;
2097 END;
2098
2099 DROP MINID MAXID;
2100
2101 /*****
2102 * SORT B1PK MEAN VINTAGE MATRIX BY STATE/AREA AND VINTAGE.  *
2103 *****/
2104 PROC SORT DATA=DUPYEAR3; BY ST VINTAGE;
2105
2106 * PROC PRINT DATA=DUPYEAR3;
2107
2108 /*****
2109 * MERGE PEAK RATE INFORMATION FOR PASS 3 WITH B1PK AVERAGE  *
2110 * VINTAGE MATRIX.
2111 *****/
2112 DATA PASS3REV;
2113     MERGE MEANRAT DUPYEAR3; BY ST VINTAGE;
2114
2115 /* VARIABLES IN PASS3REV RECORDS - 210
2116    VARIABLES FROM DATA SETS
2117        MEANRAT      DUPYEAR3
2118    -----
2119        B1            B1PKAVE
2120        B1PK
2121        B2
2122        MAXIDK
2123        MINIDK
2124        NPRATE2
2125        PRATE
2126        REPLACE2
2127    SORT KEYS:  ST VINTAGE
2128    ADD VARS:   VINTAGE
2129    KEEP VARS:  B1 REPLACE2 ST VINTAGE YR
2130    */;
2131
2132 IF REPLACE2 = 1 THEN B1 = B1PKAVE*PRATE;
2133
2134 IF REPLACE2 NE 1 THEN DELETE;
2135
2136 *** DUPLICATE VINTAGE MATRIX FOR EACH PRODUCTION YEAR.;
2137 YRLOW = 1900 + VINTAGE;
2138 YRHIGH = 1900 + MAXIDK;
2139
2140 DO YR = YRLOW TO YRHIGH;
2141     OUTPUT;
2142 END;
2143
2144 KEEP ST VINTAGE YR B1 REPLACE2;
2145
2146 /*****
2147 * FOR DEBUG PURPOSES.
2148 *****/
2149 /*
2150 PROC PRINT DATA=PASS3REV;
2151     TITLE 'TRANSACTION DATA SET FOR PASS3 REVISIONS';
2152

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2153   VAR ST VINTAGE YR B1 REPLACE2;
2154   */;
2155
2156   /*****
2157   * SORT THE PEAK RATE REGRESSION INFORMATION FROM PASS 1 AND *
2158   * PASS 2 BY STATE/AREA, VINTAGE, AND PRODUCTION YEAR.      *
2159   * SORT THE PEAK RATE INFORMATION GOING INTO PASS 3 BY THE  *
2160   * SAME VARIABLES.                                           *
2161   *****/;
2162   PROC SORT DATA=PASS2END; BY ST VINTAGE YR;
2163   PROC SORT DATA=PASS3REV; BY ST VINTAGE YR;
2164
2165   /*****
2166   * UPDATE PASS 1 AND PASS 2 REGRESSION INFORMATION WITH THE *
2167   * PEAK RATE INFORMATION GOING INTO PASS 3.                  *
2168   *****/;
2169   DATA PARM1P3;
2170     UPDATE PASS2END PASS3REV; BY ST VINTAGE YR;
2171
2172   /* VARIABLES IN PASS2END RECORDS - 210
2173      VARIABLES FROM DATA SETS
2174      PASS2END      PASS3REV
2175      -----
2176      B1P1          B1
2177      B1P1A         REPLACE2
2178      B1P1B
2179      B1START
2180      B2P1
2181      B2P1A
2182      B2P1B
2183      B2START
2184      B3
2185      B3AVE
2186      B3P1A
2187      B3P1B
2188      B3START
2189      GP2
2190      MAXIDK
2191      MEANERR1
2192      MERR1A
2193      MERR1B
2194      MERR1C
2195      MINIDK
2196      NPRATE1A
2197      NPRATE1B
2198      PCNTRES1
2199      PRATE
2200      PRATEO
2201      RECALC
2202      RECALC1A
2203      RECALC1B
2204      R1
2205      R1A
2206      R1B
2207      R1C
2208      SIGMA1
2209      SIGMA1A
2210      SIGMA1B
2211      SIGMA1C
2212      SSE1
2213      SSE1A
2214      SSE1B
2215      SSE1C
2216      SYM
2217      YHAT1
2218      YHAT1A
2219      YHAT1B
2220      YHAT1C
2221      YRHIGHK
2222      YRLOWK
2223     SORT KEYS:  ST VINTAGE YR
2224     */;
2225
2226   DROP B2;
2227
2228   IF REPLACE2 NE 1 THEN DELETE;
2229

```


Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2230     KEEP ST VINTAGE YR PRATE GP2 B1 B2START B3 REPLACE2;
2231
2232     /*****
2233     * APPEND THE NONLINEAR MODELS OUTPUT TO UNIT 20      *
2234     *****/;
2235     PROC PRINTTO UNIT=20 NEW;
2236
2237     /*****
2238     * PASS 3 NONLINEAR REGRESSION - USES THE RATIO OF B2/2ND YEAR *
2239     * PEAK PRODUCTION RATE TO CALCULATE AN ASSUMED VALUE OF B2 *
2240     * FOR ALL VINTAGE YEARS WITH ONLY 1 OR 2 YEARS OF PRODUCTION *
2241     * DATA. *
2242     *****/;
2243     PROC NLIN METHOD=MARQUARDT EFORMAT OUTEST=COEF1P3 CONVERGE=1.E-6;
2244     BOUNDS 0<B2;
2245     PARMS B2 = 1.E11;
2246
2247     IF _ITER_ = 0 THEN IF _N_ = 1 THEN B2 = B2START;
2248
2249     A = (1 - GP2/B2);
2250     IF A LE 0 THEN A = 1 - 1.E-8;
2251     SB2=B1*B3*(A** (B3-1))*(GP2/(B2*B2));
2252
2253     ** SB2=B1*B3*((1 - GP2/B2)** (B3-1))*(GP2/(B2*B2));
2254
2255     MODEL PRATE= (B1*(1-GP2/B2)**B3);
2256
2257     DER.B2=SB2;
2258
2259     OUTPUT OUT=FIT1P3 PREDICTED=YHAT3 RESIDUAL=R3;
2260
2261     TITLE1 'MARQUARDT SOLUTION FOR PASS 3';
2262     TITLE2 'ONE PARAMETER MODEL WITH FIXED B1 AND B3';
2263     BY ST VINTAGE;
2264
2265     /*****
2266     * RETURN THE PRINT TO THE NORMAL SYSOUT DATA SET      *
2267     *****/;
2268     PROC PRINTTO;
2269
2270     /*****
2271     * BRING IN PARAMETER ESTIMATES FROM PASS 3. DELETE RECORDS *
2272     * WITH DATA POINTS WHICH DID NOT CONVERGE. *
2273     *****/;
2274     DATA ANS1P3;
2275     SET COEF1P3;
2276
2277     IF _TYPE_ NE 'FINAL' THEN DELETE;
2278
2279     *** SAVE THE ERROR SUM OF SQUARES OF THE LAST ITERATION AND *;
2280     *** THE B2 PARAMETER VALUE *;
2281     SSE3 = _SSE_;
2282     B2P3 = B2;
2283
2284     DROP _NAME_ _ITER_ _SSE_ _TYPE_ B2;
2285
2286     /*****
2287     * FOR DEBUG PURPOSES
2288     *****/;
2289     /*
2290     TITLE1 'CONTENTS OF DATASET COEF1P3, PASS 3';
2291
2292     PROC PRINT;
2293     */;
2294
2295     /*****
2296     * MERGE CONVERGING PARAMETER ESTIMATES WITH THE VINTAGE *
2297     * MATRIX. *
2298     *****/;
2299     DATA ANSALLP3;
2300     MERGE ANS1P3 VINTRNGE; BY ST VINTAGE;
2301
2302     /* VARIABLES IN ANSALLP3 RECORDS - 210
2303     VARIABLES FROM DATA SETS
2304     ANS1P3          VINTRNGE
2305     -----
2306           B2P3          MAXID

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2307          SSE3          MINID
2308      SORT KEYS:  ST VINTAGE
2309          */;
2310
2311      *** DUPLICATE FOR EACH PRODUCTION YEAR;
2312      YRLOW = 1900 + VINTAGE;
2313      YRHIGH = 1900 + MAXID;
2314      DO YR = YRLOW TO YRHIGH;
2315          OUTPUT;
2316      END;
2317
2318      DROP YRLOW YRHIGH MAXID MINID;
2319
2320      /*****
2321      * KEEP ONLY CERTAIN VARIABLES FROM PASS 3 REGRESSION      *
2322      * INFORMATION.                                           *
2323      *****/;
2324      DATA FITALLP3;
2325          SET FIT1P3;
2326
2327      KEEP ST VINTAGE YR R3 YHAT3 REPLACE2;
2328
2329      /*****
2330      * SORT PASS 1 AND PASS 2 REGRESSION INFORMATION BY STATE/AREA,*
2331      * VINTAGE, AND PRODUCTION YEAR.                          *
2332      *****/;
2333      PROC SORT DATA=PASS2END; BY ST VINTAGE YR;
2334
2335      /*****
2336      * COMBINE PARAMETER AND PEAK RATE INFORMTION BEFORE pass 3  *
2337      * REGRESSION run WITH PEAK RATE AND parameter information  *
2338      * AFTER PASS 3 REGRESSION run.                              *
2339      *****/;
2340      DATA TRANSP3;
2341          SET PARM1P3 FITALLP3 ANSALLP3;
2342
2343      /*****
2344      * SORT ABOVE DATASET BY STATE/AREA AND PRODUCTION YEAR.    *
2345      *****/;
2346      PROC SORT DATA=TRANSP3; BY ST VINTAGE YR;
2347
2348      /*****
2349      * UPDATE PASS 1 AND PASS 2 PEAK RATE REGRESSION INFORMATION *
2350      * WITH PASS 3 PEAK RATE REGRESSION INFORMATION.            *
2351      *****/;
2352      DATA PASS3END;
2353          UPDATE PASS2END TRANSP3; BY ST VINTAGE YR;
2354
2355      /* VARIABLES IN PASS3END RECORDS - 210
2356      VARIABLES FROM DATA SETS
2357      PASS2END      TRANSP3
2358      -----
2359          B1          R3
2360          B1P1        YHAT3
2361          B1P1A       REPLACE2
2362          B1P1B
2363          B1P2
2364          B1START
2365          B2
2366          B2P1
2367          B2P1A
2368          B2P1B
2369          B2P2
2370          B2START
2371          B3
2372          B3AVE
2373          B3P1A
2374          B3P1B
2375          B3START
2376          GP2
2377          MAXIDK
2378          MEANERR1
2379          MEANERR2
2380          MERR1A
2381          MERR1B
2382          MERR1C
2383          MINIDK

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2384      NPRATE1A
2385      NPRATE1B
2386      NPRATE2
2387      PCNTRES1
2388      PCNTRES2
2389      PRATE
2390      PRATEO
2391      RECALC
2392      RECALC1A
2393      RECALC1B
2394      R1
2395      R1A
2396      R1B
2397      R1C
2398      R2
2399      SIGMA1
2400      SIGMA1A
2401      SIGMA1B
2402      SIGMA1C
2403      SIGMA2
2404      SSE1
2405      SSE1A
2406      SSE1B
2407      SSE1C
2408      SSE2
2409      SYM
2410      YHAT1
2411      YHAT1A
2412      YHAT1B
2413      YHAT1C
2414      YHAT2
2415      YRHIGHK
2416      YRLOWK
2417      SORT KEYS: ST VINTAGE
2418      ADD VARS: PCNTRES3 MEANERR3 SIGMA3
2419      */,
2420
2421      RETAIN MEANERR3;
2422
2423      IF R3 EQ . AND REPLACE2 EQ 1 THEN R3 = PRATEO - YHAT3;
2424
2425      IF SSE3 GT 0 THEN DO;
2426          PCNTRES3 = 100*R3/YHAT3;
2427          MEANERR3 = SQRT(SSE3/(NPRATE2-1));
2428          SIGMA3 = R3/MEANERR3;
2429          IF B2P3 NE . THEN B2 = B2P3;
2430      END;
2431
2432      /*****
2433      * FOR DEBUG PURPOSES.
2434      *****/;
2435      /*
2436      PROC PRINT;
2437          VAR YR B1 B2 B3 SIGMA1 SIGMA2 SIGMA3 PRATE GP2 SYM;
2438          TITLE 'CONTENTS OF DATASET AFTER THE THREE PASS HYPERBOLIC FITS';
2439          BY ST VINTAGE;
2440          */,
2441
2442      /*****
2443      * WRITE THE PASS 3 PLOTS TO UNIT 21
2444      *****/;
2445      PROC PRINTTO UNIT=21 NEW;
2446
2447      /*****
2448      * GET PASS 3 PEAK RATE REGRESSION INFORMATION READY FOR
2449      * PLOTTING.
2450      *****/;
2451      DATA PASS3PLT;
2452          SET PASS3END;
2453
2454          IF YHAT3 EQ . THEN DELETE;
2455
2456      /*****
2457      * PRINTER PLOTS FOR PASS 3.
2458      *****/;
2459      PROC PLOT;
2460          PLOT PRATE *GP2 = SYM

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2461          PRATEO *GP2 = SYM
2462          YHAT3 *GP2 = '*' /OVERLAY;
2463          PLOT PCNTRES3*GP2 = SYM/VREF=2 0 -2 VAXIS=-20 TO 20 BY 4;
2464          BY ST VINTAGE;
2465
2466          PROC PRINTTO;
2467
2468          /*****
2469          * GET MEAN VALUES FOR PARAMETERS B1, B2, B3 AND FOR MEAN
2470          * ERRORS OF PASS 1, 2, & 3 OF NONLINEAR REGRESSION.
2471          *****/;
2472          PROC MEANS DATA=PASS3END NOPRINT;
2473          VAR B1 B2 B3 MEANERR1 MEANERR2 MEANERR3;
2474          OUTPUT OUT=MODPARMB MEAN=B1 B2 B3 MEANERR1 MEANERR2 MEANERR3;
2475          BY ST VINTAGE;
2476
2477          /*****
2478          * FOR DEBUG PURPOSES.
2479          *****/;
2480          /*
2481          PROC PRINT DATA=MODPARMB;
2482          TITLE1 'MODEL PARAMETERS CALCULATED USING THE AVE B1/2ND YR PK';
2483          VAR ST VINTAGE B1 B2 B3 MEANERR1 MEANERR2 MEANERR3;
2484          /*;
2485
2486          /*****
2487          * UPDATE AVERAGE PARAMETERS AND MEAN ERRORS FROM PASS 1 AND 2
2488          * NONLINEAR REGRESSIONS WITH AVERAGE PARAMETERS AND MEAN
2489          * ERRORS FROM PASS 3 REGRESSION.
2490          *****/;
2491          DATA MODPARM1;
2492          UPDATE MODPARMA MODPARMB; BY ST VINTAGE;
2493
2494          /* VARIABLES IN MODPARM1 RECORDS - 210
2495          VARIABLES FROM DATA SETS
2496          MODPARMA      MODPARMB
2497          B1            B1
2498          B2            B2
2499          B3            B3
2500          MEANERR1      MEANERR1
2501          MEANERR2      MEANERR2
2502          MEANERR3      MEANERR3
2503          SORT KEYS:   ST VINTAGE
2504          /*;
2505
2506          /*****
2507          * SORT PARAMETERS AND MEAN ERRORS BY STATE/AREA.
2508          *****/;
2509          PROC SORT DATA=MODPARM1; BY ST;
2510
2511          /*****
2512          * SORT REGRESSION INFORMATION AFTER PASS 2 AND PASS 3 BY
2513          * STATE/AREA, VINTAGE, AND PRODUCTION YEAR.
2514          *****/;
2515          PROC SORT DATA=PASS2END; BY ST VINTAGE YR;
2516          PROC SORT DATA=PASS3END; BY ST VINTAGE YR;
2517
2518          /*****
2519          * UPDATE REGRESSION INFORMATION FROM AFTER PASS 2 WITH
2520          * REGRESSION INFORMATION FROM AFTER PASS 3. RESULTS IS FINAL
2521          * AND COMPREHENSIVE REGRESSION INFORMATION FROM ALL PASSES.
2522          *****/;
2523          DATA YROUT1;
2524          UPDATE PASS2END PASS3END; BY ST VINTAGE YR;
2525
2526          /* VARIABLES IN MODPARM1 RECORDS - 210
2527          VARIABLES FROM DATA SETS
2528          MODPARMA      MODPARMB
2529          -----
2530          B1            B1
2531          B1P1          B1P1
2532          B1P1A         B1P1A
2533          B1P1B         B1P1B
2534          B1P2          B1P2
2535          B1START       B1START
2536          B2            B2
2537          B2P1          B2P1

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2538      B2P1A      B2P1A
2539      B2P1B      B2P1B
2540      B2P2      B2P2
2541      B2P3      B2P3
2542      B2START    B2START
2543      B3         B3
2544      B3AVE      B3AVE
2545      B3P1A      B3P1A
2546      B3P1B      B3P1B
2547      B3START    B3START
2548      GP2        GP2
2549      MAXIDK     MAXIDK
2550      MEANERR1    MEANERR1
2551      MEANERR2    MEANERR2
2552      MEANERR3    MEANERR3
2553      MERR1A     MERR1A
2554      MERR1B     MERR1B
2555      MERR1C     MERR1C
2556      MINIDK     MINIDK
2557      NPRATE1A    NPRATE1A
2558      NPRATE1B    NPRATE1B
2559      NPRATE1C    NPRATE1C
2560      NPRATE2     NPRATE2
2561      PCNTRES1    PCNTRES1
2562      PCNTRES2    PCNTRES2
2563      PRATE       PRATE
2564      PRATEO      PRATEO
2565      RECALC      RECALC
2566      RECALC1A    RECALC1A
2567      RECALC1B    RECALC1B
2568      RECALC1C    RECALC1C
2569      REPLACE2    REPLACE2
2570      R1         R1
2571      R1A        R1A
2572      R1B        R1B
2573      R1C        R1C
2574      R2         R2
2575      R3         R3
2576      SIGMA1     SIGMA1
2577      SIGMA1A     SIGMA1A
2578      SIGMA1B     SIGMA1B
2579      SIGMA1C     SIGMA1C
2580      SIGMA2     SIGMA2
2581      SIGMA3     SIGMA3
2582      SSE1       SSE1
2583      SSE1A      SSE1A
2584      SSE1B      SSE1B
2585      SSE1C      SSE1C
2586      SSE2       SSE2
2587      SSE3       SSE3
2588      SYM        SYM
2589      YHAT1       YHAT1
2590      YHAT1A      YHAT1A
2591      YHAT1B      YHAT1B
2592      YHAT1C      YHAT1C
2593      YHAT2       YHAT2
2594      YHAT3       YHAT3
2595      YRHIGHK     YRHIGHK
2596      YRLOWK      YRLOWK
2597      SORT KEYS:  ST VINTAGE YR
2598      */;
2599
2600      MODEL = YHAT1;
2601      IF YHAT2 NE . THEN MODEL=YHAT2;
2602      IF YHAT3 NE . THEN MODEL=YHAT3;
2603
2604      TITLE1 'TOTAL PRODUCTIVE CAPACITY (MCF) CALCULATED BY';
2605      TITLE2 'ADDING ALL VINTAGE YEARS FOR EACH PRODUCTION YEAR';
2606      TITLE3 'DATA DELETED USING THE -1 SIGMA CRITERIA';
2607
2608      /*****
2609      * SORT REGRESSION INFORMATION FROM ALL PASSES BY STATE/AREA *
2610      * AND PRODUCTION YEAR. *
2611      *****/;
2612      PROC SORT DATA=YROUT1; BY ST YR;
2613

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2614 /*****
2615 * PRINT OUT THE NUMBER OF AND THE SUM OF ALL VALUES FOR *
2616 * MODEL PEAK RATE ESTIMATES PER STATE/AREA PER PRODUCTION *
2617 * YEAR. *
2618 *****/;
2619 PROC MEANS DATA=YROUT1 N SUM ;
2620 VAR MODEL;
2621 BY ST YR;
2622
2623 /*****
2624 * BRING IN PARAMETER ESTIMATES AFTER PASS 3 AND ALL MEAN *
2625 * ERRORS. MAKE SURE ALL B3 PARAMETERS HAVE VALUES. *
2626 *****/;
2627 DATA PARMS;
2628 SET MODPARM1;
2629
2630 RETAIN B3A;
2631
2632 IF B3 NE . THEN B3A = B3;
2633 B3 = B3A;
2634
2635 DROP MEANERR1 MEANERR2 MEANERR3 B3A;
2636
2637 /*****
2638 * THE FOLLOWING SECTION CALCULATES ESTIMATES OF THE MODEL *
2639 * PARAMETERS, B1, B2, AND B3 FOR 1) THE PREVIOUS YEAR AND 2) *
2640 * THE CURRENT YEAR. PROC NLIN WAS PREVIOUSLY USED TO *
2641 * CALCULATE MODEL PARAMETERS FOR VINTAGE YEARS MINID THROUGH *
2642 * MAXID-2. *
2643 *****/;
2644 DATA YROUT2;
2645 *** BRING IN PEAK RATE INFORMATION FOR ALL PASSES;
2646 SET YROUT1;
2647
2648 RETAIN B3A;
2649
2650 *** ELIMINATE EXTRANEOUS DATA;
2651 KEP=0;
2652 IF YR EQ VINTAGE + 1901 THEN KEP=1;
2653 IF VINTAGE EQ MAXIDK THEN KEP=1;
2654 IF KEP NE 1 THEN DELETE;
2655
2656 *** MAKE SURE B3 HAS VALUE;
2657 IF B3 NE . THEN B3A = B3;
2658 B3 = B3A;
2659
2660 *** MAKE SURE MODEL HAS YHAT (PREDICTED PEAK RATE) VALUE;
2661 MODEL = YHAT1;
2662 IF YHAT2 NE . THEN MODEL=YHAT2;
2663 IF YHAT3 NE . THEN MODEL=YHAT3;
2664
2665 KEEP ST VINTAGE YR MAXIDK B1 B2 B3 GP2 PRATE PRATEO MODEL YRHIGHK;
2666
2667 /*****
2668 * SORT REVISED REGRESSION INFORMATION FROM ALL PASSES BY *
2669 * STATE/AREA AND VINTAGE. *
2670 *****/;
2671 PROC SORT DATA=YROUT2; BY ST VINTAGE;
2672
2673 /*****
2674 * UPDATE ESTIMATED PARAMETERS WITH REVISED REGRESSION *
2675 * INFORMATION. *
2676 *****/;
2677 DATA FIXPARM;
2678 UPDATE PARMS YROUT2; BY ST VINTAGE;
2679
2680 /* VARIABLES IN FIXPARM RECORDS - 210
2681 VARIABLES FROM DATA SETS
2682 PARMS YROUT2
2683 -----
2684 B1 B1
2685 B2 B2
2686 B3 B3
2687 GP2
2688 MAXIDK
2689 MODEL
2690 PRATE

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2691             PRATEO
2692             YR
2693             YRHIGHK
2694     SORT KEYS:  ST VINTAGE
2695     *;/
2696
2697     /* CALCULATE B2 FOR VINTAGE MAXIDK-1.  B1 WAS CALCULATED FROM
2698     B1/2NDYR PEAK RATE RATIO; B3 WAS SET TO B3AVE. */;
2699
2700     IF (VINTAGE EQ MAXIDK-1) AND (YR EQ YRHIGHK) THEN DO;
2701         B2 = GP2/(1 - (PRATE/B1)**(1/B3));
2702         MODEL = PRATE;
2703     END;
2704
2705     /*****
2706     * READ IN NUMBER OF WELLS INFORMATION.
2707     *****/;
2708 DATA WELLS;
2709     SET IN4.PROD;
2710
2711     *** DELETE RECORDS FOR NUMBER OF WELLS EQUALING ZERO;
2712     IF GWELLS EQ 0 THEN DELETE;
2713     *** KEEP RECORDS FOR DECEMBER OF FIRST PRODUCTION YEAR;
2714     IF VINTAGE EQ (YR-1900) AND MONTH EQ 12 THEN OUTPUT;
2715     DELETE;
2716
2717     KEEP ST VINTAGE GWELLS;
2718
2719     /*****
2720     * SORT NUMBER OF WELLS INFORMATION BY STATE/AREA AND VINTAGE.
2721     * SORT PARAMETER INFORMATION BY SAME VARIABLES.
2722     *****/;
2723 PROC SORT DATA=WELLS;    BY ST VINTAGE;
2724 PROC SORT DATA=FIXPARM; BY ST VINTAGE;
2725
2726     /* CALCULATE MODEL PARAMETERS FOR THE CURRENT YEAR BASED ON THE
2727     RATIOS OF THE VALUES FOR THE PAST 3 YEARS TO THE NUMBER OF
2728     WELLS DRILLED IN EACH OF THESE YEARS. */;
2729
2730     /*****
2731     * MERGE PARAMETER INFORMATION WITH NUMBER OF WELLS INFORMATION.
2732     *****/;
2733 DATA YROUT3;
2734     MERGE FIXPARM WELLS; BY ST VINTAGE;
2735
2736     /* VARIABLES IN YROUT3  RECORDS - 210
2737     VARIABLES FROM DATA SETS
2738     FIXPARM      WELLS
2739     -----
2740             B1      GWELLS
2741             B2
2742             B3
2743             GP2
2744             MAXIDK
2745             MODEL
2746             PRATE
2747             PRATEO
2748             YR
2749             YRHIGHK
2750     SORT KEYS:  ST VINTAGE
2751     *;/
2752
2753     IF MAXIDK EQ . THEN DELETE;
2754
2755     IF VINTAGE GE MAXIDK-3 AND VINTAGE LE MAXIDK-1 THEN DO;
2756         PWB1 = B1/GWELLS;
2757         MODWELL = MODEL/GWELLS;
2758         GP2WELL = GP2/GWELLS;
2759     END;
2760
2761     TITLE 'AVERAGE PER-WELL VALUES FOR LAST THREE PRODUCTION YEARS ';
2762     PROC PRINT;
2763
2764     /*****
2765     * GET MEAN OF PWB1, GP2WELL, MODWELL PER STATE/AREA.
2766     *****/;
2767 PROC MEANS N MEAN STD;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2768 VAR PWB1 GP2WELL MODWELL;
2769 OUTPUT OUT1=AVEWELL1 MEAN= MPWB1 MGP2WELL MMODWELL;
2770 BY ST;
2771
2772 /*****
2773  * MERGE AND OUTPUT B1 PARAMETER, ESTIMATED PEAK RATE, AND GP2*
2774  * PER WELL AVERAGES FOR VINTAGE EQUAL LAST VINTAGE YEAR WITH *
2775  * FIRST AND LAST VINTAGE YEARS.
2776  *****/
2777 DATA OUT1.AVEWELL;
2778 MERGE AVEWELL1 IDRANGE;
2779
2780 /* VARIABLES IN OUT1.AVEWELL RECORDS - 210
2781 VARIABLES FROM DATA SETS
2782 AVEWELL1 IDRANGE
2783 MPWB1 MAXID
2784 MGP2WELL MINID
2785 MMODWELL
2786 SORT KEYS: ST
2787 ADD VARS: VINTAGE
2788 */;
2789
2790 VINTAGE = MAXID;
2791
2792 TITLE 'AVERAGE B1/WELL AND VALUES FOR CALCULATING AVE B2/WELL';
2793
2794 PROC PRINT;
2795
2796 /*****
2797  * SORT ABOVE AVERAGES BY STATE/AREA AND VINTAGE.
2798  * SORT PEAK RATE AND NUMBER OF WELLS INFORMATION BY SAME
2799  * VARIABLES.
2800  *****/
2801 PROC SORT DATA=OUT1.AVEWELL; BY ST VINTAGE;
2802 PROC SORT DATA=YROUT3; BY ST VINTAGE;
2803
2804 /*****
2805  * ADD AVERAGES WITH PEAK RATE AND NUMBER OF WELLS
2806  * INFORMATION.
2807  *****/
2808 DATA YROUT4;
2809 UPDATE YROUT3 OUT1.AVEWELL; BY ST VINTAGE;
2810
2811 /* VARIABLES IN YROUT4 RECORDS - 210
2812 VARIABLES FROM DATA SETS
2813 YROUT3 OUT1.AVEWELL
2814 -----
2815 B1 MAXID
2816 PWB1 MPWB1
2817 B2 MGP2WELL
2818 B3 MINID
2819 GP2 MMODWELL
2820 GP2WELL
2821 GWELLS
2822 MAXID
2823 MAXIDK
2824 MODEL
2825 MODWELL
2826 PRATE
2827 PRATEO
2828 YR
2829 YRHIGHK
2830 SORT KEYS: ST VINTAGE
2831 ADD VARS: SYM
2832 */;
2833
2834 *** CALCULATE B1 & B2 PARAMETERS, PRODUCTION RATE, AND *;
2835 *** PRODUCTION RATE FOR ALL WELLS FOR A STATE/AREA AND VINTAGE *;
2836 IF MPWB1 NE . THEN DO;
2837 B1 = MPWB1*GWELLS;
2838 PWB2 = MGP2WELL/(1 - (MMODWELL/MPWB1)**(1/B3));
2839 B2 = PWB2*GWELLS;
2840 MODEL = MMODWELL*GWELLS;
2841 SYM = 'W';
2842 END;
2843
2844 DROP MAXID MINID YR;

```


Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2845
2846 /* PREPARE THE DATA FOR FINAL OUTPUT. THE OUTPUT FROM CHYP9 CONSISTS
2847 OF THREE DATA SETS NECESSARY FOR EXECUTION OF RD4ZZ, PRINTOUTS OF
2848 THE RESULTS, AND CALCULATION OF PARAMETERS NECESSARY FOR THE
2849 PROJECTION PROGRAMS. */;
2850
2851 /*****
2852 * SORT PEAK RATE, AVERAGES, AND NUMBER OF WELLS INFORMATION *
2853 * BY STATE/AREA AND VINTAGE. *
2854 *****/;
2855 PROC SORT DATA=YROUT4; BY ST VINTAGE;
2856
2857 /*****
2858 * MERGE PEAK RATE, AVERAGES, AND NUMBER OF WELLS INFORMATION *
2859 * WITH VINTAGE MATRIX. *
2860 *****/;
2861 DATA OUT2PMS;
2862 MERGE YROUT4 VINTRNGE; BY ST VINTAGE;
2863
2864 KEEP ST VINTAGE B1 B2 B3 MAXID MINID;
2865
2866 /*****
2867 * DUPLICATE VINTAGE MATRICES FOR EACH PRODUCTION YEAR AND *
2868 * MONTH. *
2869 *****/;
2870 DATA FINAL;
2871 SET OUT2PMS;
2872
2873 YRLOW = VINTAGE + 1900;
2874 YRHIGH = MAXID + 1900;
2875 DO YR = YRLOW TO YRHIGH;
2876 DO MONTH = 1 TO 13;
2877 OUTPUT;
2878 END;
2879 END;
2880
2881 /*****
2882 * SORT REGRESSION PEAK RATE, AVERAGES, AND NUMBER OF WELLS *
2883 * VINTAGE MATRICES BY STATE/AREA, VINTAGE, PRODUCTION YEAR, *
2884 * PRODUCTION MONTH. *
2885 *****/;
2886 PROC SORT DATA=FINAL; BY ST VINTAGE YR MONTH;
2887
2888 /*****
2889 * SORT INITIAL PEAK RATE DATA BY STATE/AREA, VINTAGE, *
2890 * PRODUCTION YEAR, AND PRODUCTION MONTH. *
2891 *****/;
2892 PROC SORT DATA=DAT3; BY ST VINTAGE YR MONTH;
2893
2894 /*****
2895 * MERGE INITIAL PEAK RATE DATA WITH REGRESSION PEAK RATE *
2896 * INFORMATION, AVERAGES, AND NUMBER OF WELLS VINTAGE *
2897 * MATRICES. *
2898 *****/;
2899 DATA DAT4 DAT5 DAT6 DAT7 DAT8 ;
2900 MERGE DAT3 FINAL; BY ST VINTAGE YR MONTH;
2901
2902 /* VARIABLES IN DAT4 - DAT8 RECORDS - 210
2903 VARIABLES FROM DATA SETS
2904 DAT3 FINAL
2905 -----
2906 GPM B1
2907 GP1 B2
2908 GP2 B3
2909 LOWPRATE MAXID
2910 LOWTRATE MINID
2911 PPERC YRHIGH
2912 PRATE YRLOW
2913 RATE
2914 SYM
2915 TEST
2916 SORT KEYS: ST VINTAGE YR MONTH
2917 ADD VARS: MODEL MCUM
2918 */;
2919
2920 IF MONTH = 13 THEN MONTH = .;
2921

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2922 IF GP2 GT 0 THEN MODEL = B1*(1-GP2/B2)**B3;
2923
2924 MCUM=12*(YR-(1900+MINID)) + MONTH;
2925
2926 *** DAT6 - INITIAL PEAK RATES AND CUMS WITH PEAK DAILY RATE > ZERO;
2927 IF RATE GT 0 THEN DO;
2928     DIFF=100*(RATE/MODEL - 1);
2929     OUTPUT DAT6;
2930 END;
2931
2932 IF PRATE EQ . THEN PRATE = MODEL;
2933
2934 *** DAT4 - INITIAL PEAK RATES AND CUMS FOR VINTAGES PRIOR TO 1980;
2935 *** DAT5 - INITIAL PEAK RATES AND CUMS FOR VINTAGES 1980 AND GREATER;
2936 *** DAT7 - INITIAL PEAK RATES AND CUMS FOR FIRST PRODUCTION YEAR;
2937 *** DAT8 - ALL INITIAL PEAK RATES AND CUMS;
2938 IF MINID < VINTAGE < 80 THEN OUTPUT DAT4;
2939 IF VINTAGE GE 80 THEN OUTPUT DAT5;
2940 IF VINTAGE EQ MINID THEN OUTPUT DAT7;
2941 OUTPUT DAT8;
2942
2943 /*****
2944  * SORT PEAK RATE AND CUM DATA WITH PEAK DAILY RATE > ZERO BY *
2945  * STATE/AREA AND VINTAGE. *
2946  *****/;
2947 PROC SORT DATA=DAT6; BY ST VINTAGE;
2948
2949 /*****
2950  * FOR DEBUG PURPOSES *
2951  *****/;
2952 /*
2953 PROC PRINT DATA=DAT6;
2954 VAR GP1 GP2 RATE PPERC LOWPRATE TEST LOWTRATE B1 B2 B3 PRATE
2955     MODEL DIFF;
2956 FORMAT VINTAGE YR MONTH 6. B2 GP1 GP2 12. PPERC DIFF 6.1
2957     B1 MODEL PRATE RATE LOWTRATE LOWPRATE TEST 8. B3 8.4 ;
2958 TITLE 'HYPERBOLIC RATE CURVES FROM CHYP9';
2959 ID YR;
2960 BY ST VINTAGE;
2961 *;/
2962
2963 /*****
2964  * KEEP AND OUTPUT CERTAIN VARIABLES FROM PEAK RATE AND CUM *
2965  * DATA WITH DAILY PEAK RATES > ZERO. *
2966  *****/;
2967 DATA OUT3.SORTED;
2968 SET DAT6;
2969
2970 KEEP ST VINTAGE YR GPM RATE PRATE B3 GP1 GP2 PPERC LOWPRATE TEST
2971     LOWTRATE;
2972
2973 /*****
2974  * SORT ALL PEAK RATE AND CUM DATA BY VINTAGE, PRODUCTION *
2975  * YEAR, AND PRODUCTION MONTH. *
2976  *****/;
2977 PROC SORT DATA=DAT8; BY VINTAGE YR MONTH;
2978
2979 /*****
2980  * KEEP AND OUTPUT CERTAIN VARIABLES FROM PEAK RATE AND CUM *
2981  * DATA. *
2982  *****/;
2983 DATA OUT4.PRODDATA;
2984 SET DAT8;
2985
2986 KEEP ST VINTAGE YR MONTH GP1 GP2 RATE PRATE;
2987 *** DELETE DATA WHERE VINTAGE IS PRIOR TO EARLIEST VINTAGE YEAR;
2988 *** DELETE DATA WHERE PRODUCTION YEAR IS PRIOR TO EARLIEST PROD YEAR;
2989 IF VINTAGE LT MINID THEN DELETE;
2990 IF YR LT YRLOW THEN DELETE;
2991 OUTPUT;
2992
2993 /*****
2994  * READ IN YEAR-END CUMS. *
2995  *****/;
2996 DATA DAT9A;
2997 SET IN3.YECUMS;
2998

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

2999 *IF ST NE 'ZZZ' THEN DELETE;
3000
3001 /*****
3002  * SORT YEAR-END CUMS BY STATE/AREA AND VINTAGE.
3003  *****/;
3004 PROC SORT DATA=DAT9A; BY ST VINTAGE;
3005
3006 /*****
3007  * GET LAST PRODUCTION YEAR FROM YEAR-END CUMS PER STATE/AREA
3008  * PER VINTAGE.
3009  *****/;
3010 PROC MEANS NOPRINT;
3011   VAR YR;
3012   OUTPUT OUT=MAXYEAR MAX = MAXYR;
3013   BY ST VINTAGE;
3014
3015 /*****
3016  * MERGE LAST PRODUCTION YEAR OF YEAR-END CUMS WITH VINTAGE
3017  * MATRIX.
3018  *****/;
3019 DATA DAT9B;
3020   MERGE MAXYEAR VINTRNGE; BY ST VINTAGE;
3021
3022 /* VARIABLES IN DAT9B RECORDS - 210
3023   VARIABLES FROM DATA SETS
3024     MAXYEAR      VINTRNGE
3025   -----
3026     MAXYR          MAXID
3027                   MINID
3028   SORT KEYS:    ST VINTAGE
3029   */;
3030
3031 *** DUPLICATE MATRIX FOR EACH PRODUCTION YEAR;
3032   YRLOW = VINTAGE + 1900;
3033   YRHIGH = MAXID + 1900;
3034   DO YR = YRLOW TO YRHIGH;
3035     OUTPUT;
3036   END;
3037
3038 *IF ST NE 'ZZZ' THEN DELETE;
3039
3040 /*****
3041  * SORT LAST PRODUCTION YEAR VINTAGE MATRIX BY STATE/AREA,
3042  * VINTAGE, AND PRODUCTION YEAR.
3043  * SORT YEAR-END CUM DATA BY SAME VARIABLES.
3044  *****/;
3045 PROC SORT DATA=DAT9B; BY ST VINTAGE YR;
3046 PROC SORT DATA=DAT9A; BY ST VINTAGE YR;
3047
3048 /*****
3049  * MERGE YEAR-END CUMS WITH LAST PRODUCTION YEAR VINTAGE
3050  * MATRIX.
3051  *****/;
3052 DATA DAT9;
3053   MERGE DAT9A DAT9B; BY ST VINTAGE YR;
3054
3055 /* VARIABLES IN DAT9 RECORDS - 210
3056   VARIABLES FROM DATA SETS
3057     DAT9A      DAT9B
3058     YECUM      MAXID
3059               MAXYR
3060               MINID
3061               YRHIGH
3062               YRLOW
3063   SORT KEYS:  ST VINTAGE YR
3064   */;
3065
3066 IF YR NE MAXYR THEN DELETE;
3067
3068 KEEP YECUM ST VINTAGE YR;
3069
3070 TITLE 'LISTING OF DAT9';
3071 PROC PRINT DATA=DAT9;
3072
3073 /*****
3074  * INITIAL PEAK RATE DATA AND REGRESSION INFORMATION.
3075  *****/;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

3076 DATA DAT10;
3077 SET DAT8;
3078
3079 *** KEEP DECEMBER OF LAST PRODUCTION YEAR DATA;
3080 IF YR NE (MAXID + 1900) THEN DELETE;
3081 IF MONTH NE 12 THEN DELETE;
3082
3083 *** ELIMINATE DATA WITH NO VINTAGE YEAR;
3084 IF VINTAGE EQ . THEN DELETE;
3085
3086 *IF ST NE 'ZZZ' THEN DELETE;
3087 /*****
3088 * FOR DEBUG PURPOSES.
3089 *****/;
3090 /*
3091 TITLE 'DEBUG LISTING OF DAT10';
3092 PROC PRINT;
3093 *//;
3094
3095 /*****
3096 * SORT YEAR-END CUM VINTAGE MATRIX BY STATE/AREA, VINTAGE,
3097 * AND PRODUCTION YEAR.
3098 * SORT PEAK RATE AND REGRESSION INFORMATION BY SAME
3099 * VARIABLES.
3100 *****/;
3101 PROC SORT DATA=DAT9 ;BY ST VINTAGE YR;
3102 PROC SORT DATA=DAT10;BY ST VINTAGE YR;
3103
3104 /*****
3105 * MERGE YEAR-END CUM VINTAGE MATRIX WITH PEAK RATE AND
3106 * REGRESSION INFORMATION.
3107 *****/;
3108 DATA DAT11;
3109 MERGE DAT9 DAT10;BY ST VINTAGE YR;
3110
3111 /* VARIABLES IN DAT11 RECORDS - 210
3112 VARIABLES FROM DATA SETS
3113 DAT9 DAT10
3114 -----
3115 YECUM B1
3116 B2
3117 B3
3118 DIFF
3119 GPM
3120 GP1
3121 GP2
3122 LOWPRATE
3123 LOWTRATE
3124 MAXID
3125 MCUM
3126 MINID
3127 MODEL
3128 PPERC
3129 PRATE
3130 RATE
3131 SYM
3132 TEST
3133 YRHIGH
3134 YRLOW
3135 SORT KEYS: ST VINTAGE YR MONTH
3136 ADD VARS: MODEL MCUM
3137 *//;
3138
3139 /*****
3140 * SORT PEAK RATE, YEAR-END CUM AND REGRESSION INFORMATION
3141 * VINTAGE MATRICES BY STATE/AREA AND VINTAGE.
3142 *****/;
3143 PROC SORT DATA=DAT11; BY ST VINTAGE;
3144
3145 /*****
3146 * UPDATE PEAK RATE, YEAR-END CUM AND REGRESSION INFORMATION
3147 * VINTAGE MATRICES WITH PEAK RATE MEANS FOR LAST YEAR OF
3148 * PRODUCTION.
3149 *****/;
3150 DATA OUT2.PARMS;
3151 UPDATE DAT11 OUT1.AVEWELL; BY ST VINTAGE;
3152

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

3153   RETAIN QETOT 0 YECUMTOT 0 GP1TOT 0;
3154
3155   * KEEP ST VINTAGE YR B1 B2 B3 GP1 YECUM QE;
3156
3157   *IF ST NE 'ZZZ' THEN DELETE;
3158
3159   IF YR LT YRLOW THEN DELETE;
3160
3161   /*****
3162   *
3163   *           WARNING !!!
3164   *
3165   * THE FOLLOWING STATEMENT RE-DEFINES GP2
3166   * PREVIOUSLY: GP2 = GPM - GP1
3167   * RE-DEFINED: GP2 = YECUM - GP1
3168   *
3169   *
3170   *
3171   * *****/
3172   *****/;
3173
3174   GP2      = YECUM-GP1;
3175
3176   QE       = B1*(1-GP2/B2)**B3;
3177   OUTPUT;
3178
3179   *** CALCULATE TOTALS FOR EACH VINTAGE YEAR;
3180   QETOT    = QETOT + QE;
3181   YECUMTOT = YECUMTOT + YECUM;
3182   GP1TOT   = GP1TOT + GP1;
3183
3184   IF VINTAGE EQ MAXID THEN DO;
3185     QE      = QETOT;
3186     GP1     = GP1TOT;
3187     YECUM   = YECUMTOT;
3188     VINTAGE = 99;
3189     PWB2    = MGP2WELL/(1 - (MMODWELL/MPWB1)**(1/B3));
3190     B1      = MPWB1;
3191     B2      = PWB2;
3192     OUTPUT;
3193     ***** REINITIALIZATION OF ACCUMULATORS *****;
3194     QETOT=0; GP1TOT=0; YECUMTOT=0;
3195     END;
3196
3197   /*****
3198   * SORT PEAK RATE, YEAR-END CUM AND REGRESSION INFORMATION BY *
3199   * STATE/AREA AND VINTAGE. *
3200   *****/;
3201   PROC SORT DATA=OUT2.PARMS; BY ST VINTAGE;
3202
3203   /*****
3204   * FOR DEBUG PURPOSES *
3205   *****/;
3206   /*
3207   PROC PRINT;
3208     VAR ST YR VINTAGE GP1 YECUM B1 B2 B3 QE;
3209     TITLE 'HYPERBOLIC PRODUCTION RATE CURVES, (QP(1-GP/U)**B)';
3210     FORMAT VINTAGE YR 6. B2 GP1 12. B1 QE 8. B3 8.4 ;
3211     BY ST VINTAGE;
3212     /*;
3213
3214   /*****
3215   * FOR DEBUG PURPOSES *
3216   *****/;
3217   /*
3218   PROC PRINT;
3219     VAR ST VINTAGE YR YECUM GP1 B1 B2 B3 MODEL QE
3220     QETOT YECUMTOT GP1TOT;
3221     /*;
3222
3223
3224   /*****
3225   * THE FOLLOWING CODE IS ONLY NEEDED TO FIND THE VARIABLE *
3226   * NAMES IN THIS PROGRAM. LEAVE COMMENTED OUT WHEN NOT *
3227   * NEEDED. *
3228   *****/;
3229   /*

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

3230 PROC PRINTTO UNIT=22 NEW;
3231
3232 PROC CONTENTS DATA=ANS1P3;
3233 PROC CONTENTS DATA=ANS2P1;
3234 PROC CONTENTS DATA=ANS2P2;
3235 PROC CONTENTS DATA=ANS3AP1;
3236 PROC CONTENTS DATA=ANS3BP1;
3237 PROC CONTENTS DATA=ANSALLP2;
3238 PROC CONTENTS DATA=ANSALLP3;
3239 PROC CONTENTS DATA=ANSF3AP1;
3240 PROC CONTENTS DATA=ANSF3BP1;
3241 PROC CONTENTS DATA=ANSFT2P1;
3242 PROC CONTENTS DATA=AVEB3P1;
3243 PROC CONTENTS DATA=AVERATIO;
3244 PROC CONTENTS DATA=AVEWELL1;
3245 PROC CONTENTS DATA=COEF1P3;
3246 PROC CONTENTS DATA=COEF2P1;
3247 PROC CONTENTS DATA=COEF2P2;
3248 PROC CONTENTS DATA=COEF3AP1;
3249 PROC CONTENTS DATA=COEF3BP1;
3250 PROC CONTENTS DATA=DAT1;
3251 PROC CONTENTS DATA=DAT2;
3252 PROC CONTENTS DATA=DAT2A;
3253 PROC CONTENTS DATA=DAT2B;
3254 PROC CONTENTS DATA=DAT2C;
3255 PROC CONTENTS DATA=DAT3A;
3256 PROC CONTENTS DATA=DAT3;
3257 PROC CONTENTS DATA=DAT4;
3258 PROC CONTENTS DATA=DAT5;
3259 PROC CONTENTS DATA=DAT6;
3260 PROC CONTENTS DATA=DAT7;
3261 PROC CONTENTS DATA=DAT8;
3262 PROC CONTENTS DATA=DAT9;
3263 PROC CONTENTS DATA=DAT9A;
3264 PROC CONTENTS DATA=DAT9B;
3265 PROC CONTENTS DATA=DAT10;
3266 PROC CONTENTS DATA=DAT11;
3267 *PROC CONTENTS DATA=DAT11A;
3268 PROC CONTENTS DATA=DATX;
3269 PROC CONTENTS DATA=DEL3AP1;
3270 PROC CONTENTS DATA=DUPCOEF2;
3271 PROC CONTENTS DATA=DUPYEAR1;
3272 PROC CONTENTS DATA=DUPYEAR3;
3273 PROC CONTENTS DATA=BSTP1;
3274 PROC CONTENTS DATA=FINAL;
3275 PROC CONTENTS DATA=FIT1P3;
3276 PROC CONTENTS DATA=FIT2P1;
3277 PROC CONTENTS DATA=FIT2P2;
3278 PROC CONTENTS DATA=FIT3AP1;
3279 PROC CONTENTS DATA=FIT3BP1;
3280 PROC CONTENTS DATA=FITALLP2;
3281 PROC CONTENTS DATA=FITALLP3;
3282 PROC CONTENTS DATA=FIX2A;
3283 PROC CONTENTS DATA=FIXPARM;
3284 PROC CONTENTS DATA=IDRANGE;
3285 PROC CONTENTS DATA=INITIAL;
3286 PROC CONTENTS DATA=MAXYEAR;
3287 PROC CONTENTS DATA=MEANRAT;
3288 PROC CONTENTS DATA=MEANSTP2;
3289 PROC CONTENTS DATA=MODPARM1;
3290 PROC CONTENTS DATA=MODPARMA;
3291 PROC CONTENTS DATA=MODPARMB;
3292 PROC CONTENTS DATA=MSTP2DUP;
3293 PROC CONTENTS DATA=NMAXP1;
3294 PROC CONTENTS DATA=OUT1.AVEWELL;
3295 PROC CONTENTS DATA=OUT2PMS;
3296 PROC CONTENTS DATA=OUT3.SORTED;
3297 PROC CONTENTS DATA=OUT4.PRODDATA;
3298 PROC CONTENTS DATA=PARM1P3;
3299 PROC CONTENTS DATA=PARM2P1;
3300 PROC CONTENTS DATA=PARM2P2;
3301 PROC CONTENTS DATA=PARM3AP1;
3302 PROC CONTENTS DATA=PARM3BP1;
3303 PROC CONTENTS DATA=PARMS;
3304 PROC CONTENTS DATA=PASS1END;
3305 PROC CONTENTS DATA=PASS1PLT;
3306 PROC CONTENTS DATA=PASS2END;

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

3307 PROC CONTENTS DATA=PASS2PLT;
3308 PROC CONTENTS DATA=PASS3;
3309 PROC CONTENTS DATA=PASS3PLT;
3310 PROC CONTENTS DATA=PASS3END;
3311 PROC CONTENTS DATA=PASS3REV;
3312 PROC CONTENTS DATA=REGESTP1;
3313 PROC CONTENTS DATA=SELECTPK;
3314 PROC CONTENTS DATA=STESTP1;
3315 PROC CONTENTS DATA=TRANS2P1;
3316 PROC CONTENTS DATA=TRANSP1;
3317 PROC CONTENTS DATA=TRANSP3;
3318 PROC CONTENTS DATA=VINTRNGE;
3319 PROC CONTENTS DATA=VNMAXP1;
3320 PROC CONTENTS DATA=VNUMP1B;
3321 PROC CONTENTS DATA=VYRNMP1B;
3322 PROC CONTENTS DATA=VYRNMXP1;
3323 PROC CONTENTS DATA=WELLS;
3324 PROC CONTENTS DATA=YRCOE3A;
3325 PROC CONTENTS DATA=YRCOE3B;
3326 PROC CONTENTS DATA=YROUT1;
3327 PROC CONTENTS DATA=YROUT2;
3328 PROC CONTENTS DATA=YROUT3;
3329 PROC CONTENTS DATA=YROUT4;
3330 */;
3331
3332 /*
3333 /**
3334 /*****
3335  * INITIAL PEAK RATE AND REGRESSION INFORMATION.
3336  *****/;
3337 DATA DATX;
3338 SET DAT8;
3339
3340 *** KEEP DATA FOR DECEMBER OF 2ND PRODUCTION YEAR;
3341 IF YR EQ (1901 + VINTAGE) AND MONTH EQ 12 THEN DO;
3342 OUTPUT;
3343 END;
3344 DELETE;
3345
3346 /*****
3347  * SORT INITIAL PEAK RATE AND REGRESSION INFORMATION FOR
3348  * DECEMBER OF 2ND PRODUCTION YEAR BY STATE/AREA.
3349  *****/;
3350 PROC SORT DATA=DATX; BY ST;
3351
3352 /*****
3353  * FOR DEBUG PURPOSES
3354  *****/;
3355 /*
3356 PROC PRINT DATA=DATX;
3357 VAR ST YR VINTAGE GP1 GP2 B1 B2 B3 MODEL;
3358 FORMAT VINTAGE YR 6. B2 GP1 GP2 12. B1 MODEL 8. B3 8.4 ;
3359 TITLE 'DATA FOR CALCULATING AVERAGE B2 FROM 1ST 3YRS DATA';
3360 BY ST;
3361
3362 /*****
3363  * PEAK RATE AND REGRESSION INFORMATION FOR VINTAGES PRIOR TO
3364  * 1980.
3365  *****/;
3366 DATA DAT4A;
3367 SET DAT4;
3368
3369 *IF ST NE 'ZZZ' THEN DELETE;
3370
3371 /*****
3372  * PLOT REGRESSION CURVE FOR VINTAGES PRIOR TO 1980
3373  *****/;
3374 PROC TAG
3375 DATA=DAT4A;
3376 PARMCARDS4;
3377 GENERATE A PLOT.
3378 SAS DATA.
3379 USE X=GP2 Y= PRATE CLASS=VINTAGE .
3380 END OF DATA.
3381
3382
3383 PAGE BORDER IS 0.

```

Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

3384 X PAGE 14, Y PAGE 11.
3385
3386 X AXIS LENGTH IS 11.0.
3387 X AXIS HEIGHT IS .12.
3388 X AXIS ORIGIN IS 1.5.
3389 X MIN 0.
3390
3391 Y AXIS MIN 0.
3392 Y AXIS LENGTH IS 8.5.
3393 Y AXIS ORIGIN IS 1.5.
3394
3395 FOR EVERY CURVE, SYMBOL SIZE IS 1,SYMBOL COUNT IS 9999.
3396
3397 LEGEND X ORIGIN IS 12.6, Y ORIGIN IS 1.75, HEIGHT IS .09.
3398
3399
3400 X AXIS LABEL STYLE IS DUPLEX .
3401 Y AXIS LABEL STYLE IS DUPLEX.
3402 X AXIS STYLE IS DUPLEX.
3403 Y AXIS STYLE IS DUPLEX.
3404
3405 X GRID IS ON.
3406 Y GRID IS ON.
3407 GRID COLOR IS GREEN, TEXTURE IS 1.
3408
3409 X LABEL 'CUMULATIVE PRODUCTION '.
3410 X LABEL HEIGHT IS 0.14.
3411 Y LABEL HEIGHT IS 0.14.
3412 Y LABEL 'PEAK RATE, MCF/D'.
3413
3414 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
3415 TITLE 'HYPERBOLIC PRODUCTION RATE CURVES FOR ZZZ, (QP(1-GP/U)**B) '.
3416
3417 GO.
3418 ;;;;
3419
3420 /*****
3421  * PEAK RATE AND REGRESSION INFORMATION FOR VINTAGES OF 1980      *
3422  * AND LATER.                                                       *
3423  *****/
3424 DATA DAT5A;
3425 SET DAT5;
3426
3427 IF ST NE 'ZZZ' THEN DELETE;
3428
3429 /*****
3430  * PLOT REGRESSION CURVE FOR VINTAGES OF 1980 AND LATER.          *
3431  *****/
3432 PROC TAG
3433     DATA=DAT5A;
3434     PARMCARDS4;
3435     GENERATE A PLOT.
3436     SAS DATA.
3437     USE X=GP2 Y= PRATE CLASS=VINTAGE .
3438     END OF DATA.
3439
3440
3441 PAGE BORDER IS 0.
3442 X PAGE 14, Y PAGE 11.
3443
3444 X AXIS LENGTH IS 11.0.
3445 X AXIS HEIGHT IS .12.
3446 X AXIS ORIGIN IS 1.5.
3447 X MIN 0.
3448
3449 Y AXIS MIN 0.
3450 Y AXIS LENGTH IS 8.5.
3451 Y AXIS ORIGIN IS 1.5.
3452
3453 FOR EVERY CURVE, SYMBOL SIZE IS 1,SYMBOL COUNT IS 9999.
3454
3455 LEGEND X ORIGIN IS 12.6, Y ORIGIN IS 1.75, HEIGHT IS .09.
3456
3457
3458 X AXIS LABEL STYLE IS DUPLEX .
3459 Y AXIS LABEL STYLE IS DUPLEX.
3460 X AXIS STYLE IS DUPLEX.

```


Table B5. SAS Program Listing for CHYP9TMP (Continued)

```

3461 Y AXIS STYLE IS DUPLEX.
3462
3463 X GRID IS ON.
3464 Y GRID IS ON.
3465 GRID COLOR IS GREEN, TEXTURE IS 1.
3466
3467 X LABEL 'CUMULATIVE PRODUCTION '.
3468 X LABEL HEIGHT IS 0.14.
3469 Y LABEL HEIGHT IS 0.14.
3470 Y LABEL 'PEAK RATE, MCF/D'.
3471
3472 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
3473 TITLE 'HYPERBOLIC PRODUCTION RATE CURVES FOR ZZZ, (QP(1-GP/U)**B)'.
3474
3475 GO.
3476 ;;;;
3477
3478
3479 /*****
3480 * PEAK RATE AND REGRESSION INFORMATION FOR FIRST PRODUCTION *
3481 * YEARS. *
3482 *****/
3483 DATA DAT7A;
3484 SET DAT7;
3485
3486 IF ST NE 'ZZZ' THEN DELETE;
3487
3488 /*****
3489 * PLOT REGRESSION CURVE FOR FIRST PRODUCTION YEARS. *
3490 *****/
3491 PROC TAG
3492 DATA=DAT7 ;
3493 PARMCARDS4;
3494 GENERATE A PLOT.
3495 SAS DATA.
3496 USE X=GP2 Y= PRATE CLASS=VINTAGE .
3497 END OF DATA.
3498
3499
3500 PAGE BORDER IS 0.
3501 X PAGE 14, Y PAGE 11.
3502
3503 X AXIS LENGTH IS 11.0.
3504 X AXIS HEIGHT IS .12.
3505 X AXIS ORIGIN IS 1.5.
3506 X MIN 0.
3507
3508 Y AXIS MIN 0.
3509 Y AXIS LENGTH IS 8.5.
3510 Y AXIS ORIGIN IS 1.5.
3511
3512 FOR EVERY CURVE, SYMBOL SIZE IS 1,SYMBOL COUNT IS 9999.
3513
3514 LEGEND X ORIGIN IS 12.6, Y ORIGIN IS 1.75, HEIGHT IS .09.
3515
3516
3517 X AXIS LABEL STYLE IS DUPLEX .
3518 Y AXIS LABEL STYLE IS DUPLEX.
3519 X AXIS STYLE IS DUPLEX.
3520 Y AXIS STYLE IS DUPLEX.
3521
3522 X GRID IS ON.
3523 Y GRID IS ON.
3524 GRID COLOR IS GREEN, TEXTURE IS 1.
3525
3526 X LABEL 'CUMULATIVE PRODUCTION '.
3527 X LABEL HEIGHT IS 0.14.
3528 Y LABEL HEIGHT IS 0.14.
3529 Y LABEL 'PEAK RATE, MCF/D'.
3530
3531 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
3532 TITLE 'HYPERBOLIC PRODUCTION RATE CURVES FOR ZZZ, (QP(1-GP/U)**B)'.
3533
3534 GO.
3535 ;;;;

```

Table B6. SAS Program Listing for DRD4TMPL

```

1 //uidUR4JJ JOB (acct,DAL,,99),NAME,REGION=600K,TIME=(00,20),
2 // MSGCLASS=A
3 /*PHOLD
4 /*******
5 /** DRD4TMPL BY VELTON FUNK
6 /** MODIFIED BY LESTER J. WALTERS JR. 3/30/92
7 /**
8 /** RD4ZZ READS FIRST 12 MONTHS OF PRODUCTION DATA FOR
9 /** ALL VINTAGE YEARS AND CALCULATES AN AVERAGE PRODUCTION
10 /** PATTERN FOR THE FIRST YEAR OF NEW WELLS.
11 /** A TELL-A-GRAFILE IS ALSO CREATED BY PROC TAG.
12 /**
13 /**
14 /** EDIT CHANGES TO STATE SPECIFIC PROGRAMS
15 /**
16 /** 1. CH 'JJ' TO JOB CARD CODE EG. 00 FOR 1990 UNEDITED
17 /** 1E FOR 1991 EDITED, ETC.
18 /** 2. CH 'ZZZ' TO STATE ID DATE CODE
19 /** 3. CH 'VY1' TO 1ST VINTAGE YEAR EG. 69, 70, ...
20 /** 4. CH 'PY1' TO 1ST PROJECTION YEAR EG. 91
21 /** 5. CH 'YYY' TO YEAR CODE FOR DATA SETS EG.
22 /** U1990 FOR 1990 UNEDITED
23 /** E1991 FOR 1991 EDITED
24 /**
25 /*******
26 /**
27 //STEP1 EXEC SAS,TAGDSN='CNacct.PRJ.DRD4.YYY.ZETAPLOT',
28 // TIME=(00,20),TAGDISP='MOD'
29 /**
30 //IN1 DD DSN=CNacct.PRJ.BSASDS.MONTH9JJ,DISP=SHR
31 //IN2 DD DSN=CNacct.PRJ.CHYP9.YYY.PDATA,DISP=SHR
32 /**
33 /**
34 //OUT1 DD DSN=CNacct.PRJ.DRD4.EARLY.ZZZ,
35 // UNIT=DASD,DISP=(NEW,CATLG,DELETE),
36 // SPACE=(TRK,(75,5),RLSE)
37 /**
38 //OUT2 DD DSN=CNacct.PRJ.DRD4.PROD.ZZZ,
39 // UNIT=DASD,DISP=(NEW,CATLG,DELETE),
40 // SPACE=(TRK,(75,5),RLSE)
41 /**
42 //SYSIN DD *
43
44 ** DRD4TMPL ZZZ **;
45
46 /*****
47 *
48 * THIS PROGRAM READS IN THE FIRST 12 MONTHS OF PRODUCTION DATA
49 * PASSED IN FROM THE BSASDS PROGRAM AND CALCULATES THE AVERAGE
50 * PRODUCTION RATE PATTERN FOR THE FIRST YEAR OF NEW WELLS.
51 * THIS PROGRAM ALSO READS IN THE GOOD PRODUCTION DATA FROM THE
52 * CHYP9 SAS PROGRAM AND UPDATES ALL PRODUCTION RATES TO THE
53 * ORIGINAL TOTAL RATES.
54 *
55 *
56 * INPUT DATA FILE
57 *
58 * &BSASDS.MONTH9JJ - DAILY PRODUCTION RATES & NUMBER OF
59 * PRODUCING GAS WELLS
60 *
61 * &CHYP9.YYY.PDATA - ESTIMATED PRODUCTION RATES
62 *
63 *
64 * OUTPUT DATA SETS
65 *
66 * OUT1.WELLS - AVERAGE PRODUCTION RATE/WELL FOR EACH MONTH
67 * VARIABLES - ARATE, ST, MONTH
68 *
69 * OUT2.PRODDATA - ESTIMATED PRODUCTION RATES WITH TOTAL
70 * PRODUCTION VALUES
71 * VARIABLES - VINTAGE, ST, YR, MONTH, PRATE, GP1, GP2
72 *
73 *
74 * VARIABLES USED IN THIS PROGRAM
75 *
76 * VARIABLE USAGE CODES:
77 * I - INPUT VARIABLES

```

Table B6. SAS Program Listing for DRD4TMPL (Continued)

```

78      *          O - OUTPUT VARIABLES
79      *          I/O - INPUT & OUTPUT VARIABLES
80      *
81      *
82      *   GWELLS   (I)   - NUMBER OF GAS WELLS
83      *
84      *   RATE     (I)   - PEAK DAILY PRODUCTION RATE, MCF/DAY
85      *
86      *   ORATE    (I)   - DAILY PRODUCTION RATE EACH MONTH, MCF/DAY
87      *
88      *   VINTAGE  (I/O) - FIRST YEAR OF PRODUCTION
89      *
90      *   YR       (I/O) - PRODUCTION YEAR
91      *
92      *   MONTH    (I/O) - PRODUCTION MONTH
93      *
94      *   ST       (I/O) - STATE OR AREA CODE
95      *
96      *   PRATE    (I/O) - ESTIMATED PRODUCTION RATE BY MONTH, MCF/DAY
97      *
98      *   ARATE    (O)   - AVERAGE PRODUCTION RATE PER WELL, MCF/DAY
99      *
100     *
101     *****/;
102
103     /*****
104     * READ IN DAILY PRODUCTION RATES AND NUMBER OF PRODUCING WELLS.
105     *****/;
106     DATA IN1PROD;
107     SET IN1.PROD;
108
109     /* DATA STEPS DAT1 THROUGH DAT5 PREPARE THE MONTHLY PRODUCTION/WELL
110     * FOR PLOTTING ON THE ZETA PLOTTER WITH PROC TAG */;
111
112     /*****
113     * SELECT THE STATE TO BE PROCESSED AND DELETE EXTRANEIOUS DATA
114     * VALUES.
115     *****/;
116     DATA DAT1;
117     SET IN1PROD;
118     IF ST NE 'ZZZ' THEN DELETE;
119     IF ORATE LE 0 THEN DELETE;
120     IF (1900 + VINTAGE) NE (YR) THEN DELETE;
121
122     IF MONTH LE 0 OR MONTH GT 24 THEN DELETE;
123
124     ***** NOTE THAT YOU CAN CHANGE THE VINTAGE YRS USED HERE.*****;
125
126     IF VINTAGE GE PY1 OR VINTAGE LT VY1 THEN DELETE;
127
128     /*****
129     * SORT DAILY PRODUCTION RATES AND NUMBER OF PRODUCING WELLS BY
130     * STATE/AREA, VINTAGE, AND DESCENDING MONTH.
131     *****/;
132     PROC SORT DATA=DAT1; BY ST VINTAGE DESCENDING MONTH;
133
134     /*****
135     * CALCULATE THE AVERAGE PRODUCTION RATE/WELL (ARATE) USING THE
136     * MONTHLY RATE/YEAR-END WELL COUNT
137     *****/;
138     DATA DAT2;
139     SET DAT1;
140     RETAIN MAXWELLS;
141     IF MONTH EQ 12 THEN MAXWELLS= GWELLS ;
142     ARATE= ORATE/MAXWELLS;
143
144     /*****
145     * SORT DAILY PRODUCTION RATES, NUMBER OF PRODUCING WELLS, AND
146     * AVERAGE PRODUCTION RATE/WELL BY STATE/AREA AND VINTAGE.
147     *****/;
148     PROC SORT DATA=DAT2; BY ST VINTAGE;
149
150     /*****
151     * FOR DEBUGGING/CHECKING PURPOSES
152     *****/;
153     PROC PRINT ;
154     VAR ORATE GWELLS MAXWELLS ARATE;

```

Table B6. SAS Program Listing for DRD4TMPL (Continued)

```

155 ID MONTH;
156 BY ST VINTAGE;
157
158 /*****
159  * DELETE THE FIRST VINTAGE YEAR WHICH CONTAINS PRE-RECORD DATA  *
160  *****/;
161 DATA DAT3;
162 SET DAT2;
163 IF VINTAGE EQ VY1 THEN DELETE;
164
165 /*****
166  * SORT DAILY PRODUCTION RATES, NUMBER OF PRODUCING WELLS, AND  *
167  * AVERAGE PRODUCTION RATE/WELL BY STATE/AREA AND PRODUCTION MONTH.*
168  *****/;
169 PROC SORT DATA=DAT3; BY ST MONTH;
170
171 /*****
172  * DATA SET OUT1.WELLS CONTAINS THE AVERAGE PRODUCTION RATE/WELL  *
173  * FOR EACH MONTH  *
174  *****/;
175 PROC MEANS DATA=DAT3 NOPRINT;
176 VAR ARATE;
177 OUTPUT OUT=OUT1.WELLS MEAN=ARATE;
178 BY ST MONTH;
179
180 /*****
181  * FOR DEBUGGING/CHECKING PURPOSES  *
182  *****/;
183 PROC PRINT DATA=OUT1.WELLS;
184
185 /*****
186  * THE VINTAGE FOR THE AVERAGE VALUES IS SET TO 60 SO THAT IT  *
187  * WILL BE THE FIRST YEAR ON THE PLOTS  *
188  *****/;
189 DATA DAT4;
190 SET OUT1.WELLS;
191 VINTAGE=60;
192
193 /*****
194  * APPENDS TO THE DAILY PRODUCTION RATES, NUMBER OF PRODUCING  *
195  * WELLS, AND AVERAGE PRODUCTION RATE/WELL DATA SET THE DATA SET  *
196  * CONTAINING THE AVERAGE PRODUCTION RATE/WELL FOR EACH MONTH.  *
197  *****/;
198 DATA DAT5;
199 SET DAT2 DAT4;
200
201 /*****
202  * SORT THE PRODUCTION AND AVERAGE PRODUCTION RATES BY PRODUCTION  *
203  * MONTH.  *
204  *****/;
205 PROC SORT DATA= DAT5; BY MONTH;
206
207 /*****
208  * DATA STEPS DAT6 THROUGH DAT11 CALCULATE THE TOTAL PRODUCTION  *
209  * IN EACH YEAR AND MONTH SUMMED OVER ALL VINTAGE YEARS. THESE  *
210  * TOTALS ARE MERGED WITH THE PRODUCTION DATA FROM PROGRAM CHYP9  *
211  * AND OUTPUT FOR USE IN THE PROJECTION ROUTINE  *
212  *****/;
213
214 /*****
215  * SELECT THE STATE TO BE PROCESSED FROM THE DAILY PRODUCTION  *
216  * RATES AND NUMBER OF PRODUCING WELLS DATA SET.  *
217  *****/;
218 DATA DAT6;
219 SET IN1PROD;
220 IF ST NE 'ZZZ' THEN DELETE;
221
222 /*****
223  * SORT THE ABOVE DATA SET BY STATE/AREA, PRODUCTION YEAR, AND  *
224  * PRODUCTION MONTH.  *
225  *****/;
226 PROC SORT DATA=DAT6; BY ST YR MONTH;
227
228 /*****
229  * CALCULATE THE TOTAL PRODUCTION RATES AND TOTAL NUMBER OF  *
230  * PRODUCING WELLS, AND ORGANIZE BY PRODUCTION YEAR AND MONTH.  *
231  *****/;

```

Table B6. SAS Program Listing for DRD4TMPL (Continued)

```

232 PROC SUMMARY;
233   CLASS YR MONTH;
234   VAR ORATE GWELLS;
235   ID ST;
236   OUTPUT OUT=DAT7 SUM(ORATE)= TPROD
237           SUM(GWELLS)=TWELLS;
238
239   /*****
240   * IF THE RECORD IS OF TYPE 3 FROM THE ABOVE PROC SUMMARY, SET
241   * DAILY PRODUCTION RATE EACH MONTH TO THE TOTAL PRODUCTION RATE
242   * AND THE NUMBER OF WELLS TO THE TOTAL NUMBER OF WELLS FOR EACH
243   * MONTH.
244   *****/;
245 DATA DAT8;
246   SET DAT7;
247
248   * VINTAGE IS SET TO 99 TO BE CONSISTENT WITH OUTPUT FROM THE CHYP9;
249   * PROGRAM;
250
251   IF _TYPE_ EQ 3 THEN DO;
252     ORATE=TPROD;
253     GWELLS= TWELLS;
254     VINTAGE=99;
255     OUTPUT DAT8;
256   END;
257   DELETE;
258
259   /*****
260   * APPEND DATA SET WITH PRODUCTION RATE AND NUMBER OF WELLS TOTALS
261   * TO THE DATA SET WITH THE DAILY PRODUCTION RATES AND NUMBER OF
262   * PRODUCING GAS WELLS.
263   *****/;
264 DATA DAT9;
265   SET DAT6 DAT8;
266
267   /*****
268   * READ IN GOOD PRODUCTION DATA FROM CHYP9 PROGRAM AND SELECT THE
269   * APPROPRIATE DATA FROM THE GIVEN STATE/AREA.
270   *****/;
271 DATA DAT10;
272   SET IN2.PRODDATA;
273   IF ST NE 'ZZZ' THEN DELETE;
274
275   /*****
276   * SORT BY VINTAGE, PRODUCTION YEAR, AND PRODUCTION MONTH.
277   *****/;
278 PROC SORT DATA= DAT9; BY ST VINTAGE YR MONTH;
279 PROC SORT DATA= DAT10; BY ST VINTAGE YR MONTH;
280
281   /*****
282   * MERGE PRODUCTION DATA BY STATE/AREA, VINTAGE, PRODUCTION YEAR,
283   * AND PRODUCTION MONTH.
284   *****/;
285 DATA DAT11;
286   MERGE DAT9 DAT10; BY ST VINTAGE YR MONTH;
287
288   *** RESTORE ORIGINAL VALUE OF PRATE;
289   IF PRATE LE 0 THEN PRATE= ORATE;
290
291   /*****
292   * SORT PRODUCTION DATA BY DESCENDING PRODUCTION MONTH.
293   *****/;
294 PROC SORT DATA= DAT11; BY DESCENDING MONTH;
295
296   /*****
297   * FOR DEBUGGING/CHECKING PURPOSES
298   *****/;
299   /*
300   PROC PRINT ;
301   */;
302
303   /*****
304   * OUTPUT PRODUCTION DATA.
305   *****/;
306 DATA OUT2.PRODDATA;
307   SET DAT11;
308

```

Table B6. SAS Program Listing for DRD4TMPL (Continued)

```

309     KEEP VINTAGE ST YR MONTH PRATE GP1 GP2;
310
311     /*****
312      * SORT PRODUCTION DATA BY PRODUCTION MONTH.
313      *****/;
314     PROC SORT DATA= DAT7; BY MONTH;
315
316
317     /*****
318      * PLOT THE AVERAGE PRODUCTION VS. TIME (IN MONTHS) FOR THE
319      * FIRST YEAR OF NEW WELLS.
320      *****/;
321     PROC TAG
322           DATA=DAT5;
323           PARMCAR=3;
324           GENERATE A PLOT.
325           SAS DATA.
326           USE X=MONTH Y=ARATE CLASS=VINTAGE .
327           END OF DATA.
328
329           FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
330
331           CURVE 1 THICKNESS IS 3,TEXTURE IS 1,COLOR IS GREEN,SYMBOL IS 16,
332             SYMBOL COUNT IS 1.
333
334
335           PAGE BORDER IS 0.
336           X PAGE 22, Y PAGE 11.
337
338           X AXIS LENGTH IS 16.
339           X AXIS HEIGHT IS .12.
340           X AXIS ORIGIN IS 1.5.
341
342           Y AXIS MIN 0.
343           Y AXIS LENGTH IS 7.0.
344           Y AXIS ORIGIN IS 1.5.
345
346           LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE 'VINTAGE YEAR'.
347
348           X AXIS LABEL STYLE IS DUPLEX .
349           Y AXIS LABEL STYLE IS DUPLEX.
350           X AXIS STYLE IS DUPLEX.
351           Y AXIS STYLE IS DUPLEX.
352
353           X GRID IS ON.
354           Y GRID IS ON.
355           GRID COLOR IS GREEN,TEXTURE IS 1,THICKNESS IS 1.
356
357           X LABEL ' MONTHS FROM BEGINNING OF PRODUCTION '.
358           X LABEL HEIGHT IS 0.14.
359           Y LABEL HEIGHT IS 0.14.
360           Y LABEL 'MONTHLY PRODUCTION, MCF/DAY/WELL'.
361
362           TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.
363           TITLE 'SUMMATION OF PRODUCTION CURVES FOR ZZZ'.
364
365           GO.
366           ****
367
368
369           /*
370           /**

```

Table B7. COBOL Program Listing for DWTC309A

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     DWTC309A.
000400 REMARKS. NAME DWTC309A MEANS: DWIGHT COL 309 ALL.
000500     WRITES ID AND FIELD NAME FOR ALL ID RECORDS WITH ANYTHING
000600     IN COL 309. (LIKE COAL BED = M). FOR GASCAP92, WE WERE
000700     LOOKING FOR CO2 WHICH IS A C. THE RECORDS WITH A C IN COL
000800     309 ARE PUT INTO A DATASET THAT IS RERUN AGAINST THE INPUT
000900     FILE AND ALL RECORDS FOR THAT PARTICULAR ID ARE NOT KEPT.
001000     THAT PROGRAM IS DWTD02, WHICH DELETES THOSE RECORDS.
001100     *****
001200     ***** INPUT/OUTPUT DATA FIELD NAMES AND VARIABLES *****
001300     *****
001400     INPUT          I-FLD-NAME      FIELD NAME
001500     INPUT          I-ID            FIELD ID
001600     INPUT          I-KIND          DATA TYPE FOUND IN COL 309
001700     INPUT          I-REC-TYPE      TYPE OF RECORD (00=ID)
001800     OUTPUT         F-FLD-NAME      FIELD NAME
001900     OUTPUT         F-ID            FIELD ID
002000     OUTPUT         F-KIND          DATA TYPE FOUND IN COL 309
002100     *****
002200 AUTHOR. FR8, RHONDA GREEN.
002300 DATE-COMPILED. 06/15/92
002400 ENVIRONMENT DIVISION.
002500 CONFIGURATION SECTION.
002600 SOURCE-COMPUTER. IBM-370-168.
002700 OBJECT-COMPUTER. IBM-370-168.
002800 INPUT-OUTPUT SECTION.
002900 FILE-CONTROL.
003000     SELECT INDWT ASSIGN TO UT-S-INDWT.
003100     SELECT DWTFET ASSIGN TO UT-S-DWTFET.
003200 *****
003300 *INPUT IS THE EDITED DWIGHTS DATA TAPE.
003400 *****
003500 DATA DIVISION.
003600 FILE SECTION.
003700 FD INDWT
003800     RECORD CONTAINS 466 CHARACTERS
003900     BLOCK CONTAINS 0 CHARACTERS
004000     RECORDING MODE IS F
004100     LABEL RECORDS ARE STANDARD.
004200 01 ID-REC.
004300     05 FILLER          PIC X.
004400     05 I-ID            PIC X(31).
004500     05 I-REC-TYPE      PIC 99.
004600     05 FILLER          PIC X(19).
004700     05 I-FLD-NAME      PIC X(38).
004800     05 FILLER          PIC X(217).
004900     05 I-KIND          PIC X.
005000     05 FILLER          PIC X(157).
005100 FD DWTFET
005200     RECORD CONTAINS 80 CHARACTERS
005300     BLOCK CONTAINS 0 CHARACTERS
005400     RECORDING MODE IS F
005500     LABEL RECORDS ARE STANDARD.
005600 01 DWT-FET-REC.
005700     05 CC              PIC X.
005800     05 FILLER          PIC X.
005900     05 F-ID            PIC X(31).
006000     05 FILLER          PIC XXX.
006100     05 F-KIND          PIC X.
006200     05 FILLER          PIC XXX.
006300     05 F-FLD-NAME      PIC X(38).
006400     05 FILLER          PIC XX.
006500 WORKING-STORAGE SECTION.
006600 77 LAST-RECORD        PIC X          VALUE 'N'.
006700
006800 PROCEDURE DIVISION.
006900 MAIN-LINE-ROUTINE.
007000     OPEN INPUT INDWT
007100     OUTPUT DWTFET.
007200     READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
007300     MOVE SPACES TO DWT-FET-REC.
007400     PERFORM DETERMINE-PROCESS UNTIL LAST-RECORD = 'Y'.
007500     CLOSE INDWT DWTFET.
007600     STOP RUN.

```

Table B7. COBOL Program Listing for DWTC309A (Continued)

```

007700*****
007800*IF YOU ARE AN ID RECORD (TYPE 00) THEN SEE IF YOU HAVE SOME-
007900*THING IN COL 309. IF YOU DO (NOT A BLANK) THEN WRITE THE ID,
008000*FIELD NAME, AND WHAT IS IN COL 309 TO THE OUT FILE. OTHERWISE,
008100*READ UNTIL YOU ARE AN ID RECORD AND ASK THE QUESTIONS AGAIN.
008200*****
008300 DETERMINE-PROCESS.
008400     IF I-REC-TYPE = 00
008500         PERFORM CHECK-I309.
008600     READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
008700 CHECK-I309.
008800     IF I-KIND NOT = SPACES
008900         MOVE I-ID TO F-ID
009000         MOVE I-KIND TO F-KIND
009100         MOVE I-FLD-NAME TO F-FLD-NAME
009200         WRITE DWT-FET-REC.

```

Table B8. COBOL Program Listing for DWTC02

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     DWTC02.
000400 REMARKS. NAME DWTC02 MEANS: DELETE CO2 DATA FROM DWIGHTS.
000500     USES INPUT FILE CREATED BY DWTC309A WHICH HAS CO2 IDS AND
000600     DELETES THESE IDS FROM SAME DWIGHTS FILE THEY CAME FROM.
000700     *****
000800     ***** INPUT/OUTPUT DATA FIELD NAMES AND VARIABLES *****
000900     *****
001000     INPUT          I-ID          THE DWIGHT'S FILE ID
001100     INPUT          CO2-ID        THE CO2 FILE ID
001200     *****
001300 AUTHOR. FR8, RHONDA GREEN.
001400 DATE-COMPILED. 06/16/92
001500 ENVIRONMENT DIVISION.
001600 CONFIGURATION SECTION.
001700 SOURCE-COMPUTER. IBM-370-168.
001800 OBJECT-COMPUTER. IBM-370-168.
001900 INPUT-OUTPUT SECTION.
002000 FILE-CONTROL.
002100     SELECT INDWT ASSIGN TO UT-S-INDWT.
002200     SELECT INCO2 ASSIGN TO UT-S-INCO2.
002300     SELECT DWTMOD ASSIGN TO UT-S-DWTMOD.
002400 DATA DIVISION.
002500 FILE SECTION.
002600 FD INDWT
002700     RECORD CONTAINS 466 CHARACTERS
002800     BLOCK CONTAINS 0 CHARACTERS
002900     RECORDING MODE IS F
003000     LABEL RECORDS ARE STANDARD.
003100 01 ID-REC.
003200     05 FILLER          PIC X.
003300     05 I-ID            PIC X(31).
003400     05 FILLER          PIC X(434).
003500 FD INCO2
003600     RECORD CONTAINS 32 CHARACTERS
003700     BLOCK CONTAINS 0 CHARACTERS
003800     RECORDING MODE IS F
003900     LABEL RECORDS ARE STANDARD.
004000 01 ID-CO2.
004100     05 FILLER          PIC X.
004200     05 CO2-ID          PIC X(31).
004300 FD DWTMOD
004400     RECORD CONTAINS 466 CHARACTERS
004500     BLOCK CONTAINS 0 CHARACTERS
004600     RECORDING MODE IS F
004700     LABEL RECORDS ARE STANDARD.
004800 01 DWT-MOD-REC.
004900     05 O-ALL-REC       PIC X(466).
005000 WORKING-STORAGE SECTION.
005100 77 LAST-DWT-RECORD     PIC X          VALUE 'N'.
005200 77 LAST-CO2-RECORD     PIC X          VALUE 'N'.
005300
005400 PROCEDURE DIVISION.

```


Table B8. COBOL Program Listing for DWTDCO2 (Continued)

```

005500 MAIN-LINE-ROUTINE.
005600     OPEN INPUT INDWT INCO2
005700         OUTPUT DWTMOD.
005800     READ INDWT AT END MOVE 'Y' TO LAST-DWT-RECORD.
005900     READ INCO2 AT END MOVE 'Y' TO LAST-CO2-RECORD.
006000     MOVE SPACES TO DWT-MOD-REC.
006100     PERFORM DETERMINE-PROCESS UNTIL LAST-DWT-RECORD = 'Y'.
006200     CLOSE INDWT INCO2 DWTMOD.
006300     STOP RUN.
006400
006500 *****
006600 *COMPARE THE TWO INPUT FILES. THE CO2 FILE CONTAINS THE IDS YOU
006700 *DO NOT WANT TO KEEP, SO WHEN YOU FIND THAT ID IN THE DWIGHTS
006800 *INPUT FILE YOU SKIP ALL RECORDS WITH THAT ID AND DO NOT WRITE
006900 *THEM TO THE NEW DWIGHTS FILE YOU ARE CREATING THAT HAS NO CO2
007000 *WELLS ON IT.
007100 *****
007200 DETERMINE-PROCESS.
007300     IF I-ID = CO2-ID
007400         DISPLAY 'I-ID ' I-ID ' CO2ID ' CO2-ID
007500         PERFORM READ-INDWT UNTIL I-ID NOT = CO2-ID
007600             OR LAST-DWT-RECORD = 'Y'
007700         PERFORM READ-INCO2
007800     ELSE PERFORM WRITE-REC
007900         PERFORM READ-INDWT.
008000 READ-INCO2.
008100     READ INCO2 AT END MOVE 'Y' TO LAST-CO2-RECORD.
008200 READ-INDWT.
008300     READ INDWT AT END MOVE 'Y' TO LAST-DWT-RECORD.
008400 WRITE-REC.
008500     MOVE ID-REC TO DWT-MOD-REC.
008600     WRITE DWT-MOD-REC.

```

Table B9. COBOL Program Listing for DWTEDGAS

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     DWTEDGAS.
000400 REMARKS. EDITS GAS PRODUCTION DATA FOR GASCAP92 STUDY.
000500     THIS PROGRAM EDITS GAS PRODUCTION DATA ONLY FOR DWIGHTS
000600     FILES. **** DO NOT USE ON DWIGHTS OIL FILES. ****
000700     FOR WELLS WHO'S VINTAGE YEAR PRE 69, PRODUCTION IS EDITED
000800     BEGINNING IN 1970. FOR WELLS WHO'S VINTAGE YEAR IS 69,
000900     PRODUCTION IS EDITED BEGINNING IN 1971. FOR VINTAGE YEARS
001000     > OR = 70, THE FIRST 2 PRODUCTION YEARS (RECORDS) ARE
001100     SKIPPED BEFORE EDITING BEGINS.
001200     THIS IS WHY NO-OF-YEARS IS CHECKED AGAINST THE VALUE 3. A
001300     RUNNING AVERAGE IS COMPUTED TO REPLACE DATA SPIKES. A WELL
001400     MUST HAVE A SPIKE 2 MONTHS IN A ROW BEFORE THE RUNNING
001500     AVERAGE REPLACES THE FIRST SPIKE. THE AVERAGE MUST FLOW
001600     BETWEEN PRODUCTION YEARS, SO THE PRODUCTION RECORD IS
001700     MOVED TO HOLD TO BE OPERATED ON AFTER THE NEXT RECORD TYPE
001800     HAS BEEN DETERMINED. THE PROGRAM USES MAY FLAGS TO
001900     DETERMINE IF DATA SPIKES ARE REPLACED WITH THE AVERAGE.
002000 AUTHOR. FR8.
002100 DATE-COMPILED. 01/13/92.
002200 ENVIRONMENT DIVISION.
002300 CONFIGURATION SECTION.
002400 SOURCE-COMPUTER. IBM-370-168.
002500 OBJECT-COMPUTER. IBM-370-168.
002600 INPUT-OUTPUT SECTION.
002700 FILE-CONTROL.
002800     SELECT INDWT ASSIGN TO UT-S-INDWT.
002900     SELECT DWTMOD ASSIGN TO UT-S-DWTMOD.
003000     SELECT DWTFTF ASSIGN TO UT-S-DWTFTF.
003100 DATA DIVISION.
003200 FILE SECTION.
003300 *****
003400 * INPUT FILE IS THE DWIGHT'S FILE AS PROCESSED FOR USE IN DFO.*
003500 *****
003600 FD INDWT
003700     RECORD CONTAINS 466 CHARACTERS
003800     BLOCK CONTAINS 0 CHARACTERS

```

Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

003900      RECORDING MODE IS F
004000      LABEL RECORDS ARE STANDARD.
004100 01   ID-REC.
004200      05   I-ID                      PIC X(32).
004300      05   I-REC-TYPE                PIC 99.
004400      05   FILLER                    PIC X.
004500      05   I-COUN-C                  PIC X(3).
004600      05   I-FDISC-M                PIC X(2).
004700      05   I-FDISC-D                PIC X(2).
004800      05   I-FDISC-Y                PIC X(2).
004900      05   I-FLD-ID                 PIC 9(9).
005000      05   I-FLD-NAME                PIC X(38).
005100      05   I-G-GATH                  PIC X(5).
005200      05   I-O-GATH                  PIC X(5).
005300      05   I-U-PERF                  PIC 9(5).
005400      05   I-L-PERF                  PIC 9(5).
005500      05   I-STATUS                  PIC X(2).
005600      05   I-OPROD-M                PIC 99.
005700      05   I-OPROD-D                PIC 99.
005800      05   I-OPROD-Y                PIC 99.
005900      05   I-TOTDPTH                PIC 9(5).
006000      05   I-SPGG                    PIC 9V99.
006100      05   I-SPGO                    PIC 99V9.
006200      05   I-GOR                     PIC 9(4).
006300      05   I-NGW                     PIC 9V999.
006400      05   I-LOCATION                  PIC X(11).
006500      05   I-COUN-NAM                PIC X(15).
006600      05   I-OPER-NAME                PIC X(24).
006700      05   I-OPER-ID                 PIC 9(6).
006800      05   I-WELL-NAM                PIC X(36).
006900      05   I-WELL-NUM                PIC X(6).
007000      05   I-STAT-M                  PIC X(2).
007100      05   I-STAT-D                  PIC X(2).
007200      05   I-STAT-Y                  PIC X(2).
007300      05   FILLER                    PIC X(4).
007400      05   I-CUM-OIL                  PIC 9(13).
007500      05   I-CUM-GAS                  PIC 9(13).
007600      05   I-TGRAD                    PIC 9V999.
007700      05   FILLER                    PIC X.
007800      05   I-TEMPC                    PIC 9(3).
007900      05   I-PRSC                     PIC 9(3).
008000      05   FILLER                    PIC X.
008100      05   I-OCUM-Y                   PIC 99.
008200      05   I-OCUM-M                   PIC 99.
008300      05   I-GCUM-Y                   PIC 99.
008400      05   I-GCUM-M                   PIC 99.
008500      05   I-GPROD-M                   PIC 99.
008600      05   I-GPROD-Y                   PIC 99.
008700      05   I-API-NUM                  PIC X(7).
008800      05   FILLER                    PIC X(163).
008900 01   PROD-REC.
009000      05   P-ID                      PIC X(32).
009100      05   P-REC-TYPE                PIC 99.
009200      05   FWELL-1                   PIC 9(3).
009300      05   LWELL-1                   PIC 9(3).
009400      05   ALWBL-1                   PIC 9(7).
009500      05   PROD-1O                    PIC 9(7).
009600      05   WATER-1                   PIC 9(7).
009700      05   PROD-1G                    PIC 9(9).
009800      05   FWELL-2                   PIC 9(3).
009900      05   LWELL-2                   PIC 9(3).
010000      05   ALWBL-2                   PIC 9(7).
010100      05   PROD-2O                    PIC 9(7).
010200      05   WATER-2                   PIC 9(7).
010300      05   PROD-2G                    PIC 9(9).
010400      05   FWELL-3                   PIC 9(3).
010500      05   LWELL-3                   PIC 9(3).
010600      05   ALWBL-3                   PIC 9(7).
010700      05   PROD-3O                    PIC 9(7).
010800      05   WATER-3                   PIC 9(7).
010900      05   PROD-3G                    PIC 9(9).
011000      05   FWELL-4                   PIC 9(3).
011100      05   LWELL-4                   PIC 9(3).
011200      05   ALWBL-4                   PIC 9(7).
011300      05   PROD-4O                    PIC 9(7).
011400      05   WATER-4                   PIC 9(7).
011500      05   PROD-4G                    PIC 9(9).

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Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

011600      05  FWELL-5          PIC 9(3).
011700      05  LWELL-5          PIC 9(3).
011800      05  ALWBL-5          PIC 9(7).
011900      05  PROD-50          PIC 9(7).
012000      05  WATER-5          PIC 9(7).
012100      05  PROD-5G          PIC 9(9).
012200      05  FWELL-6          PIC 9(3).
012300      05  LWELL-6          PIC 9(3).
012400      05  ALWBL-6          PIC 9(7).
012500      05  PROD-60          PIC 9(7).
012600      05  WATER-6          PIC 9(7).
012700      05  PROD-6G          PIC 9(9).
012800      05  FWELL-7          PIC 9(3).
012900      05  LWELL-7          PIC 9(3).
013000      05  ALWBL-7          PIC 9(7).
013100      05  PROD-70          PIC 9(7).
013200      05  WATER-7          PIC 9(7).
013300      05  PROD-7G          PIC 9(9).
013400      05  FWELL-8          PIC 9(3).
013500      05  LWELL-8          PIC 9(3).
013600      05  ALWBL-8          PIC 9(7).
013700      05  PROD-80          PIC 9(7).
013800      05  WATER-8          PIC 9(7).
013900      05  PROD-8G          PIC 9(9).
014000      05  FWELL-9          PIC 9(3).
014100      05  LWELL-9          PIC 9(3).
014200      05  ALWBL-9          PIC 9(7).
014300      05  PROD-90          PIC 9(7).
014400      05  WATER-9          PIC 9(7).
014500      05  PROD-9G          PIC 9(9).
014600      05  FWELL-10         PIC 9(3).
014700      05  LWELL-10         PIC 9(3).
014800      05  ALWBL-10         PIC 9(7).
014900      05  PROD-100         PIC 9(7).
015000      05  WATER-10         PIC 9(7).
015100      05  PROD-10G         PIC 9(9).
015200      05  FWELL-11         PIC 9(3).
015300      05  LWELL-11         PIC 9(3).
015400      05  ALWBL-11         PIC 9(7).
015500      05  PROD-110         PIC 9(7).
015600      05  WATER-11         PIC 9(7).
015700      05  PROD-11G         PIC 9(9).
015800      05  FWELL-12         PIC 9(3).
015900      05  LWELL-12         PIC 9(3).
016000      05  ALWBL-12         PIC 9(7).
016100      05  PROD-120         PIC 9(7).
016200      05  WATER-12         PIC 9(7).
016300      05  PROD-12G         PIC 9(9).
016400  FD   DWTMOD
016500      RECORD CONTAINS 466 CHARACTERS
016600      BLOCK CONTAINS 0 CHARACTERS
016700      RECORDING MODE IS F
016800      LABEL RECORDS ARE STANDARD.
016900 01   DWT-MOD-REC.
017000      05  O-ALL-REC          PIC X(466).
017100*****
017200* WRITES TO FETCH THE ID AND YEAR OF THE PRODUCTION RECORD
017300* THAT HAD ANY CHANGE IN ANY MONTH OF PRODUCTION.
017400*****
017500  FD   DWTFET
017600      RECORD CONTAINS 38 CHARACTERS
017700      BLOCK CONTAINS 0 CHARACTERS
017800      RECORDING MODE IS F
017900      LABEL RECORDS ARE STANDARD.
018000 01   DWT-FET-REC.
018100      05  FILLER              PIC X.
018200      05  F-ID                 PIC X(32).
018300      05  FILLER              PIC XXX.
018400      05  F-REC-TYPE          PIC 99.
018500 WORKING-STORAGE SECTION.
018600*****
018700* THE PRODUCTION RECORD IS MOVED TO WORKING STORAGE TO HOLD IT
018800* SO IT CAN BE PROCESSED AFTER THE NEXT RECORD HAS BEEN READ.
018900*****
019000 01   HOLD-PROD-REC.
019100      05  H-ID                 PIC X(32).
019200      05  H-REC-TYPE          PIC 99.

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Table B9. COBOL Program Listing for DWTEGAS (Continued)

019300	05	H-FWELL-1	PIC 9(3).	
019400	05	H-LWELL-1	PIC 9(3).	
019500	05	H-ALWBL-1	PIC 9(7).	
019600	05	H-PROD-10	PIC 9(7).	
019700	05	H-WATER-1	PIC 9(7).	
019800	05	HPROD-1G	PIC 9(9).	
019900	05	H-FWELL-2	PIC 9(3).	
020000	05	H-LWELL-2	PIC 9(3).	
020100	05	H-ALWBL-2	PIC 9(7).	
020200	05	H-PROD-20	PIC 9(7).	
020300	05	H-WATER-2	PIC 9(7).	
020400	05	HPROD-2G	PIC 9(9).	
020500	05	H-FWELL-3	PIC 9(3).	
020600	05	H-LWELL-3	PIC 9(3).	
020700	05	H-ALWBL-3	PIC 9(7).	
020800	05	H-PROD-30	PIC 9(7).	
020900	05	H-WATER-3	PIC 9(7).	
021000	05	HPROD-3G	PIC 9(9).	
021100	05	H-FWELL-4	PIC 9(3).	
021200	05	H-LWELL-4	PIC 9(3).	
021300	05	H-ALWBL-4	PIC 9(7).	
021400	05	H-PROD-40	PIC 9(7).	
021500	05	H-WATER-4	PIC 9(7).	
021600	05	HPROD-4G	PIC 9(9).	
021700	05	H-FWELL-5	PIC 9(3).	
021800	05	H-LWELL-5	PIC 9(3).	
021900	05	H-ALWBL-5	PIC 9(7).	
022000	05	H-PROD-50	PIC 9(7).	
022100	05	H-WATER-5	PIC 9(7).	
022200	05	HPROD-5G	PIC 9(9).	
022300	05	H-FWELL-6	PIC 9(3).	
022400	05	H-LWELL-6	PIC 9(3).	
022500	05	H-ALWBL-6	PIC 9(7).	
022600	05	H-PROD-60	PIC 9(7).	
022700	05	H-WATER-6	PIC 9(7).	
022800	05	HPROD-6G	PIC 9(9).	
022900	05	H-FWELL-7	PIC 9(3).	
023000	05	H-LWELL-7	PIC 9(3).	
023100	05	H-ALWBL-7	PIC 9(7).	
023200	05	H-PROD-70	PIC 9(7).	
023300	05	H-WATER-7	PIC 9(7).	
023400	05	HPROD-7G	PIC 9(9).	
023500	05	H-FWELL-8	PIC 9(3).	
023600	05	H-LWELL-8	PIC 9(3).	
023700	05	H-ALWBL-8	PIC 9(7).	
023800	05	H-PROD-80	PIC 9(7).	
023900	05	H-WATER-8	PIC 9(7).	
024000	05	HPROD-8G	PIC 9(9).	
024100	05	H-FWELL-9	PIC 9(3).	
024200	05	H-LWELL-9	PIC 9(3).	
024300	05	H-ALWBL-9	PIC 9(7).	
024400	05	H-PROD-90	PIC 9(7).	
024500	05	H-WATER-9	PIC 9(7).	
024600	05	HPROD-9G	PIC 9(9).	
024700	05	H-FWELL-10	PIC 9(3).	
024800	05	H-LWELL-10	PIC 9(3).	
024900	05	H-ALWBL-10	PIC 9(7).	
025000	05	H-PROD-100	PIC 9(7).	
025100	05	H-WATER-10	PIC 9(7).	
025200	05	HPROD-10G	PIC 9(9).	
025300	05	H-FWELL-11	PIC 9(3).	
025400	05	H-LWELL-11	PIC 9(3).	
025500	05	H-ALWBL-11	PIC 9(7).	
025600	05	H-PROD-110	PIC 9(7).	
025700	05	H-WATER-11	PIC 9(7).	
025800	05	HPROD-11G	PIC 9(9).	
025900	05	H-FWELL-12	PIC 9(3).	
026000	05	H-LWELL-12	PIC 9(3).	
026100	05	H-ALWBL-12	PIC 9(7).	
026200	05	H-PROD-120	PIC 9(7).	
026300	05	H-WATER-12	PIC 9(7).	
026400	05	HPROD-12G	PIC 9(9).	
026500	77	LAST-RECORD	PIC X	VALUE 'N'.
026600	77	NO-OF-YEARS	PIC 999	VALUE ZEROS.
026700	77	REC-IN-HOLD	PIC X	VALUE 'N'.
026800	77	PROD-REC-CHANGE	PIC X	VALUE 'N'.
026900	77	NEXT-P1	PIC X	VALUE 'N'.

Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

027000 77 NEXT-P2          PIC X          VALUE 'N'.
027100 77 ALL-ZEROS        PIC X          VALUE 'N'.
027200 77 PRODX9           PIC 9(9)       VALUE ZEROES.
027300 77 PROD1            PIC 9(10)      VALUE ZEROES.
027400 77 PROD2            PIC 9(10)      VALUE ZEROES.
027500 77 PROD3            PIC 9(10)      VALUE ZEROES.
027600 77 PROD4            PIC 9(10)      VALUE ZEROES.
027700 77 PROD5            PIC 9(10)      VALUE ZEROES.
027800 77 PROD6            PIC 9(10)      VALUE ZEROES.
027900 77 PROD7            PIC 9(10)      VALUE ZEROES.
028000 77 PROD8            PIC 9(10)      VALUE ZEROES.
028100 77 PROD9            PIC 9(10)      VALUE ZEROES.
028200 77 PROD10           PIC 9(10)      VALUE ZEROES.
028300 77 PROD11           PIC 9(10)      VALUE ZEROES.
028400 77 PROD12           PIC 9(10)      VALUE ZEROES.
028500 77 HPROD2           PIC 9(10)      VALUE ZEROES.
028600 77 HPROD3           PIC 9(10)      VALUE ZEROES.
028700 77 HPROD4           PIC 9(10)      VALUE ZEROES.
028800 77 HPROD5           PIC 9(10)      VALUE ZEROES.
028900 77 HPROD6           PIC 9(10)      VALUE ZEROES.
029000 77 HPROD7           PIC 9(10)      VALUE ZEROES.
029100 77 HPROD8           PIC 9(10)      VALUE ZEROES.
029200 77 HPROD9           PIC 9(10)      VALUE ZEROES.
029300 77 HPROD10          PIC 9(10)      VALUE ZEROES.
029400 77 HPROD11          PIC 9(10)      VALUE ZEROES.
029500 77 HPROD12          PIC 9(10)      VALUE ZEROES.
029600 77 FACTOR           PIC 9          VALUE 9.
029700 77 AVG              PIC 9(9)       VALUE ZEROES.
029800
029900 PROCEDURE DIVISION.
030000 MAIN-LINE-ROUTINE.
030100     OPEN INPUT INDWT
030200     OUTPUT DWTMOD DWTFT
030300     READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
030400     MOVE SPACES TO DWT-MOD-REC HOLD-PROD-REC DWT-FET-REC.
030500     PERFORM DETERMINE-PROCESS UNTIL LAST-RECORD = 'Y'.
030600     PERFORM CHECK-HOLD.
030700     CLOSE INDWT DWTMOD DWTFT.
030800     STOP RUN.
030900
031000*****
031100***** DETERMINE-PROCESS MODULE COMMENTS *****
031200*****
031300* FOR A WELL WHO'S VINTAGE YEAR IS PRE 69, PRODUCTION IS EDITED
031400* BEGINNING IN 1970. A WELL WHO'S VINTAGE YEAR IS 69, PRODUC-
031500* TION IS EDITED BEGINNING IN 1971. FOR VINTAGE YEARS > OR =70,
031600* THE 1ST 2 PRODUCTION YEARS ARE SKIPPED BEFORE EDITING BEGINS.
031700* THIS IS WHY NO-OF-YEARS IS CHECKED AGAINST THE VALUE 3. ***
031800*****
031900* IF THE RECORD TYPE IS LESS THAN 68, THEN PERFORM CHECK-HOLD
032000* AND SEE IF REC-IN-HOLD=Y AND NO-OF-YEARS IS LESS THAN 3. IF
032100* BOTH CONDITIONS ARE TRUE, SET NO-OF-YEARS BACK TO ZERO AND
032200* RESET FLAG TO 'N' FOR REC-IN-HOLD AND PERFORM MOVE-AND-WRITE
032300* WHICH MOVES THE RECORD IN HOLD TO THE OUT, WRITES THAT OUT
032400* FILE, BUT IF ONE CONDITION IS NOT TRUE BUT THE REC-IN-HOLD=Y
032500* WRITE TO FETCH THE ID AND YEAR, AND MOVE 'N' TO PROD-REC-
032600* CHANGE VALUE AND THEN MOVE SPACES TO THE OUT FETCH FILE.
032700* BUT IF THE RECORD TYPE IS GREATER THAN 68, THEN YOU MUST ALSO
032800* CHECK AND SEE OF THERE IS A RECORD IN HOLD THAT MUST BE
032900* PROCESSED FIRST, SO IF REC-IN-HOLD IS = TO 'Y', THEN PERFORM
033000* YEARS OF PROD WHICH INSTRUCTS THE PROGRAM TO ADD 1 TO THE
033100* NO-OF-YEARS FIRST AND THEN ASKS IF THAT VALUE IS GREATER THAN
033200* 3, IF IT IS PERFORM WHERE TO START MODULE, ELSE PERFORM THE
033300* MOVE-AND-WRITE MODULE AND THEN MOVE THE PRODUCTION RECORD
033400* TO THE HOLD PRODUCTION AREA. BUT IF THE RECORD TYPE IS
033500* GREATER THAN 68, BUT THE REC-IN-HOLD=N, ADD 1 TO NO-OF-YEARS
033600* AND MOVE THE RECORD TO HOLD.
033700*****
033800
033900 DETERMINE-PROCESS.
034000     IF I-REC-TYPE < 68
034100         PERFORM CHECK-HOLD
034200         PERFORM WRITE-DWT-REC
034300     ELSE IF REC-IN-HOLD = 'Y'
034400         PERFORM YEARS-OF-PROD
034500     ELSE MOVE 'Y' TO REC-IN-HOLD
034600         ADD 1 TO NO-OF-YEARS

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Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

034700          MOVE PROD-REC TO HOLD-PROD-REC.
034800      READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
034900  CHECK-HOLD.
035000      IF REC-IN-HOLD = 'Y' AND NO-OF-YEARS < 3
035100          MOVE ZERO TO NO-OF-YEARS
035200          MOVE 'N' TO REC-IN-HOLD
035300          PERFORM MOVE-AND-WRITE
035400      ELSE IF REC-IN-HOLD = 'Y'
035500          MOVE 'N' TO REC-IN-HOLD
035600          PERFORM WHERE-TO-START.
035700  YEARS-OF-PROD.
035800      ADD 1 TO NO-OF-YEARS.
035900      IF NO-OF-YEARS > 3
036000          PERFORM WHERE-TO-START
036100      ELSE PERFORM MOVE-AND-WRITE
036200          MOVE PROD-REC TO HOLD-PROD-REC.
036300  WRITE-DWT-REC.
036400      MOVE ID-REC TO DWT-MOD-REC
036500      WRITE DWT-MOD-REC.
036600  MOVE-AND-WRITE.
036700      MOVE HOLD-PROD-REC TO DWT-MOD-REC.
036800      WRITE DWT-MOD-REC.
036900      IF PROD-REC-CHANGE = 'Y'
037000          MOVE H-ID TO F-ID
037100          MOVE H-REC-TYPE TO F-REC-TYPE
037200          WRITE DWT-FET-REC
037300          MOVE 'N' TO PROD-REC-CHANGE
037400          MOVE SPACES TO DWT-FET-REC.
037500
037600*****
037700*****      WHERE-TO-START MODULE COMMENTS      *****
037800*****
037900* THE VALUE OF NEXT-P1 AND NEXT-P2 ARE INITIALLY SET TO 'N'. **
038000*YOU MUST DETERMINE WHERE TO START PROCESSING THE PRODUCTION **
038100*RECORDS. THIS IS CRITICAL WHEN YOU HAVE AN AVERAGE YOU MUST **
038200*CARRY FORWARD OR IF YOU ARE STARTING A NEW AVERAGE. FIRST **
038300*TIME YOU PROCESS PRODUCTION RECORDS, NEXT-P1 AND NEXT-P2 **
038400*WILL BE 'N' SO PROCESSING WOULD BEGIN IN MODULES START-AT-P1**
038500*THRU START-AT-P11 UNLESS ALL MONTHS OF ANY PRODUCTION RECORD**
038600*ARE ZEROS, THEN YOU WOULD PERFORM ALL-ZERO-RECORD WHICH JUST**
038700*WRITES THE RECORD IN HOLD AND RESETS AVERAGE TO ZERO IF THERE*
038800*ARE NO MORE PRODUCTION RECORDS, OR IF THE NEXT RECORD IS A **
038900*PRODUCTION RECORD THEN YOU MOVE AND WRITE AND THEN MOVE THE **
039000*CURRENT PRODUCTION RECORD TO THE HOLD AREA AND PROCESS. **
039100*****
039200
039300  WHERE-TO-START.
039400      IF NEXT-P1 = 'Y' MOVE 'N' TO NEXT-P1
039500          PERFORM P1-NEXT
039600      ELSE IF NEXT-P2 = 'Y' MOVE 'N' TO NEXT-P2
039700          PERFORM P2-NEXT
039800      ELSE IF HPROD-1G > 0 MOVE HPROD-1G TO AVG
039900          PERFORM START-AT-P1
040000      ELSE IF HPROD-2G > 0 MOVE HPROD-2G TO AVG
040100          PERFORM START-AT-P2
040200      ELSE IF HPROD-3G > 0 MOVE HPROD-3G TO AVG
040300          PERFORM START-AT-P3
040400      ELSE IF HPROD-4G > 0 MOVE HPROD-4G TO AVG
040500          PERFORM START-AT-P4
040600      ELSE IF HPROD-5G > 0 MOVE HPROD-5G TO AVG
040700          PERFORM START-AT-P5
040800      ELSE IF HPROD-6G > 0 MOVE HPROD-6G TO AVG
040900          PERFORM START-AT-P6
041000      ELSE IF HPROD-7G > 0 MOVE HPROD-7G TO AVG
041100          PERFORM START-AT-P7
041200      ELSE IF HPROD-8G > 0 MOVE HPROD-8G TO AVG
041300          PERFORM START-AT-P8
041400      ELSE IF HPROD-9G > 0 MOVE HPROD-9G TO AVG
041500          PERFORM START-AT-P9
041600      ELSE IF HPROD-10G > 0 MOVE HPROD-10G TO AVG
041700          PERFORM START-AT-P10
041800      ELSE IF HPROD-11G > 0 MOVE HPROD-11G TO AVG
041900          PERFORM START-AT-P11
042000      ELSE IF HPROD-12G > 0 MOVE HPROD-12G TO AVG
042100          PERFORM MOVE-AND-WRITE
042200          PERFORM WHO-NEXT
042300      ELSE PERFORM ALL-ZERO-REC.

```

Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

042400
042500*****
042600***** START-AT-P1 THRU START-AT P11 MODULES  COMMENTS *****
042700*****
042800*THE START-AT MODULES ARE ENTERED FROM THE WHERE-TO-START **
042900*MODULE WHERE IT IS DETERMINED WHERE THE FIRST NON-ZERO PROD- **
043000*DUCTION MONTH IS FOUND, THEREFORE YOU ONLY NEED TO ASK ABOUT**
043100*THE NEXT MONTHS PRODUCTION WHEN YOU START IN ONE OF THESE **
043200*MODULES. BASIC MODULE LOGIC IS: IF THE NEXT MONTHS PRODUC- **
043300*TION IS NOT 0, MULTIPLY THE PREVIOUS MONTHS PRODUCTION BY **
043400*9 GIVING PRODX9. IF THE NEXT MONTHS PRODUCTION IS LESS OR **
043500*EQUAL PRODX9, COMPUTE AN AVERAGE PRODUCTION USING 80% OF **
043600*1ST NON-ZERO PRODUCTION AND 20% OF THE 2ND NON-ZERO PRODUC- **
043700*TION AND THEN GO ON TO PERFORM THE PROPER PX-NEXT MODULE **
043800*(WHERE X=1-12). BUT IF THE NEXT MONTHS PRODUCTION IS GREATER**
043900*THAN PRODX9 THEN COMPUTE AVERAGE USING 80% OF THE 2ND NON- **
044000*ZERO PRODUCTION AND 20% OF THE 3RD MONTHS PRODUCTION AND **
044100*THEN GO ON TO PERFORM THE PROPER PX-NEXT MODULE, BUT IF THE **
044200*NEXT MONTHS WAS NOT GREATER, SEE IF REC-IN-HOLD = 'Y'. IF IT**
044300*DOES, PERFORM COMPARE-HPRODX-LONG (WHERE X = 1-10) OR PER- **
044400*FORM COMPARE-HPROD11. IF REC-IN-HOLD = 'N', THEN PERFORM **
044500*COMPARE-HPROD-X-SHORT (WHERE X = 1-10) OR VARIOUS MODULES **
044600*WHICH HAVE BEEN COMMENTED ON THEIR OWN. **
044700*****
044800
044900 START-AT-P1.
045000     IF     HPROD-2G NOT = 0
045100         MULTIPLY HPROD-1G BY FACTOR GIVING PRODX9
045200         IF     HPROD-2G IS < PRODX9 OR HPROD-2G IS = PRODX9
045300             COMPUTE AVG ROUNDED =
045400                 (.80 * HPROD-1G) + (.20 * HPROD-2G)
045500             PERFORM P3-NEXT
045600         ELSE IF HPROD-3G > PRODX9
045700             COMPUTE AVG ROUNDED =
045800                 (.80 * HPROD-2G) + (.20 * HPROD-3G)
045900             PERFORM P4-NEXT
046000         ELSE IF REC-IN-HOLD = 'Y'
046100             PERFORM COMPARE-HPROD2-LONG
046200             ELSE PERFORM COMPARE-HPROD2-SHORT
046300         ELSE MOVE HPROD-1G TO AVG
046400         PERFORM P3-NEXT.
046500 START-AT-P2.
046600     IF     HPROD-3G NOT = 0
046700         MULTIPLY HPROD-2G BY FACTOR GIVING PRODX9
046800         IF     HPROD-3G IS < PRODX9 OR HPROD-3G IS = PRODX9
046900             COMPUTE AVG ROUNDED =
047000                 (.80 * HPROD-2G) + (.20 * HPROD-3G)
047100             PERFORM P4-NEXT
047200         ELSE IF HPROD-4G > PRODX9
047300             COMPUTE AVG ROUNDED =
047400                 (.80 * HPROD-3G) + (.20 * HPROD-4G)
047500             PERFORM P5-NEXT
047600         ELSE IF REC-IN-HOLD = 'Y'
047700             PERFORM COMPARE-HPROD3-LONG
047800             ELSE PERFORM COMPARE-HPROD3-SHORT
047900         ELSE MOVE HPROD-2G TO AVG
048000         PERFORM P4-NEXT.
048100 START-AT-P3.
048200     IF     HPROD-4G NOT = 0
048300         MULTIPLY HPROD-3G BY FACTOR GIVING PRODX9
048400         IF     HPROD-4G IS < PRODX9 OR HPROD-4G IS = PRODX9
048500             COMPUTE AVG ROUNDED =
048600                 (.80 * HPROD-3G) + (.20 * HPROD-4G)
048700             PERFORM P5-NEXT
048800         ELSE IF HPROD-5G > PRODX9
048900             COMPUTE AVG ROUNDED =
049000                 (.80 * HPROD-4G) + (.20 * HPROD-5G)
049100             PERFORM P6-NEXT
049200         ELSE IF REC-IN-HOLD = 'Y'
049300             PERFORM COMPARE-HPROD4-LONG
049400             ELSE PERFORM COMPARE-HPROD4-SHORT
049500         ELSE MOVE HPROD-3G TO AVG
049600         PERFORM P5-NEXT.
049700 START-AT-P4.
049800     IF     HPROD-5G NOT = 0
049900         MULTIPLY HPROD-4G BY FACTOR GIVING PRODX9
050000         IF     HPROD-5G IS < PRODX9 OR HPROD-5G IS = PRODX9

```

Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

050100      COMPUTE AVG ROUNDED =
050200          (.80 * HPROD-4G) + (.20 * HPROD-5G)
050300      PERFORM P6-NEXT
050400      ELSE IF HPROD-6G > PRODX9
050500          COMPUTE AVG ROUNDED =
050600              (.80 * HPROD-5G) + (.20 * HPROD-6G)
050700      PERFORM P7-NEXT
050800      ELSE IF REC-IN-HOLD = 'Y'
050900          PERFORM COMPARE-HPROD5-LONG
051000      ELSE PERFORM COMPARE-HPROD5-SHORT
051100      ELSE MOVE HPROD-4G TO AVG
051200      PERFORM P6-NEXT.
051300  START-AT-P5.
051400      IF HPROD-6G NOT = 0
051500          MULTIPLY HPROD-5G BY FACTOR GIVING PRODX9
051600          IF HPROD-6G IS < PRODX9 OR HPROD-6G IS = PRODX9
051700              COMPUTE AVG ROUNDED =
051800                  (.80 * HPROD-5G) + (.20 * HPROD-6G)
051900          PERFORM P7-NEXT
052000      ELSE IF HPROD-7G > PRODX9
052100          COMPUTE AVG ROUNDED =
052200              (.80 * HPROD-6G) + (.20 * HPROD-7G)
052300          PERFORM P8-NEXT
052400      ELSE IF REC-IN-HOLD = 'Y'
052500          PERFORM COMPARE-HPROD6-LONG
052600      ELSE PERFORM COMPARE-HPROD6-SHORT
052700      ELSE MOVE HPROD-5G TO AVG
052800      PERFORM P7-NEXT.
052900  START-AT-P6.
053000      IF HPROD-7G NOT = 0
053100          MULTIPLY HPROD-6G BY FACTOR GIVING PRODX9
053200          IF HPROD-7G IS < PRODX9 OR HPROD-7G IS = PRODX9
053300              COMPUTE AVG ROUNDED =
053400                  (.80 * HPROD-6G) + (.20 * HPROD-7G)
053500          PERFORM P8-NEXT
053600      ELSE IF HPROD-8G > PRODX9
053700          COMPUTE AVG ROUNDED =
053800              (.80 * HPROD-7G) + (.20 * HPROD-8G)
053900          PERFORM P9-NEXT
054000      ELSE IF REC-IN-HOLD = 'Y'
054100          PERFORM COMPARE-HPROD7-LONG
054200      ELSE PERFORM COMPARE-HPROD7-SHORT
054300      ELSE MOVE HPROD-6G TO AVG
054400      PERFORM P8-NEXT.
054500  START-AT-P7.
054600      IF HPROD-8G NOT = 0
054700          MULTIPLY HPROD-7G BY FACTOR GIVING PRODX9
054800          IF HPROD-8G IS < PRODX9 OR HPROD-8G IS = PRODX9
054900              COMPUTE AVG ROUNDED =
055000                  (.80 * HPROD-7G) + (.20 * HPROD-8G)
055100          PERFORM P9-NEXT
055200      ELSE IF HPROD-9G > PRODX9
055300          COMPUTE AVG ROUNDED =
055400              (.80 * HPROD-8G) + (.20 * HPROD-9G)
055500          PERFORM P10-NEXT
055600      ELSE IF REC-IN-HOLD = 'Y'
055700          PERFORM COMPARE-HPROD8-LONG
055800      ELSE PERFORM COMPARE-HPROD8-SHORT
055900      ELSE MOVE HPROD-7G TO AVG
056000      PERFORM P9-NEXT.
056100  START-AT-P8.
056200      IF HPROD-9G NOT = 0
056300          MULTIPLY HPROD-8G BY FACTOR GIVING PRODX9
056400          IF HPROD-9G IS < PRODX9 OR HPROD-9G IS = PRODX9
056500              COMPUTE AVG ROUNDED =
056600                  (.80 * HPROD-8G) + (.20 * HPROD-9G)
056700          PERFORM P10-NEXT
056800      ELSE IF HPROD-10G > PRODX9
056900          COMPUTE AVG ROUNDED =
057000              (.80 * HPROD-9G) + (.20 * HPROD-10G)
057100          PERFORM P11-NEXT
057200      ELSE IF REC-IN-HOLD = 'Y'
057300          PERFORM COMPARE-HPROD9-LONG
057400      ELSE PERFORM COMPARE-HPROD9-SHORT
057500      ELSE MOVE HPROD-8G TO AVG
057600      PERFORM P10-NEXT.
057700  START-AT-P9.

```


Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

057800 IF HPROD-10G NOT = 0
057900 MULTIPLY HPROD-9G BY FACTOR GIVING PRODX9
058000 IF HPROD-10G IS < PRODX9 OR HPROD-10G IS = PRODX9
058100 COMPUTE AVG ROUNDED =
058200 (.80 * HPROD-9G) + (.20 * HPROD-10G)
058300 PERFORM P11-NEXT
058400 ELSE IF HPROD-11G > PRODX9
058500 COMPUTE AVG ROUNDED =
058600 (.80 * HPROD-10G) + (.20 * HPROD-11G)
058700 PERFORM P12-NEXT
058800 ELSE IF REC-IN-HOLD = 'Y'
058900 PERFORM COMPARE-HPROD10-LONG
059000 ELSE PERFORM COMPARE-HPROD10-SHORT
059100 ELSE MOVE HPROD-9G TO AVG
059200 PERFORM P11-NEXT.
059300 START-AT-P10.
059400 IF HPROD-11G NOT = 0
059500 MULTIPLY HPROD-10G BY FACTOR GIVING PRODX9
059600 IF HPROD-11G IS < PRODX9 OR HPROD-11G IS = PRODX9
059700 COMPUTE AVG ROUNDED =
059800 (.80 * HPROD-10G) + (.20 * HPROD-11G)
059900 PERFORM P12-NEXT
060000 ELSE IF HPROD-12G > PRODX9
060100 COMPUTE AVG ROUNDED =
060200 (.80 * HPROD-11G) + (.20 * HPROD-12G)
060300 PERFORM MOVE-AND-WRITE
060400 PERFORM WHO-NEXT
060500 ELSE IF REC-IN-HOLD = 'Y'
060600 PERFORM COMPARE-HPROD11
060700 ELSE PERFORM MOVE-AND-WRITE
060800 PERFORM WHO-NEXT
060900 ELSE MOVE HPROD-10G TO AVG
061000 PERFORM P12-NEXT.
061100 START-AT-P11.
061200 IF HPROD-12G NOT = 0
061300 MULTIPLY HPROD-11G BY FACTOR GIVING PRODX9
061400 IF HPROD-12G IS < PRODX9 OR HPROD-12G IS = PRODX9
061500 COMPUTE AVG ROUNDED =
061600 (.80 * HPROD-11G) + (.20 * HPROD-12G)
061700 PERFORM MOVE-AND-WRITE
061800 PERFORM WHO-NEXT
061900 ELSE IF REC-IN-HOLD = 'Y' AND PROD-1G > PRODX9
062000 COMPUTE AVG ROUNDED =
062100 (.80 * HPROD-12G) + (.20 * PROD-1G)
062200 PERFORM MOVE-AND-WRITE
062300 MOVE 'Y' TO NEXT-P2
062400 MOVE PROD-REC TO HOLD-PROD-REC
062500 ELSE PERFORM ANOTHER-REC
062600 ELSE PERFORM MOVE-AND-WRITE
062700 PERFORM WHO-NEXT.
062800
062900 *****
063000 ***** P1-NEXT THRU P12-NEXT MODULES COMMENTS *****
063100 *****
063200 *THESE MODULES ARE ENTERED FROM THE START-AT MODULES AND ARE **
063300 *MORE OR LESS CONTINUATION MODULES, DIRECTING WHERE THE NEXT **
063400 *MONTH SHOULD START AND IT DETERMINES WHAT AVERAGE AND COMPARE*
063500 *VARIABLES ARE CARRIED FORWARD. THE PROCESSING LOGIC IS THE **
063600 *SAME AS DESCRIBED IN THE START-AT-PX MODULES COMMENTS. **
063700 *****
063800
063900 P1-NEXT.
064000 IF HPROD-1G NOT = 0
064100 MULTIPLY AVG BY FACTOR GIVING PRODX9
064200 IF HPROD-1G IS < PRODX9 OR HPROD-1G IS = PRODX9
064300 COMPUTE AVG ROUNDED =
064400 (.80 * AVG) + (.20 * HPROD-1G)
064500 PERFORM P2-NEXT
064600 ELSE IF HPROD-2G > PRODX9
064700 COMPUTE AVG ROUNDED =
064800 (.80 * HPROD-1G) + (.20 * HPROD-2G)
064900 PERFORM P3-NEXT
065000 ELSE IF REC-IN-HOLD = 'Y'
065100 PERFORM COMPARE-HPROD1-LONG
065200 ELSE PERFORM COMPARE-HPROD1-SHORT
065300 ELSE PERFORM P2-NEXT.
065400 P2-NEXT.

```

Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

065500     IF  HPROD-2G NOT = 0
065600         MULTIPLY AVG BY FACTOR GIVING PRODX9
065700         IF  HPROD-2G IS < PRODX9 OR HPROD-2G IS = PRODX9
065800             COMPUTE AVG ROUNDED =
065900                 (.80 * AVG) + (.20 * HPROD-2G)
066000             PERFORM P3-NEXT
066100         ELSE IF  HPROD-3G > PRODX9
066200             COMPUTE AVG ROUNDED =
066300                 (.80 * HPROD-2G) + (.20 * HPROD-3G)
066400             PERFORM P4-NEXT
066500         ELSE IF  REC-IN-HOLD = 'Y'
066600             PERFORM COMPARE-HPROD2-LONG
066700         ELSE PERFORM COMPARE-HPROD2-SHORT
066800     ELSE PERFORM P3-NEXT.
066900 P3-NEXT.
067000     IF  HPROD-3G NOT = 0
067100         MULTIPLY AVG BY FACTOR GIVING PRODX9
067200         IF  HPROD-3G IS < PRODX9 OR HPROD-3G IS = PRODX9
067300             COMPUTE AVG ROUNDED =
067400                 (.80 * AVG) + (.20 * HPROD-3G)
067500             PERFORM P4-NEXT
067600         ELSE IF  HPROD-4G > PRODX9
067700             COMPUTE AVG ROUNDED =
067800                 (.80 * HPROD-3G) + (.20 * HPROD-4G)
067900             PERFORM P5-NEXT
068000         ELSE IF  REC-IN-HOLD = 'Y'
068100             PERFORM COMPARE-HPROD3-LONG
068200         ELSE PERFORM COMPARE-HPROD3-SHORT
068300     ELSE PERFORM P4-NEXT.
068400 P4-NEXT.
068500     IF  HPROD-4G NOT = 0
068600         MULTIPLY AVG BY FACTOR GIVING PRODX9
068700         IF  HPROD-4G IS < PRODX9 OR HPROD-4G IS = PRODX9
068800             COMPUTE AVG ROUNDED =
068900                 (.80 * AVG) + (.20 * HPROD-4G)
069000             PERFORM P5-NEXT
069100         ELSE IF  HPROD-5G > PRODX9
069200             COMPUTE AVG ROUNDED =
069300                 (.80 * HPROD-4G) + (.20 * HPROD-5G)
069400             PERFORM P6-NEXT
069500         ELSE IF  REC-IN-HOLD = 'Y'
069600             PERFORM COMPARE-HPROD4-LONG
069700         ELSE PERFORM COMPARE-HPROD4-SHORT
069800     ELSE PERFORM P5-NEXT.
069900 P5-NEXT.
070000     IF  HPROD-5G NOT = 0
070100         MULTIPLY AVG BY FACTOR GIVING PRODX9
070200         IF  HPROD-5G IS < PRODX9 OR HPROD-5G IS = PRODX9
070300             COMPUTE AVG ROUNDED =
070400                 (.80 * AVG) + (.20 * HPROD-5G)
070500             PERFORM P6-NEXT
070600         ELSE IF  HPROD-6G > PRODX9
070700             COMPUTE AVG ROUNDED =
070800                 (.80 * HPROD-5G) + (.20 * HPROD-6G)
070900             PERFORM P7-NEXT
071000         ELSE IF  REC-IN-HOLD = 'Y'
071100             PERFORM COMPARE-HPROD5-LONG
071200         ELSE PERFORM COMPARE-HPROD5-SHORT
071300     ELSE PERFORM P6-NEXT.
071400 P6-NEXT.
071500     IF  HPROD-6G NOT = 0
071600         MULTIPLY AVG BY FACTOR GIVING PRODX9
071700         IF  HPROD-6G IS < PRODX9 OR HPROD-6G IS = PRODX9
071800             COMPUTE AVG ROUNDED =
071900                 (.80 * AVG) + (.20 * HPROD-6G)
072000             PERFORM P7-NEXT
072100         ELSE IF  HPROD-7G > PRODX9
072200             COMPUTE AVG ROUNDED =
072300                 (.80 * HPROD-6G) + (.20 * HPROD-7G)
072400             PERFORM P8-NEXT
072500         ELSE IF  REC-IN-HOLD = 'Y'
072600             PERFORM COMPARE-HPROD6-LONG
072700         ELSE PERFORM COMPARE-HPROD6-SHORT
072800     ELSE PERFORM P7-NEXT.
072900 P7-NEXT.
073000     IF  HPROD-7G NOT = 0
073100         MULTIPLY AVG BY FACTOR GIVING PRODX9

```

Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

073200      IF  HPROD-7G IS < PRODX9 OR  HPROD-7G IS = PRODX9
073300          COMPUTE AVG ROUNDED =
073400              (.80 * AVG) + (.20 * HPROD-7G)
073500          PERFORM P8-NEXT
073600      ELSE IF  HPROD-8G > PRODX9
073700          COMPUTE AVG ROUNDED =
073800              (.80 * HPROD-7G) + (.20 * HPROD-8G)
073900          PERFORM P9-NEXT
074000      ELSE IF  REC-IN-HOLD = 'Y'
074100          PERFORM COMPARE-HPROD7-LONG
074200      ELSE PERFORM COMPARE-HPROD7-SHORT
074300      ELSE PERFORM P8-NEXT.
074400 P8-NEXT.
074500      IF  HPROD-8G NOT = 0
074600          MULTIPLY AVG BY FACTOR GIVING PRODX9
074700      IF  HPROD-8G IS < PRODX9 OR  HPROD-8G IS = PRODX9
074800          COMPUTE AVG ROUNDED =
074900              (.80 * AVG) + (.20 * HPROD-8G)
075000          PERFORM P9-NEXT
075100      ELSE IF  HPROD-9G > PRODX9
075200          COMPUTE AVG ROUNDED =
075300              (.80 * HPROD-8G) + (.20 * HPROD-9G)
075400          PERFORM P10-NEXT
075500      ELSE IF  REC-IN-HOLD = 'Y'
075600          PERFORM COMPARE-HPROD8-LONG
075700      ELSE PERFORM COMPARE-HPROD8-SHORT
075800      ELSE PERFORM P9-NEXT.
075900 P9-NEXT.
076000      IF  HPROD-9G NOT = 0
076100          MULTIPLY AVG BY FACTOR GIVING PRODX9
076200      IF  HPROD-9G IS < PRODX9 OR  HPROD-9G IS = PRODX9
076300          COMPUTE AVG ROUNDED =
076400              (.80 * AVG) + (.20 * HPROD-9G)
076500          PERFORM P10-NEXT
076600      ELSE IF  HPROD-10G > PRODX9
076700          COMPUTE AVG ROUNDED =
076800              (.80 * HPROD-9G) + (.20 * HPROD-10G)
076900          PERFORM P11-NEXT
077000      ELSE IF  REC-IN-HOLD = 'Y'
077100          PERFORM COMPARE-HPROD9-LONG
077200      ELSE PERFORM COMPARE-HPROD9-SHORT
077300      ELSE PERFORM P10-NEXT.
077400 P10-NEXT.
077500      IF  HPROD-10G NOT = 0
077600          MULTIPLY AVG BY FACTOR GIVING PRODX9
077700      IF  HPROD-10G IS < PRODX9 OR  HPROD-10G IS = PRODX9
077800          COMPUTE AVG ROUNDED =
077900              (.80 * AVG) + (.20 * HPROD-10G)
078000          PERFORM P11-NEXT
078100      ELSE IF  HPROD-11G > PRODX9
078200          COMPUTE AVG ROUNDED =
078300              (.80 * HPROD-10G) + (.20 * HPROD-11G)
078400          PERFORM P12-NEXT
078500      ELSE IF  REC-IN-HOLD = 'Y'
078600          PERFORM COMPARE-HPROD10-LONG
078700      ELSE PERFORM COMPARE-HPROD10-SHORT
078800      ELSE PERFORM P11-NEXT.
078900 P11-NEXT.
079000      IF  HPROD-11G NOT = 0
079100          MULTIPLY AVG BY FACTOR GIVING PRODX9
079200      IF  HPROD-11G IS < PRODX9 OR  HPROD-11G IS = PRODX9
079300          COMPUTE AVG ROUNDED =
079400              (.80 * AVG) + (.20 * HPROD-11G)
079500          PERFORM P12-NEXT
079600      ELSE IF  HPROD-12G > PRODX9
079700          COMPUTE AVG ROUNDED =
079800              (.80 * HPROD-11G) + (.20 * HPROD-12G)
079900          PERFORM MOVE-AND-WRITE
080000          PERFORM WHO-NEXT
080100      ELSE IF  REC-IN-HOLD = 'Y'
080200          PERFORM COMPARE-HPROD11
080300      ELSE MOVE AVG TO HPROD-11G
080400          MOVE 'Y' TO PROD-REC-CHANGE
080500          PERFORM MOVE-AND-WRITE
080600          PERFORM WHO-NEXT
080700      ELSE PERFORM P12-NEXT.
080800 P12-NEXT.

```

Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

080900      IF      HPROD-12G NOT = 0
081000      MULTIPLY AVG BY FACTOR GIVING PRODX9
081100      IF      HPROD-12G IS < PRODX9 OR HPROD-12G IS = PRODX9
081200      COMPUTE AVG ROUNDED =
081300      (.80 * AVG) + (.20 * HPROD-12G)
081400      PERFORM MOVE-AND-WRITE
081500      PERFORM WHO-NEXT
081600      ELSE IF   REC-IN-HOLD = 'Y' AND
081700      PROD-1G > PRODX9
081800      COMPUTE AVG ROUNDED =
081900      (.80 * HPROD-12G) + (.20 * PROD-1G)
082000      PERFORM MOVE-AND-WRITE
082100      MOVE 'Y' TO NEXT-P2
082200      MOVE PROD-REC TO HOLD-PROD-REC
082300      ELSE PERFORM ANOTHER-REC
082400      ELSE PERFORM MOVE-AND-WRITE
082500      PERFORM WHO-NEXT.
082600
082700***** THE FOLLOWING COMMENT MODULES ARE ALL DISCUSSED HERE. ****
082800***
082900*COMPARE-HPROD1-SHORT - COMPARE-HPROD10-SHORT, COMPARE-HPROD11,
083000*COMPARE-HPROD1-LONG - COMPARE-HPROD10-LONG AND COMPARE-HPROD12
083100*|||||||||||||||||||||||||||||||||||||||||||||||||||||||||**
083200*THESE MODULES ARE ENTERED FROM THE START-AT-P1 THROUGH THE **
083300*START-AT-P11 MODULES OR THE P1-NEXT THROUGH THE P12-NEXT **
083400*MODULES. THE SHORT MODULES ARE USED TO CHECK THE REST OF **
083500*THE PRODUCTION RECORD FOR VALUES THAT ARE 50% HIGHER THAN **
083600*THE SPIKED VALUE IN THE MONTHLY PRODUCTION VALUE THAT MADE **
083700*THE PROGRAM ENTER THESE MODULES AND THE LONG MODULES ARE **
083800*USED TO CHECK FOR THE SAME THING PLUS WILL CHECK THE ENTIRE **
083900*NEXT PRODUCTION RECORD (LONG ENTERED ONLY IF THE NEXT RECORD **
084000*IS A PRODUCTION RECORD). IF A GIVEN MONTH SPIKES, YOU MUST **
084100*CHECK TO SEE IF IT IS AN ODDITY (MEANING ALL THE REMAINING **
084200*MONTHS OF PRODUCTION ARE NOT 50% HIGHER THAN THE SPIKED **
084300*VALUE AS WELL AS THE ENTIRE NEXT PRODUCTION YEAR). IF THE **
084400*REMAINING YEAR AND THE NEXT YEAR (IF APPLICABLE) ARE 50% **
084500*HIGHER, THEN YOU KEEP THE SPIKED VALUE AND USE IT TO COMPUTE**
084600*20% OF YOUR NEW AVERAGE AND CARRY ON. IF THE SPIKED VALUE IS**
084700*AN ODDITY, THEN YOU MOVE THE AVERAGE VALUE TO THAT MONTH AND**
084800*CONTINUE ON.
084900*****
085000
085100 COMPARE-HPROD1-SHORT.
085200 PERFORM COMPUTE-HPROD.
085300 IF      HPROD2 IS > HPROD-1G OR
085400      HPROD3 IS > HPROD-1G OR
085500      HPROD4 IS > HPROD-1G OR
085600      HPROD5 IS > HPROD-1G OR
085700      HPROD6 IS > HPROD-1G OR
085800      HPROD7 IS > HPROD-1G OR
085900      HPROD8 IS > HPROD-1G OR
086000      HPROD9 IS > HPROD-1G OR
086100      HPROD10 IS > HPROD-1G OR
086200      HPROD11 IS > HPROD-1G OR
086300      HPROD12 IS > HPROD-1G
086400      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-1G)
086500      ELSE MOVE AVG TO HPROD-1G
086600      MOVE 'Y' TO PROD-REC-CHANGE.
086700      PERFORM P2-NEXT.
086800 COMPARE-HPROD1-LONG.
086900 PERFORM COMPUTE-HPROD.
087000 PERFORM COMPUTE-PROD.
087100 IF      HPROD2 IS > HPROD-1G OR
087200      HPROD3 IS > HPROD-1G OR
087300      HPROD4 IS > HPROD-1G OR
087400      HPROD5 IS > HPROD-1G OR
087500      HPROD6 IS > HPROD-1G OR
087600      HPROD7 IS > HPROD-1G OR
087700      HPROD8 IS > HPROD-1G OR
087800      HPROD9 IS > HPROD-1G OR
087900      HPROD10 IS > HPROD-1G OR
088000      HPROD11 IS > HPROD-1G OR
088100      HPROD12 IS > HPROD-1G OR
088200      PROD1 IS > HPROD-1G OR
088300      PROD2 IS > HPROD-1G OR
088400      PROD3 IS > HPROD-1G OR
088500      PROD4 IS > HPROD-1G OR

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Table B9. COBOL Program Listing for DWTEGAS (Continued)

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088600      PROD5  IS > HPROD-1G  OR
088700      PROD6  IS > HPROD-1G  OR
088800      PROD7  IS > HPROD-1G  OR
088900      PROD8  IS > HPROD-1G  OR
089000      PROD9  IS > HPROD-1G  OR
089100      PROD10 IS > HPROD-1G  OR
089200      PROD11 IS > HPROD-1G  OR
089300      PROD12 IS > HPROD-1G
089400      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-1G)
089500      ELSE MOVE AVG TO HPROD-1G
089600      MOVE 'Y' TO PROD-REC-CHANGE.
089700      PERFORM P2-NEXT.
089800 COMPARE-HPROD2-SHORT.
089900      PERFORM COMPUTE-HPROD.
090000      IF     HPROD3 IS > HPROD-2G  OR
090100      HPROD4 IS > HPROD-2G  OR
090200      HPROD5 IS > HPROD-2G  OR
090300      HPROD6 IS > HPROD-2G  OR
090400      HPROD7 IS > HPROD-2G  OR
090500      HPROD8 IS > HPROD-2G  OR
090600      HPROD9 IS > HPROD-2G  OR
090700      HPROD10 IS > HPROD-2G  OR
090800      HPROD11 IS > HPROD-2G  OR
090900      HPROD12 IS > HPROD-2G
091000      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-2G)
091100      ELSE MOVE AVG TO HPROD-2G
091200      MOVE 'Y' TO PROD-REC-CHANGE.
091300      PERFORM P3-NEXT.
091400 COMPARE-HPROD2-LONG.
091500      PERFORM COMPUTE-HPROD.
091600      PERFORM COMPUTE-PROD.
091700      IF     HPROD3 IS > HPROD-2G  OR
091800      HPROD4 IS > HPROD-2G  OR
091900      HPROD5 IS > HPROD-2G  OR
092000      HPROD6 IS > HPROD-2G  OR
092100      HPROD7 IS > HPROD-2G  OR
092200      HPROD8 IS > HPROD-2G  OR
092300      HPROD9 IS > HPROD-2G  OR
092400      HPROD10 IS > HPROD-2G  OR
092500      HPROD11 IS > HPROD-2G  OR
092600      HPROD12 IS > HPROD-2G  OR
092700      PROD1  IS > HPROD-2G  OR
092800      PROD2  IS > HPROD-2G  OR
092900      PROD3  IS > HPROD-2G  OR
093000      PROD4  IS > HPROD-2G  OR
093100      PROD5  IS > HPROD-2G  OR
093200      PROD6  IS > HPROD-2G  OR
093300      PROD7  IS > HPROD-2G  OR
093400      PROD8  IS > HPROD-2G  OR
093500      PROD9  IS > HPROD-2G  OR
093600      PROD10 IS > HPROD-2G  OR
093700      PROD11 IS > HPROD-2G  OR
093800      PROD12 IS > HPROD-2G
093900      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-2G)
094000      ELSE MOVE AVG TO HPROD-2G
094100      MOVE 'Y' TO PROD-REC-CHANGE.
094200      PERFORM P3-NEXT.
094300 COMPARE-HPROD3-SHORT.
094400      PERFORM COMPUTE-HPROD.
094500      IF     HPROD4 IS > HPROD-3G  OR
094600      HPROD5 IS > HPROD-3G  OR
094700      HPROD6 IS > HPROD-3G  OR
094800      HPROD7 IS > HPROD-3G  OR
094900      HPROD8 IS > HPROD-3G  OR
095000      HPROD9 IS > HPROD-3G  OR
095100      HPROD10 IS > HPROD-3G  OR
095200      HPROD11 IS > HPROD-3G  OR
095300      HPROD12 IS > HPROD-3G
095400      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-3G)
095500      ELSE MOVE AVG TO HPROD-3G
095600      MOVE 'Y' TO PROD-REC-CHANGE.
095700      PERFORM P4-NEXT.
095800 COMPARE-HPROD3-LONG.
095900      PERFORM COMPUTE-HPROD.
096000      PERFORM COMPUTE-PROD.
096100      IF     HPROD4 IS > HPROD-3G  OR
096200      HPROD5 IS > HPROD-3G  OR

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Table B9. COBOL Program Listing for DWTEDGAS (Continued)

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096300      HPROD6  IS > HPROD-3G  OR
096400      HPROD7  IS > HPROD-3G  OR
096500      HPROD8  IS > HPROD-3G  OR
096600      HPROD9  IS > HPROD-3G  OR
096700      HPROD10 IS > HPROD-3G  OR
096800      HPROD11 IS > HPROD-3G  OR
096900      HPROD12 IS > HPROD-3G  OR
097000      PROD1   IS > HPROD-3G  OR
097100      PROD2   IS > HPROD-3G  OR
097200      PROD3   IS > HPROD-3G  OR
097300      PROD4   IS > HPROD-3G  OR
097400      PROD5   IS > HPROD-3G  OR
097500      PROD6   IS > HPROD-3G  OR
097600      PROD7   IS > HPROD-3G  OR
097700      PROD8   IS > HPROD-3G  OR
097800      PROD9   IS > HPROD-3G  OR
097900      PROD10  IS > HPROD-3G  OR
098000      PROD11  IS > HPROD-3G  OR
098100      PROD12  IS > HPROD-3G
098200      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-3G)
098300      ELSE MOVE AVG TO HPROD-3G
098400      MOVE 'Y' TO PROD-REC-CHANGE.
098500      PERFORM P4-NEXT.
098600      COMPARE-HPROD4-SHORT.
098700      PERFORM COMPUTE-HPROD.
098800      IF      HPROD5  IS > HPROD-4G  OR
098900      HPROD6  IS > HPROD-4G  OR
099000      HPROD7  IS > HPROD-4G  OR
099100      HPROD8  IS > HPROD-4G  OR
099200      HPROD9  IS > HPROD-4G  OR
099300      HPROD10 IS > HPROD-4G  OR
099400      HPROD11 IS > HPROD-4G  OR
099500      HPROD12 IS > HPROD-4G
099600      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-4G)
099700      ELSE MOVE AVG TO HPROD-4G
099800      MOVE 'Y' TO PROD-REC-CHANGE.
099900      PERFORM P5-NEXT.
100000      COMPARE-HPROD4-LONG.
100100      PERFORM COMPUTE-HPROD.
100200      PERFORM COMPUTE-PROD.
100300      IF      HPROD5  IS > HPROD-4G  OR
100400      HPROD6  IS > HPROD-4G  OR
100500      HPROD7  IS > HPROD-4G  OR
100600      HPROD8  IS > HPROD-4G  OR
100700      HPROD9  IS > HPROD-4G  OR
100800      HPROD10 IS > HPROD-4G  OR
100900      HPROD11 IS > HPROD-4G  OR
101000      HPROD12 IS > HPROD-4G  OR
101100      PROD1   IS > HPROD-4G  OR
101200      PROD2   IS > HPROD-4G  OR
101300      PROD3   IS > HPROD-4G  OR
101400      PROD4   IS > HPROD-4G  OR
101500      PROD5   IS > HPROD-4G  OR
101600      PROD6   IS > HPROD-4G  OR
101700      PROD7   IS > HPROD-4G  OR
101800      PROD8   IS > HPROD-4G  OR
101900      PROD9   IS > HPROD-4G  OR
102000      PROD10  IS > HPROD-4G  OR
102100      PROD11  IS > HPROD-4G  OR
102200      PROD12  IS > HPROD-4G
102300      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-4G)
102400      ELSE MOVE AVG TO HPROD-4G
102500      MOVE 'Y' TO PROD-REC-CHANGE.
102600      PERFORM P5-NEXT.
102700      COMPARE-HPROD5-SHORT.
102800      PERFORM COMPUTE-HPROD.
102900      IF      HPROD6  IS > HPROD-5G  OR
103000      HPROD7  IS > HPROD-5G  OR
103100      HPROD8  IS > HPROD-5G  OR
103200      HPROD9  IS > HPROD-5G  OR
103300      HPROD10 IS > HPROD-5G  OR
103400      HPROD11 IS > HPROD-5G  OR
103500      HPROD12 IS > HPROD-5G
103600      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-5G)
103700      ELSE MOVE AVG TO HPROD-5G
103800      MOVE 'Y' TO PROD-REC-CHANGE.
103900      PERFORM P6-NEXT.

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Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

104000 COMPARE-HPROD5-LONG.
104100     PERFORM COMPUTE-HPROD.
104200     PERFORM COMPUTE-PROD.
104300     IF     HPROD6 IS > HPROD-5G  OR
104400           HPROD7 IS > HPROD-5G  OR
104500           HPROD8 IS > HPROD-5G  OR
104600           HPROD9 IS > HPROD-5G  OR
104700           HPROD10 IS > HPROD-5G  OR
104800           HPROD11 IS > HPROD-5G  OR
104900           HPROD12 IS > HPROD-5G  OR
105000           PROD1 IS > HPROD-5G  OR
105100           PROD2 IS > HPROD-5G  OR
105200           PROD3 IS > HPROD-5G  OR
105300           PROD4 IS > HPROD-5G  OR
105400           PROD5 IS > HPROD-5G  OR
105500           PROD6 IS > HPROD-5G  OR
105600           PROD7 IS > HPROD-5G  OR
105700           PROD8 IS > HPROD-5G  OR
105800           PROD9 IS > HPROD-5G  OR
105900           PROD10 IS > HPROD-5G  OR
106000           PROD11 IS > HPROD-5G  OR
106100           PROD12 IS > HPROD-5G
106200           COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-5G)
106300     ELSE MOVE AVG TO HPROD-5G
106400           MOVE 'Y' TO PROD-REC-CHANGE.
106500     PERFORM P6-NEXT.
106600 COMPARE-HPROD6-SHORT.
106700     PERFORM COMPUTE-HPROD.
106800     IF     HPROD7 IS > HPROD-6G  OR
106900           HPROD8 IS > HPROD-6G  OR
107000           HPROD9 IS > HPROD-6G  OR
107100           HPROD10 IS > HPROD-6G  OR
107200           HPROD11 IS > HPROD-6G  OR
107300           HPROD12 IS > HPROD-6G
107400           COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-6G)
107500     ELSE MOVE AVG TO HPROD-6G
107600           MOVE 'Y' TO PROD-REC-CHANGE.
107700     PERFORM P7-NEXT.
107800 COMPARE-HPROD6-LONG.
107900     PERFORM COMPUTE-HPROD.
108000     PERFORM COMPUTE-PROD.
108100     IF     HPROD7 IS > HPROD-6G  OR
108200           HPROD8 IS > HPROD-6G  OR
108300           HPROD9 IS > HPROD-6G  OR
108400           HPROD10 IS > HPROD-6G  OR
108500           HPROD11 IS > HPROD-6G  OR
108600           HPROD12 IS > HPROD-6G  OR
108700           PROD1 IS > HPROD-6G  OR
108800           PROD2 IS > HPROD-6G  OR
108900           PROD3 IS > HPROD-6G  OR
109000           PROD4 IS > HPROD-6G  OR
109100           PROD5 IS > HPROD-6G  OR
109200           PROD6 IS > HPROD-6G  OR
109300           PROD7 IS > HPROD-6G  OR
109400           PROD8 IS > HPROD-6G  OR
109500           PROD9 IS > HPROD-6G  OR
109600           PROD10 IS > HPROD-6G  OR
109700           PROD11 IS > HPROD-6G  OR
109800           PROD12 IS > HPROD-6G
109900           COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-6G)
110000     ELSE MOVE AVG TO HPROD-6G
110100           MOVE 'Y' TO PROD-REC-CHANGE.
110200     PERFORM P7-NEXT.
110300 COMPARE-HPROD7-SHORT.
110400     PERFORM COMPUTE-HPROD.
110500     IF     HPROD8 IS > HPROD-7G  OR
110600           HPROD9 IS > HPROD-7G  OR
110700           HPROD10 IS > HPROD-7G  OR
110800           HPROD11 IS > HPROD-7G  OR
110900           HPROD12 IS > HPROD-7G
111000           COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-7G)
111100     ELSE MOVE AVG TO HPROD-7G
111200           MOVE 'Y' TO PROD-REC-CHANGE.
111300     PERFORM P8-NEXT.
111400 COMPARE-HPROD7-LONG.
111500     PERFORM COMPUTE-HPROD.
111600     PERFORM COMPUTE-PROD.

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Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

111700     IF      HPROD8  IS > HPROD-7G  OR
111800         HPROD9  IS > HPROD-7G  OR
111900         HPROD10 IS > HPROD-7G  OR
112000         HPROD11 IS > HPROD-7G  OR
112100         HPROD12 IS > HPROD-7G  OR
112200         PROD1   IS > HPROD-7G  OR
112300         PROD2   IS > HPROD-7G  OR
112400         PROD3   IS > HPROD-7G  OR
112500         PROD4   IS > HPROD-7G  OR
112600         PROD5   IS > HPROD-7G  OR
112700         PROD6   IS > HPROD-7G  OR
112800         PROD7   IS > HPROD-7G  OR
112900         PROD8   IS > HPROD-7G  OR
113000         PROD9   IS > HPROD-7G  OR
113100         PROD10  IS > HPROD-7G  OR
113200         PROD11  IS > HPROD-7G  OR
113300         PROD12  IS > HPROD-7G
113400         COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-7G)
113500     ELSE MOVE AVG TO HPROD-7G
113600         MOVE 'Y' TO PROD-REC-CHANGE.
113700     PERFORM P8-NEXT.
113800 COMPARE-HPROD8-SHORT.
113900     PERFORM COMPUTE-HPROD.
114000     IF      HPROD9  IS > HPROD-8G  OR
114100         HPROD10 IS > HPROD-8G  OR
114200         HPROD11 IS > HPROD-8G  OR
114300         HPROD12 IS > HPROD-8G
114400         COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-8G)
114500     ELSE MOVE AVG TO HPROD-8G
114600         MOVE 'Y' TO PROD-REC-CHANGE.
114700     PERFORM P9-NEXT.
114800 COMPARE-HPROD8-LONG.
114900     PERFORM COMPUTE-HPROD.
115000     PERFORM COMPUTE-PROD.
115100     IF      HPROD9  IS > HPROD-8G  OR
115200         HPROD10 IS > HPROD-8G  OR
115300         HPROD11 IS > HPROD-8G  OR
115400         HPROD12 IS > HPROD-8G  OR
115500         PROD1   IS > HPROD-8G  OR
115600         PROD2   IS > HPROD-8G  OR
115700         PROD3   IS > HPROD-8G  OR
115800         PROD4   IS > HPROD-8G  OR
115900         PROD5   IS > HPROD-8G  OR
116000         PROD6   IS > HPROD-8G  OR
116100         PROD7   IS > HPROD-8G  OR
116200         PROD8   IS > HPROD-8G  OR
116300         PROD9   IS > HPROD-8G  OR
116400         PROD10  IS > HPROD-8G  OR
116500         PROD11  IS > HPROD-8G  OR
116600         PROD12  IS > HPROD-8G
116700         COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-8G)
116800     ELSE MOVE AVG TO HPROD-8G
116900         MOVE 'Y' TO PROD-REC-CHANGE.
117000     PERFORM P9-NEXT.
117100 COMPARE-HPROD9-SHORT.
117200     COMPUTE HPROD10 ROUNDED = HPROD-10G * 1.50.
117300     COMPUTE HPROD11 ROUNDED = HPROD-11G * 1.50.
117400     COMPUTE HPROD12 ROUNDED = HPROD-12G * 1.50.
117500     IF      HPROD10 IS > HPROD-9G  OR
117600         HPROD11 IS > HPROD-9G  OR
117700         HPROD12 IS > HPROD-9G
117800         COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-9G)
117900     ELSE MOVE AVG TO HPROD-9G
118000         MOVE 'Y' TO PROD-REC-CHANGE.
118100     PERFORM P10-NEXT.
118200 COMPARE-HPROD9-LONG.
118300     COMPUTE HPROD10 ROUNDED = HPROD-10G * 1.50.
118400     COMPUTE HPROD11 ROUNDED = HPROD-11G * 1.50.
118500     COMPUTE HPROD12 ROUNDED = HPROD-12G * 1.50.
118600     PERFORM COMPUTE-PROD.
118700     IF      HPROD10 IS > HPROD-9G  OR
118800         HPROD11 IS > HPROD-9G  OR
118900         HPROD12 IS > HPROD-9G  OR
119000         PROD1   IS > HPROD-9G  OR
119100         PROD2   IS > HPROD-9G  OR
119200         PROD3   IS > HPROD-9G  OR
119300         PROD4   IS > HPROD-9G  OR

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Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

119400      PROD5      IS > HPROD-9G      OR
119500      PROD6      IS > HPROD-9G      OR
119600      PROD7      IS > HPROD-9G      OR
119700      PROD8      IS > HPROD-9G      OR
119800      PROD9      IS > HPROD-9G      OR
119900      PROD10     IS > HPROD-9G      OR
120000      PROD11     IS > HPROD-9G      OR
120100      PROD12     IS > HPROD-9G
120200      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-9G)
120300      ELSE MOVE AVG TO HPROD-9G
120400      MOVE 'Y' TO PROD-REC-CHANGE.
120500      PERFORM P10-NEXT.
120600  COMPARE-HPROD10-SHORT.
120700      COMPUTE HPROD11 ROUNDED = HPROD-11G * 1.50.
120800      COMPUTE HPROD12 ROUNDED = HPROD-12G * 1.50.
120900      IF HPROD11 IS > HPROD-10G OR HPROD12 IS > HPROD-10G
121000          COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-10G)
121100      ELSE MOVE AVG TO HPROD-10G
121200      MOVE 'Y' TO PROD-REC-CHANGE.
121300      PERFORM P11-NEXT.
121400  COMPARE-HPROD10-LONG.
121500      COMPUTE HPROD11 ROUNDED = HPROD-11G * 1.50.
121600      COMPUTE HPROD12 ROUNDED = HPROD-12G * 1.50.
121700      PERFORM COMPUTE-PROD.
121800      IF HPROD11 IS > HPROD-10G OR
121900      HPROD12 IS > HPROD-10G OR
122000      PROD1 IS > HPROD-10G OR
122100      PROD2 IS > HPROD-10G OR
122200      PROD3 IS > HPROD-10G OR
122300      PROD4 IS > HPROD-10G OR
122400      PROD5 IS > HPROD-10G OR
122500      PROD6 IS > HPROD-10G OR
122600      PROD7 IS > HPROD-10G OR
122700      PROD8 IS > HPROD-10G OR
122800      PROD9 IS > HPROD-10G OR
122900      PROD10 IS > HPROD-10G OR
123000      PROD11 IS > HPROD-10G OR
123100      PROD12 IS > HPROD-10G
123200      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-10G)
123300      ELSE MOVE AVG TO HPROD-10G
123400      MOVE 'Y' TO PROD-REC-CHANGE.
123500      PERFORM P11-NEXT.
123600  COMPARE-HPROD11.
123700      COMPUTE HPROD12 ROUNDED = HPROD-12G * 1.50.
123800      PERFORM COMPUTE-PROD.
123900      IF HPROD12 IS > HPROD-11G OR
124000      PROD1 IS > HPROD-11G OR
124100      PROD2 IS > HPROD-11G OR
124200      PROD3 IS > HPROD-11G OR
124300      PROD4 IS > HPROD-11G OR
124400      PROD5 IS > HPROD-11G OR
124500      PROD6 IS > HPROD-11G OR
124600      PROD7 IS > HPROD-11G OR
124700      PROD8 IS > HPROD-11G OR
124800      PROD9 IS > HPROD-11G OR
124900      PROD10 IS > HPROD-11G OR
125000      PROD11 IS > HPROD-11G OR
125100      PROD12 IS > HPROD-11G
125200      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-11G)
125300      ELSE MOVE AVG TO HPROD-11G
125400      MOVE 'Y' TO PROD-REC-CHANGE.
125500      PERFORM P12-NEXT.
125600  COMPARE-HPROD12.
125700      PERFORM COMPUTE-PROD.
125800      IF PROD1 IS > HPROD-12G OR
125900      PROD2 IS > HPROD-12G OR
126000      PROD3 IS > HPROD-12G OR
126100      PROD4 IS > HPROD-12G OR
126200      PROD5 IS > HPROD-12G OR
126300      PROD6 IS > HPROD-12G OR
126400      PROD7 IS > HPROD-12G OR
126500      PROD8 IS > HPROD-12G OR
126600      PROD9 IS > HPROD-12G OR
126700      PROD10 IS > HPROD-12G OR
126800      PROD11 IS > HPROD-12G OR
126900      PROD12 IS > HPROD-12G
127000      COMPUTE AVG ROUNDED = (.80 * AVG) + (.20 * HPROD-12G)

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Table B9. COBOL Program Listing for DWTEDGAS (Continued)

```

127100      ELSE MOVE AVG TO HPROD-12G
127200      MOVE 'Y' TO PROD-REC-CHANGE.
127300
127400*****
127500* WHO-NEXT IS A DECISION MODULE ASKING THERE IS ANOTHER *
127600* PRODUCTION RECORD TO BE PROCESSED. IF THERE IS, IT DIRECTS *
127700* THE PROGRAM WHERE TO START AGAIN BY MOVING 'Y' TO NEXT-P1 AND *
127800* MOVING THE PRODUCTION RECORD TO THE HOLD AREA, OTHERWISE IT *
127900* MOVES 'N' TO NEXT-P1, AND ZEROS TO NO-OF-YEARS AND AVERAGE *
128000* BECAUSE YOU ARE STARTING OVER ON A NEW WELL. *
128100*****
128200
128300 WHO-NEXT.
128400      IF REC-IN-HOLD = 'Y'
128500          MOVE 'Y' TO NEXT-P1
128600          MOVE PROD-REC TO HOLD-PROD-REC
128700      ELSE MOVE 'N' TO NEXT-P1
128800          MOVE ZERO TO NO-OF-YEARS
128900          MOVE ZEROS TO AVG.
129000
129100*****
129200* ALL-ZERO-REC IS A DECISION MODULE ENTERED FROM THE WHERE-TO-*
129300* START MODULE WHEN A PRODUCTION RECORD IS FOUND TO HAVE NO *
129400* PRODUCTION FOR ANY MONTH. PROGRAM CHECKS TO SEE IF THE NEXT *
129500* RECORD IS A PRODUCTION RECORD. IF NOT, MOVE AND WRITE THE *
129600* PRODUCTION RECORD IN HOLD AND MOVE ZEROS TO AVERAGE AND NO- *
129700* OF YEARS, IF 'Y', MOVE AND WRITE AND MOVE THE PRODUCTION *
129800* RECORD TO THE HOLD AREA.
129900*****
130000
130100 ALL-ZERO-REC.
130200      IF REC-IN-HOLD = 'N'
130300          PERFORM MOVE-AND-WRITE
130400          MOVE ZEROS TO AVG
130500          MOVE ZERO TO NO-OF-YEARS
130600      ELSE PERFORM MOVE-AND-WRITE
130700          MOVE PROD-REC TO HOLD-PROD-REC.
130800
130900*****
131000* THE ANOTHER-REC MODULE IS ENTERED FROM THE START-AT-P11 OR *
131100* P12-NEXT MODULES. IF THERE IS A RECORD IN HOLD, PERFORM THE *
131200* 2 MENTIONED MODULES, THEN MOVE 'Y' TO NEXT-P2 AND MOVE THE *
131300* CURRENT PRODUCTION RECORD TO THE HOLD AREA, ELSE, THERE IS *
131400* NOT ANOTHER PRODUCTION RECORD SO YOU MOVE AVERAGE VALUE TO *
131500* PRODUCTION FOR THE 12TH MONTH, MOVE 'Y' TO PROD-REC-CHANGE, *
131600* AND THEN PERFORM THE 2 MENTIONED MODULES. *
131700*****
131800
131900 ANOTHER-REC.
132000      IF REC-IN-HOLD = 'Y'
132100          PERFORM COMPARE-HPROD12
132200          PERFORM MOVE-AND-WRITE
132300          MOVE 'Y' TO NEXT-P2
132400          MOVE PROD-REC TO HOLD-PROD-REC
132500      ELSE MOVE AVG TO HPROD-12G
132600          MOVE 'Y' TO PROD-REC-CHANGE
132700          PERFORM MOVE-AND-WRITE
132800          PERFORM WHO-NEXT.
132900
133000*****
133100***** COMPUTE-HPROD AND COMPUTE-PROD MODULES DISCUSSION *****
133200*****
133300* WHERE A SPIKE IN PRODUCTION IS ENCOUNTERED, THE SPIKED VALUE*
133400* IS MULTIPLIED BY 1.5. THIS VALUE IS THEN COMPARED WITH THE *
133500* REMAINING MONTH OF THE SAME YEAR TO SEE IF ANY OF THOSE *
133600* VALUES ARE MORE THAN THE SPIKED. THIS COMPARE IS DONE IN THE*
133700* COMPARE-HPROD1-SHORT THROUGH COMPARE-HPROD10-SHORT MODULES, *
133800* THE COMPARE-HPROD1-LONG THROUGH COMPARE-HPROD10-LONG MODULES*
133900* AND THE COMPARE-HPROD11 AND COMPARE-HPROD12 MODULES. *
134000*****
134100
134200 COMPUTE-HPROD.
134300      COMPUTE HPROD2 ROUNDED = HPROD-2G * 1.50.
134400      COMPUTE HPROD3 ROUNDED = HPROD-3G * 1.50.
134500      COMPUTE HPROD4 ROUNDED = HPROD-4G * 1.50.
134600      COMPUTE HPROD5 ROUNDED = HPROD-5G * 1.50.
134700      COMPUTE HPROD6 ROUNDED = HPROD-6G * 1.50.

```

Table B9. COBOL Program Listing for DWTEGAS (Continued)

```

134800      COMPUTE HPROD7 ROUNDED = HPROD-7G * 1.50.
134900      COMPUTE HPROD8 ROUNDED = HPROD-8G * 1.50.
135000      COMPUTE HPROD9 ROUNDED = HPROD-9G * 1.50.
135100      COMPUTE HPROD10 ROUNDED = HPROD-10G * 1.50.
135200      COMPUTE HPROD11 ROUNDED = HPROD-11G * 1.50.
135300      COMPUTE HPROD12 ROUNDED = HPROD-12G * 1.50.
135400      COMPUTE-PROD.
135500      COMPUTE PROD1 ROUNDED = PROD-1G * 1.50.
135600      COMPUTE PROD2 ROUNDED = PROD-2G * 1.50.
135700      COMPUTE PROD3 ROUNDED = PROD-3G * 1.50.
135800      COMPUTE PROD4 ROUNDED = PROD-4G * 1.50.
135900      COMPUTE PROD5 ROUNDED = PROD-5G * 1.50.
136000      COMPUTE PROD6 ROUNDED = PROD-6G * 1.50.
136100      COMPUTE PROD7 ROUNDED = PROD-7G * 1.50.
136200      COMPUTE PROD8 ROUNDED = PROD-8G * 1.50.
136300      COMPUTE PROD9 ROUNDED = PROD-9G * 1.50.
136400      COMPUTE PROD10 ROUNDED = PROD-10G * 1.50.
136500      COMPUTE PROD11 ROUNDED = PROD-11G * 1.50.
136600      COMPUTE PROD12 ROUNDED = PROD-12G * 1.50.

```

Table B10. COBOL Program Listing for DWTGOR

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     DWTGOR.
000400 REMARKS. NAME DWTGOR MEANS: DWIGHT GAS TO OIL RATIO.
000500     RUN PROGRAM DWTIDPD FIRST WHICH EXTRACTS PROD FROM DWTS.
000600     ORIGINAL PROGRAM DWTWRITE. MODIFIED FOR GASCAP92 STUDY TO
000700     DETERMINE THE GAS FIELDS THAT ARE ON THE OIL FEDERAL PAC-
000800     IFIC TAPE. THESE GAS WELLS WILL BE CONCATENATED WITH THE
000900     CALIFORNIA GAS TAPE. THIS PGM WRITES THE WELL ID, WITH THE
001000     OIL AND GAS CUMS, OF ONLY THOSE WELLS WITH OIL PRODUCTION,
001100     TIMES 50, LESS THAN THE GAS CUM. THESE WELLS ARE ASSUMED
001200     TO BE GAS WELLS ON THE OIL TAPE. THESE WILL BE FOUND IN
001300     TO FETCH OUTPUT OF SUMRECS. THE FIRST 2 COLUMNS ARE THE
001400     PRODUCTION YEAR. CHANGE THOSE 2 COLUMNS TO BE A BLANK IN
001500     IN COLUMN 1. THEN DELETE ALL COLUMNS AFTER COLUMN 32, AND
001600     ALL LINES THAT DO NOT HAVE AN ID OF 003600000 OR AN ID OF
001700     004200000. THE ONLY 2 FIELDS YOU ARE KEEPING ARE PITAS
001800     POINT AND SANTA CLARA. THEN DELETE ALL LINES WITH
001900     003600000 BUT ONE AND DELETE ALL COLUMNS ON THAT ONE LINE
002000     AFTER COLUMN 10. THIS ID SHOULD BE THE VERY FIRST ONE IN
002100     THE INSTREAM DATA YOU ARE GOING TO PUT IN THE JCL. NOW PUT
002200     9 9'S AS THE LAST ID YOU ARE GOING TO PUT IN THE JCL SO
002300     THE PROGRAM WILL KNOW WHEN TO QUIT. NOW PUT THESE LINE AS
002400     INSTREAM DD * OF CAPART2 OR OFFFLDS JCLS.
002500 AUTHOR.   FR8.
002600 DATE-COMPILED.
002700     06/25/92.
002800 ENVIRONMENT DIVISION.
002900 CONFIGURATION SECTION.
003000 SOURCE-COMPUTER. IBM-370-168.
003100 OBJECT-COMPUTER. IBM-370-168.
003200 INPUT-OUTPUT SECTION.
003300 FILE-CONTROL.
003400     SELECT PRODRECS ASSIGN TO UT-S-PRODRECS.
003500     SELECT SUMRECS ASSIGN TO UT-S-SUMRECS.
003600 DATA DIVISION.
003700 FILE SECTION.
003800 FD PRODRECS
003900     RECORD CONTAINS 227 CHARACTERS
004000     BLOCK CONTAINS 0 CHARACTERS
004100     RECORDING MODE IS F
004200     LABEL RECORDS ARE STANDARD.
004300 01 PROD-REC.
004400     05 FILLER                                PIC XX.
004500     05 I-ID                                  PIC X(31).
004600     05 I-PROD-10                             PIC 9(7).
004700     05 I-PROD-1G                             PIC 9(9).
004800     05 I-PROD-20                             PIC 9(7).
004900     05 I-PROD-2G                             PIC 9(9).
005000     05 I-PROD-30                             PIC 9(7).
005100     05 I-PROD-3G                             PIC 9(9).

```

Table B10. COBOL Program Listing for DWTGOR (Continued)

```

005200      05  I-PROD-4O          PIC 9(7).
005300      05  I-PROD-4G          PIC 9(9).
005400      05  I-PROD-5O          PIC 9(7).
005500      05  I-PROD-5G          PIC 9(9).
005600      05  I-PROD-6O          PIC 9(7).
005700      05  I-PROD-6G          PIC 9(9).
005800      05  I-PROD-7O          PIC 9(7).
005900      05  I-PROD-7G          PIC 9(9).
006000      05  I-PROD-8O          PIC 9(7).
006100      05  I-PROD-8G          PIC 9(9).
006200      05  I-PROD-9O          PIC 9(7).
006300      05  I-PROD-9G          PIC 9(9).
006400      05  I-PROD-10O         PIC 9(7).
006500      05  I-PROD-10G         PIC 9(9).
006600      05  I-PROD-11O         PIC 9(7).
006700      05  I-PROD-11G         PIC 9(9).
006800      05  I-PROD-12O         PIC 9(7).
006900      05  I-PROD-12G         PIC 9(9).
007000      05  I-YEAR             PIC 99.
007100
007200  FD  SUMRECS
007300      RECORD CONTAINS 53 CHARACTERS
007400      BLOCK CONTAINS 0 CHARACTERS
007500      RECORDING MODE IS F
007600      LABEL RECORDS ARE STANDARD.
007700  01  SUMMED-REC.
007800      05  O-YEAR              PIC XX.
007900      05  O-ID                PIC X(31).
008000      05  O-CUM-OIL          PIC ZZZZZZZZZ9.
008100      05  O-CUM-GAS          PIC ZZZZZZZZZ9.
008200  WORKING-STORAGE SECTION.
008300  77  LAST-RECORD             PIC X          VALUE 'N'.
008400  77  CUM-OIL-PROD           PIC 9(10)        VALUE ZEROES.
008500  77  CUM-GAS-PROD           PIC 9(10)        VALUE ZEROES.
008600  77  TEST                   PIC 9(12)        VALUE ZEROES.
008700
008800  PROCEDURE DIVISION.
008900  MAIN-LINE-ROUTINE.
009000      OPEN INPUT PRODRECS
009100      OUTPUT SUMRECS.
009200      READ PRODRECS AT END MOVE 'Y' TO LAST-RECORD.
009300      MOVE SPACES TO SUMMED-REC.
009400      PERFORM SUM-PROD-RECS UNTIL LAST-RECORD = 'Y'.
009500      CLOSE PRODRECS
009600      SUMRECS.
009700      STOP RUN.
009800  SUM-PROD-RECS.
009900 *****
010000* SUM OIL AND GAS MONTHLY DATA ON EACH REC TO GET ANNUAL CUM
010100 *****
010200      ADD I-PROD-1O I-PROD-2O I-PROD-3O I-PROD-4O
010300      I-PROD-5O I-PROD-6O I-PROD-7O I-PROD-8O
010400      I-PROD-9O I-PROD-10O I-PROD-11O I-PROD-12O
010500      TO CUM-OIL-PROD.
010600      ADD I-PROD-1G I-PROD-2G I-PROD-3G I-PROD-4G
010700      I-PROD-5G I-PROD-6G I-PROD-7G I-PROD-8G
010800      I-PROD-9G I-PROD-10G I-PROD-11G I-PROD-12G
010900      TO CUM-GAS-PROD.
011000 *****
011100* SEE IF THE OIL CUM TIMES 50 IS GREATER THAT THE GAS CUM. IF
011200* IT IS, THEN CONSIDER IT AN OIL FIELD AND CONTINUE ON. IF IT
011300* IS NOT GREATER, THE CONSIDER IT A GAS FIELD AND WRITE OUT TO
011400* FETCH THE WELL ID, AND BOTH OIL AND GAS CUMS.
011500 *****
011600      MULTIPLY CUM-OIL-PROD BY 50 GIVING TEST.
011700      IF TEST IS LESS THAN CUM-GAS-PROD
011800      PERFORM WRITE-SUMMED-RECS.
011900      MOVE ZEROES TO CUM-OIL-PROD CUM-GAS-PROD TEST.
012000      READ PRODRECS AT END MOVE 'Y' TO LAST-RECORD.
012100  WRITE-SUMMED-RECS.
012200      MOVE I-ID TO O-ID.
012300      MOVE I-YEAR TO O-YEAR.
012400      MOVE CUM-OIL-PROD TO O-CUM-OIL.
012500      MOVE CUM-GAS-PROD TO O-CUM-GAS.
012600      WRITE SUMMED-REC.

```

Table B11. COBOL Program Listing for DWTIDPD

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     DWTIDPD.
000400 REMARKS. NAME DWTIDPD MEANS: DWIGHT ID WITH PRODUCTION.
000500     ORIGINAL PROGRAM DWTOPRPD. MODIFIED FOR GASCAP92 STUDY.
000600     TO EXTRACT PRODUCTION RECORDS FROM DWIGHTS OIL FEDERAL
000700     PACIFIC TAPES SO THEY COULD BE FURTHER PROCESSED AND
000800     CONSOLIDATED BY PROGRAM DWTGOR.
000900     *****
001000     ***** INPUT/OUTPUT DATA FIELD NAMES AND VARIABLES *****
001100     *****
001200     INPUT          P-WELL-ID          DWIGHT'S WELL ID
001300     INPUT          P-REC-TYPE          REC TYPE, > 50 = PROD REC
001400     INPUT          PROD-1G TO 12G      12 MONTHS OF GAS PRODUCTION
001500     INPUT          PROD-1G TO 12G      12 MONTHS OF GAS PRODUCTION
001600     OUTPUT         O-WELL-ID          DWIGHT'S WELL ID
001700     OUTPUT         O-YEAR              PRODUCTION YEAR
001800     OUTPUT         PROD-1G TO 12G      12 MONTHS OF GAS PRODUCTION
001900     OUTPUT         PROD-1G TO 12G      12 MONTHS OF GAS PRODUCTION
002000     *****
002100 AUTHOR.      FR8.
002200 DATE-COMPILED.
002300     06/25/92.
002400 ENVIRONMENT DIVISION.
002500 CONFIGURATION SECTION.
002600 SOURCE-COMPUTER. IBM-370-168.
002700 OBJECT-COMPUTER. IBM-370-168.
002800 INPUT-OUTPUT SECTION.
002900 FILE-CONTROL.
003000     SELECT INDWT ASSIGN TO UT-S-INDWT.
003100     SELECT DWTMOD ASSIGN TO UT-S-DWTMOD.
003200 DATA DIVISION.
003300 FILE SECTION.
003400 FD INDWT
003500     RECORD CONTAINS 466 CHARACTERS
003600     BLOCK CONTAINS 0 CHARACTERS
003700     RECORDING MODE IS F
003800     LABEL RECORDS ARE STANDARD.
003900 01 PROD-REC.
004000     05 FILLER              PIC X.
004100     05 P-WELL-ID           PIC X(31).
004200     05 P-REC-TYPE          PIC 99.
004300     05 FWELL-1             PIC 9(3).
004400     05 LWELL-1             PIC 9(3).
004500     05 ALWBL-1             PIC 9(7).
004600     05 PROD-10             PIC 9(7).
004700     05 WATER-1             PIC 9(7).
004800     05 PROD-1G             PIC 9(9).
004900     05 FWELL-2             PIC 9(3).
005000     05 LWELL-2             PIC 9(3).
005100     05 ALWBL-2             PIC 9(7).
005200     05 PROD-20             PIC 9(7).
005300     05 WATER-2             PIC 9(7).
005400     05 PROD-2G             PIC 9(9).
005500     05 FWELL-3             PIC 9(3).
005600     05 LWELL-3             PIC 9(3).
005700     05 ALWBL-3             PIC 9(7).
005800     05 PROD-30             PIC 9(7).
005900     05 WATER-3             PIC 9(7).
006000     05 PROD-3G             PIC 9(9).
006100     05 FWELL-4             PIC 9(3).
006200     05 LWELL-4             PIC 9(3).
006300     05 ALWBL-4             PIC 9(7).
006400     05 PROD-40             PIC 9(7).
006500     05 WATER-4             PIC 9(7).
006600     05 PROD-4G             PIC 9(9).
006700     05 FWELL-5             PIC 9(3).
006800     05 LWELL-5             PIC 9(3).
006900     05 ALWBL-5             PIC 9(7).
007000     05 PROD-50             PIC 9(7).
007100     05 WATER-5             PIC 9(7).
007200     05 PROD-5G             PIC 9(9).
007300     05 FWELL-6             PIC 9(3).
007400     05 LWELL-6             PIC 9(3).
007500     05 ALWBL-6             PIC 9(7).
007600     05 PROD-60             PIC 9(7).
007700     05 WATER-6             PIC 9(7).

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Table B11. COBOL Program Listing for DWTIDPD (Continued)

007800	05	PROD-6G	PIC 9(9).
007900	05	FWELL-7	PIC 9(3).
008000	05	LWELL-7	PIC 9(3).
008100	05	ALWBL-7	PIC 9(7).
008200	05	PROD-7O	PIC 9(7).
008300	05	WATER-7	PIC 9(7).
008400	05	PROD-7G	PIC 9(9).
008500	05	FWELL-8	PIC 9(3).
008600	05	LWELL-8	PIC 9(3).
008700	05	ALWBL-8	PIC 9(7).
008800	05	PROD-8O	PIC 9(7).
008900	05	WATER-8	PIC 9(7).
009000	05	PROD-8G	PIC 9(9).
009100	05	FWELL-9	PIC 9(3).
009200	05	LWELL-9	PIC 9(3).
009300	05	ALWBL-9	PIC 9(7).
009400	05	PROD-9O	PIC 9(7).
009500	05	WATER-9	PIC 9(7).
009600	05	PROD-9G	PIC 9(9).
009700	05	FWELL-10	PIC 9(3).
009800	05	LWELL-10	PIC 9(3).
009900	05	ALWBL-10	PIC 9(7).
010000	05	PROD-10O	PIC 9(7).
010100	05	WATER-10	PIC 9(7).
010200	05	PROD-10G	PIC 9(9).
010300	05	FWELL-11	PIC 9(3).
010400	05	LWELL-11	PIC 9(3).
010500	05	ALWBL-11	PIC 9(7).
010600	05	PROD-11O	PIC 9(7).
010700	05	WATER-11	PIC 9(7).
010800	05	PROD-11G	PIC 9(9).
010900	05	FWELL-12	PIC 9(3).
011000	05	LWELL-12	PIC 9(3).
011100	05	ALWBL-12	PIC 9(7).
011200	05	PROD-12O	PIC 9(7).
011300	05	WATER-12	PIC 9(7).
011400	05	PROD-12G	PIC 9(9).
011500			
011600	FD	DWTMOD	
011700		RECORD CONTAINS 227 CHARACTERS	
011800		BLOCK CONTAINS 0 CHARACTERS	
011900		RECORDING MODE IS F	
012000		LABEL RECORDS ARE STANDARD.	
012100	01	DWT-MOD-PROD-REC.	
012200	05	FILLER	PIC XX.
012300	05	O-WELL-ID	PIC X(31).
012400	05	O-PROD-1O	PIC 9(7).
012500	05	O-PROD-1G	PIC 9(9).
012600	05	O-PROD-2O	PIC 9(7).
012700	05	O-PROD-2G	PIC 9(9).
012800	05	O-PROD-3O	PIC 9(7).
012900	05	O-PROD-3G	PIC 9(9).
013000	05	O-PROD-4O	PIC 9(7).
013100	05	O-PROD-4G	PIC 9(9).
013200	05	O-PROD-5O	PIC 9(7).
013300	05	O-PROD-5G	PIC 9(9).
013400	05	O-PROD-6O	PIC 9(7).
013500	05	O-PROD-6G	PIC 9(9).
013600	05	O-PROD-7O	PIC 9(7).
013700	05	O-PROD-7G	PIC 9(9).
013800	05	O-PROD-8O	PIC 9(7).
013900	05	O-PROD-8G	PIC 9(9).
014000	05	O-PROD-9O	PIC 9(7).
014100	05	O-PROD-9G	PIC 9(9).
014200	05	O-PROD-10O	PIC 9(7).
014300	05	O-PROD-10G	PIC 9(9).
014400	05	O-PROD-11O	PIC 9(7).
014500	05	O-PROD-11G	PIC 9(9).
014600	05	O-PROD-12O	PIC 9(7).
014700	05	O-PROD-12G	PIC 9(9).
014800	05	O-YEAR	PIC 99.
014900		WORKING-STORAGE SECTION.	
015000	77	LAST-RECORD	PIC X VALUE 'N'.
015100			
015200		PROCEDURE DIVISION.	

Table B11. COBOL Program Listing for DWTIDPD (Continued)

```

015300 MAIN-LINE-ROUTINE.
015400 OPEN INPUT INDWT
015500 OUTPUT DWTMOD.
015600 READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
015700 MOVE SPACES TO DWT-MOD-PROD-REC.
015800 PERFORM DETERMINE-PROCESS UNTIL LAST-RECORD = 'Y'.
015900 CLOSE INDWT
016000 DWTMOD.
016100 STOP RUN.
016200
016300 DETERMINE-PROCESS.
016400 *****
016500* IF THE RECORD TYPE IS GREATER THAN 50 (MEANING A PRODUCTION
016600* RECORD) THEN WRITE IT OUT IN THE NEW FORMAT, OTHERWISE READ
016700* UNTIL YOU FIND THE NEXT ONE GREATER THAN 50 AND WRITE.
016800*****
016900 IF P-REC-TYPE > 50
017000 PERFORM WRITE-DWT-MOD-RECS.
017100 READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
017200 WRITE-DWT-MOD-RECS.
017300 MOVE P-WELL-ID TO O-WELL-ID.
017400 MOVE P-REC-TYPE TO O-YEAR.
017500 MOVE PROD-1O TO O-PROD-1O.
017600 MOVE PROD-1G TO O-PROD-1G.
017700 MOVE PROD-2O TO O-PROD-2O.
017800 MOVE PROD-2G TO O-PROD-2G.
017900 MOVE PROD-3O TO O-PROD-3O.
018000 MOVE PROD-3G TO O-PROD-3G.
018100 MOVE PROD-4O TO O-PROD-4O.
018200 MOVE PROD-4G TO O-PROD-4G.
018300 MOVE PROD-5O TO O-PROD-5O.
018400 MOVE PROD-5G TO O-PROD-5G.
018500 MOVE PROD-6O TO O-PROD-6O.
018600 MOVE PROD-6G TO O-PROD-6G.
018700 MOVE PROD-7O TO O-PROD-7O.
018800 MOVE PROD-7G TO O-PROD-7G.
018900 MOVE PROD-8O TO O-PROD-8O.
019000 MOVE PROD-8G TO O-PROD-8G.
019100 MOVE PROD-9O TO O-PROD-9O.
019200 MOVE PROD-9G TO O-PROD-9G.
019300 MOVE PROD-10O TO O-PROD-10O.
019400 MOVE PROD-10G TO O-PROD-10G.
019500 MOVE PROD-11O TO O-PROD-11O.
019600 MOVE PROD-11G TO O-PROD-11G.
019700 MOVE PROD-12O TO O-PROD-12O.
019800 MOVE PROD-12G TO O-PROD-12G.
019900 WRITE DWT-MOD-PROD-REC.

```

Table B12. COBOL Program Listing for DWTKEY

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300 DWTKEY.
000400 REMARKS. WRITES THE DATA FIELDS OF FIELD ID AND OPERATOR ID
000500 TO THE FIRST 16 BYTES OF EACH RECORD OF A DWIGHT'S 450
000600 TAPE. THIS MAKES SORTING AND PROCESSING EASIER IN FUTURE
000700 PROGRAMS BY KEEPING LIKE WELL AND LEASE RECORDS TOGETHER.
000800 THIS PROGRAM CREATES THE 466 LRCL USED IN THE DFO.
000900 AUTHOR. JP6, JACK PERRIN.
001000 DATE-COMPILED. A LONG TIME AGO.
001100 ENVIRONMENT DIVISION.
001200 CONFIGURATION SECTION.
001300 SOURCE-COMPUTER. IBM-370-168.
001400 OBJECT-COMPUTER. IBM-370-168.
001500 SPECIAL-NAMES.
001600 C01 IS TOP-PAGE.

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Table B12. COBOL Program Listing for DWTKEY (Continued)

```

001700 INPUT-OUTPUT SECTION.
001800 FILE-CONTROL.
001900     SELECT IN-A-FILE ASSIGN TO UT-S-AFILE.
002000     SELECT OUT-A-FILE ASSIGN TO UT-S-KEY.
002100 DATA DIVISION.
002200 FILE SECTION.
002300 FD IN-A-FILE
002400     RECORD CONTAINS 450 CHARACTERS
002500     BLOCK CONTAINS 27000 CHARACTERS
002600     RECORDING MODE IS F
002700     LABEL RECORDS ARE STANDARD.
002800 01 IN-A-FILE-REC.
002900     05 PART1                PIC X(16).
003000     05 TYP1                 PIC 99.
003100     05 PART2                PIC X(10).
003200     05 I-FIELD-ID           PIC X(9).
003300     05 PART3                PIC X(135).
003400     05 I-OPER-ID            PIC X(6).
003500     05 PART4                PIC X(272).
003600 FD OUT-A-FILE
003700     RECORD CONTAINS 466 CHARACTERS
003800     BLOCK CONTAINS 27960 CHARACTERS
003900     RECORDING MODE IS F
004000     LABEL RECORDS ARE STANDARD.
004100 01 OUT-A-FILE-REC.
004200     05 O-BLANK              PIC X.
004300     05 FIELD-ID             PIC X(9).
004400     05 OPER-ID              PIC X(6).
004500     05 O-PART1              PIC X(16).
004600     05 O-TYP1               PIC 99.
004700     05 O-PART2              PIC X(10).
004800     05 O-FIELD-ID           PIC X(9).
004900     05 O-PART3              PIC X(135).
005000     05 O-OPER-ID           PIC X(6).
005100     05 O-PART4              PIC X(272).
005200 WORKING-STORAGE SECTION.
005300 77 LAST-RECORD              PIC X.
005400 77 FIELD-ID2                PIC X(9).
005500 77 OPER-ID2                 PIC X(6).
005600
005700 PROCEDURE DIVISION.
005800 MAIN-LINE-ROUTINE.
005900     OPEN INPUT IN-A-FILE
006000     OUTPUT OUT-A-FILE.
006100     MOVE 'N' TO LAST-RECORD.
006200     READ IN-A-FILE
006300     AT END MOVE 'Y' TO LAST-RECORD.
006400     PERFORM PROCESS-WRITE-READ
006500     UNTIL LAST-RECORD = 'Y'.
006600     CLOSE IN-A-FILE
006700     OUT-A-FILE.
006800     STOP RUN.
006900
007000 PROCESS-WRITE-READ.
007100     IF TYP1 = 0
007200         MOVE I-FIELD-ID TO FIELD-ID
007300         MOVE I-OPER-ID TO OPER-ID
007400         MOVE I-FIELD-ID TO FIELD-ID2
007500         MOVE I-OPER-ID TO OPER-ID2
007600     ELSE MOVE FIELD-ID2 TO FIELD-ID
007700         MOVE OPER-ID2 TO OPER-ID.
007800     MOVE SPACE TO O-BLANK.
007900     MOVE PART1 TO O-PART1.
008000     MOVE TYP1 TO O-TYP1.
008100     MOVE PART2 TO O-PART2.
008200     MOVE I-FIELD-ID TO O-FIELD-ID.
008300     MOVE PART3 TO O-PART3.
008400     MOVE I-OPER-ID TO O-OPER-ID.
008500     MOVE PART4 TO O-PART4.
008600     WRITE OUT-A-FILE-REC.
008700     READ IN-A-FILE
008800     AT END MOVE 'Y' TO LAST-RECORD.

```


Table B13. COBOL Program Listing for DWTLFAC

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     DWTLFAC.
000400 REMARKS. SUMS ANNUAL PRODUCTION FOR ALL WELLS AND ANNUAL
000500     PRODUCTION FOR WELLS ONLY PRODUCING IN DECEMBER.
000600     IN STREAM JCL ALLOW YOU TO SELECT BEGINNING AND
000700     ENDING 10 YEAR INTERVAL (82-91 FOR EXAMPLE).
000800 *****
000900 ***** INPUT/OUTPUT DATA FIELD NAMES AND VARIABLES *****
001000 *****
001100 INPUT          I-STATE          STATE POSTAL CODE
001200 INPUT          I-REC-TYPE       REC TYPE, > 50 = PROD REC
001300 INPUT          PROD-1G TO 12G   12 MONTHS OF GAS PRODUCTION
001400 INPUT          PROD-1G TO 12G   12 MONTHS OF GAS PRODUCTION
001500 INPUT JCL      N1                BEGINNING DATA YEAR
001600 INPUT JCL      N2                ENDING DATA YEAR
001700 OUTPUT         WELLSYR1 - WELLSYR10  WELLS PER YEAR
001800 OUTPUT         OUTYR1 - OUTYR10     12 MONTHS OF GAS PRODUCTION
001900 OUTPUT         N1-PLUS-1 - 10      JCL YEAR PLUS 1
002000 OUTPUT         ADD-YEAR1 - 10     SUM OF WELLS FOR EACH YEAR
002100 OUTPUT         ADD-DECW1 - 10     SUM OF WELLS, DEC ONLY
002200 OUTPUT         PERCENT-YR1 - 10   PERCENT BY YEAR
002300 OUTPUT         SUM-PERCENT        SUM OF THE PERCENTAGES
002400 OUTPUT         AVG-PERCENT       AVERAGE OF PERCENTAGES
002500 OUTPUT         PROD-PCT          PRODUCTION PERCENT FOR YEAR
002600 OUTPUT         CUM-PROD-PCT      CUM PRODUCTION PERCENT
002700 OUTPUT         CUM-ALL-YR1 - 10  CUM FOR ALL WELLS
002800 OUTPUT         CUM-WITH-DECYR1 - 10 DEC WELL CUM
002900 *****
003000 AUTHOR.      FR8.
003100 DATE-COMPILED. 11/05/92.
003200 ENVIRONMENT DIVISION.
003300 CONFIGURATION SECTION.
003400 SOURCE-COMPUTER. IBM-370-168.
003500 OBJECT-COMPUTER. IBM-370-168.
003600 INPUT-OUTPUT SECTION.
003700 FILE-CONTROL.
003800     SELECT INDWT ASSIGN TO UT-S-INDWT.
003900     SELECT JCL-DATA ASSIGN TO UT-S-NUM.
004000     SELECT FETCH ASSIGN TO UT-S-FETCH.
004100 DATA DIVISION.
004200 FILE SECTION.
004300 FD      INDWT
004400     RECORD CONTAINS 466 CHARACTERS
004500     BLOCK CONTAINS 0 CHARACTERS
004600     RECORDING MODE IS F
004700     LABEL RECORDS ARE STANDARD.
004800 01     ID-REC.
004900     05 I-KIND          PIC X.
005000     05 I-ID-PART1     PIC X(15).
005100     05 I-STATE        PIC XX.
005200     05 I-ID-PART2     PIC X(14).
005300     05 I-REC-TYPE     PIC 99.
005400     05 P-GCUM         PIC 9(13).
005500     05 PROD-10        PIC 9(7).
005600     05 WATER-1        PIC 9(7).
005700     05 PROD-1G        PIC 9(9).
005800     05 FWELL-2        PIC 9(3).
005900     05 LWELL-2        PIC 9(3).
006000     05 ALWBL-2       PIC 9(7).
006100     05 PROD-20        PIC 9(7).
006200     05 WATER-2        PIC 9(7).
006300     05 PROD-2G        PIC 9(9).
006400     05 FWELL-3        PIC 9(3).
006500     05 LWELL-3        PIC 9(3).
006600     05 ALWBL-3       PIC 9(7).
006700     05 PROD-30        PIC 9(7).
006800     05 WATER-3        PIC 9(7).
006900     05 PROD-3G        PIC 9(9).
007000     05 FWELL-4        PIC 9(3).
007100     05 LWELL-4        PIC 9(3).
007200     05 ALWBL-4       PIC 9(7).
007300     05 PROD-40        PIC 9(7).
007400     05 WATER-4        PIC 9(7).
007500     05 PROD-4G        PIC 9(9).
007600     05 FWELL-5        PIC 9(3).
007700     05 LWELL-5        PIC 9(3).

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

```

007800      05  ALWBL-5          PIC 9(7).
007900      05  PROD-50         PIC 9(7).
008000      05  WATER-5         PIC 9(7).
008100      05  PROD-5G         PIC 9(9).
008200      05  FWELL-6         PIC 9(3).
008300      05  LWELL-6         PIC 9(3).
008400      05  ALWBL-6         PIC 9(7).
008500      05  PROD-60         PIC 9(7).
008600      05  WATER-6         PIC 9(7).
008700      05  PROD-6G         PIC 9(9).
008800      05  FWELL-7         PIC 9(3).
008900      05  LWELL-7         PIC 9(3).
009000      05  ALWBL-7         PIC 9(7).
009100      05  PROD-70         PIC 9(7).
009200      05  WATER-7         PIC 9(7).
009300      05  PROD-7G         PIC 9(9).
009400      05  FWELL-8         PIC 9(3).
009500      05  LWELL-8         PIC 9(3).
009600      05  ALWBL-8         PIC 9(7).
009700      05  PROD-80         PIC 9(7).
009800      05  WATER-8         PIC 9(7).
009900      05  PROD-8G         PIC 9(9).
010000      05  FWELL-9         PIC 9(3).
010100      05  LWELL-9         PIC 9(3).
010200      05  ALWBL-9         PIC 9(7).
010300      05  PROD-90         PIC 9(7).
010400      05  WATER-9         PIC 9(7).
010500      05  PROD-9G         PIC 9(9).
010600      05  FWELL-10        PIC 9(3).
010700      05  LWELL-10        PIC 9(3).
010800      05  ALWBL-10        PIC 9(7).
010900      05  PROD-100        PIC 9(7).
011000      05  WATER-10        PIC 9(7).
011100      05  PROD-10G        PIC 9(9).
011200      05  FWELL-11        PIC 9(3).
011300      05  LWELL-11        PIC 9(3).
011400      05  ALWBL-11        PIC 9(7).
011500      05  PROD-110        PIC 9(7).
011600      05  WATER-11        PIC 9(7).
011700      05  PROD-11G        PIC 9(9).
011800      05  FWELL-12        PIC 9(3).
011900      05  LWELL-12        PIC 9(3).
012000      05  ALWBL-12        PIC 9(7).
012100      05  PROD-120        PIC 9(7).
012200      05  WATER-12        PIC 9(7).
012300      05  PROD-12G        PIC 9(9).
012400 FD   JCL--DATA
012500      BLOCK CONTAINS 0 CHARACTERS
012600      RECORDING MODE IS F
012700      LABEL RECORDS ARE OMITTED.
012800 01   JCL-DATA-REC.
012900      05  N1              PIC 99.
013000      05  FILLER         PIC XX.
013100      05  N2              PIC 99.
013200      05  FILLER         PIC X(74).
013300 FD   FETCH
013400      RECORD CONTAINS 81 CHARACTERS
013500      BLOCK CONTAINS 0 CHARACTERS
013600      RECORDING MODE IS F
013700      LABEL RECORDS ARE STANDARD.
013800 01   DWT-FET-REC.
013900      05  OUT-CC          PIC X.
014000      05  WELLSYR1       PIC ZZZZZZZ9.
014100      05  WELLSYR2       PIC ZZZZZZZ9.
014200      05  WELLSYR3       PIC ZZZZZZZ9.
014300      05  WELLSYR4       PIC ZZZZZZZ9.
014400      05  WELLSYR5       PIC ZZZZZZZ9.
014500      05  WELLSYR6       PIC ZZZZZZZ9.
014600      05  WELLSYR7       PIC ZZZZZZZ9.
014700      05  WELLSYR8       PIC ZZZZZZZ9.
014800      05  WELLSYR9       PIC ZZZZZZZ9.
014900      05  WELLSYR10      PIC ZZZZZZZ9.
015000 01   DWT-FET-REC-PCT.
015100      05  OUT-CC          PIC X.
015200      05  OUTYR1         PIC ZZZZ.999.
015300      05  OUTYR2         PIC ZZZZ.999.
015400      05  OUTYR3         PIC ZZZZ.999.

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

```

015500      05  OUTYR4          PIC  ZZZZ.999.
015600      05  OUTYR5          PIC  ZZZZ.999.
015700      05  OUTYR6          PIC  ZZZZ.999.
015800      05  OUTYR7          PIC  ZZZZ.999.
015900      05  OUTYR8          PIC  ZZZZ.999.
016000      05  OUTYR9          PIC  ZZZZ.999.
016100      05  OUTYR10         PIC  ZZZZ.999.
016200  01  DWT-FET-REC-PROD.
016300      05  OUT-CC          PIC  X.
016400      05  OUT-YEAR19      PIC  XX.
016500      05  OUT-YEAR       PIC  XX.
016600      05  FILLER          PIC  X(5).
016700      05  OUT-CUM-ALL     PIC  ZZZZZZZZZZZZZ9.
016800      05  FILLER          PIC  X(5).
016900      05  OUT-CUM-DEC     PIC  ZZZZZZZZZZZZZ9.
017000      05  FILLER          PIC  X(5).
017100      05  OUT-PCT        PIC  ZZZZ.999.
017200      05  FILLER          PIC  X(25).
017300  01  DWT-FET-REC-AVG.
017400      05  OUT-CC          PIC  X.
017500      05  OUT-AVGS        PIC  X(18).
017600      05  OUT-PCT-AVG     PIC  ZZZZ.999.
017700      05  FILLER          PIC  X(54).
017800  01  DWT-FET-REC-STATE.
017900      05  OUT-CC          PIC  X.
018000      05  OUT-ST-CODE     PIC  X(13).
018100      05  OUT-I-STATE     PIC  99.
018200      05  OUT-MORE        PIC  X(52).
018300      05  OUT-MORE1       PIC  X(13).
018400  WORKING-STORAGE SECTION.
018500  01  DWT-FET-REC-HEADER.
018600      05  FILLER          PIC  X(7)  VALUE ' 19'.
018700      05  YEAR1           PIC  99.
018800      05  FILLER          PIC  X(6)  VALUE ' 19'.
018900      05  YEAR2           PIC  99.
019000      05  FILLER          PIC  X(6)  VALUE ' 19'.
019100      05  YEAR3           PIC  99.
019200      05  FILLER          PIC  X(6)  VALUE ' 19'.
019300      05  YEAR4           PIC  99.
019400      05  FILLER          PIC  X(6)  VALUE ' 19'.
019500      05  YEAR5           PIC  99.
019600      05  FILLER          PIC  X(6)  VALUE ' 19'.
019700      05  YEAR6           PIC  99.
019800      05  FILLER          PIC  X(6)  VALUE ' 19'.
019900      05  YEAR7           PIC  99.
020000      05  FILLER          PIC  X(6)  VALUE ' 19'.
020100      05  YEAR8           PIC  99.
020200      05  FILLER          PIC  X(6)  VALUE ' 19'.
020300      05  YEAR9           PIC  99.
020400      05  FILLER          PIC  X(6)  VALUE ' 19'.
020500      05  YEAR10          PIC  99.
020600  77  FOR-OUT-MORE1       PIC  X(13) VALUE ' PERCENT'.
020700  77  FOR-OUT-MORE        PIC  X(52) VALUE
020800      ' LINE 1 = YEARS LINE 2 = ALL WELLS LINE 3 ='.
020900  77  N1-PLUS-1           PIC  99  VALUE ZEROS.
021000  77  N1-PLUS-2           PIC  99  VALUE ZEROS.
021100  77  N1-PLUS-3           PIC  99  VALUE ZEROS.
021200  77  N1-PLUS-4           PIC  99  VALUE ZEROS.
021300  77  N1-PLUS-5           PIC  99  VALUE ZEROS.
021400  77  N1-PLUS-6           PIC  99  VALUE ZEROS.
021500  77  N1-PLUS-7           PIC  99  VALUE ZEROS.
021600  77  N1-PLUS-8           PIC  99  VALUE ZEROS.
021700  77  N1-PLUS-9           PIC  99  VALUE ZEROS.
021800  77  N1-PLUS-10          PIC  99  VALUE ZEROS.
021900  77  ADD-YEAR1           PIC  9(8) VALUE ZEROS.
022000  77  ADD-YEAR2           PIC  9(8) VALUE ZEROS.
022100  77  ADD-YEAR3           PIC  9(8) VALUE ZEROS.
022200  77  ADD-YEAR4           PIC  9(8) VALUE ZEROS.
022300  77  ADD-YEAR5           PIC  9(8) VALUE ZEROS.
022400  77  ADD-YEAR6           PIC  9(8) VALUE ZEROS.
022500  77  ADD-YEAR7           PIC  9(8) VALUE ZEROS.
022600  77  ADD-YEAR8           PIC  9(8) VALUE ZEROS.
022700  77  ADD-YEAR9           PIC  9(8) VALUE ZEROS.
022800  77  ADD-YEAR10          PIC  9(8) VALUE ZEROS.
022900  77  ADD-DECW1           PIC  9(8) VALUE ZEROS.
023000  77  ADD-DECW2           PIC  9(8) VALUE ZEROS.
023100  77  ADD-DECW3           PIC  9(8) VALUE ZEROS.

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

```

023200 77 ADD-DECW4          PIC 9(8) VALUE ZEROS.
023300 77 ADD-DECW5          PIC 9(8) VALUE ZEROS.
023400 77 ADD-DECW6          PIC 9(8) VALUE ZEROS.
023500 77 ADD-DECW7          PIC 9(8) VALUE ZEROS.
023600 77 ADD-DECW8          PIC 9(8) VALUE ZEROS.
023700 77 ADD-DECW9          PIC 9(8) VALUE ZEROS.
023800 77 ADD-DECW10         PIC 9(8) VALUE ZEROS.
023900 77 PERCENT-YR1        PIC V99999999 VALUE ZEROS.
024000 77 PERCENT-YR2        PIC V99999999 VALUE ZEROS.
024100 77 PERCENT-YR3        PIC V99999999 VALUE ZEROS.
024200 77 PERCENT-YR4        PIC V99999999 VALUE ZEROS.
024300 77 PERCENT-YR5        PIC V99999999 VALUE ZEROS.
024400 77 PERCENT-YR6        PIC V99999999 VALUE ZEROS.
024500 77 PERCENT-YR7        PIC V99999999 VALUE ZEROS.
024600 77 PERCENT-YR8        PIC V99999999 VALUE ZEROS.
024700 77 PERCENT-YR9        PIC V99999999 VALUE ZEROS.
024800 77 PERCENT-YR10       PIC V99999999 VALUE ZEROS.
024900 77 SUM-PERCENT        PIC 99999V999 VALUE ZEROS.
025000 77 AVG-PERCENT        PIC 99999V999 VALUE ZEROS.
025100 77 PROD-PCT          PIC V9999999999999999 VALUE ZEROS.
025200 77 CUM-PROD-PCT       PIC 999999999999V999 VALUE ZEROS.
025300 77 CUM-ALL-YR1        PIC 9(14) VALUE ZEROS.
025400 77 CUM-ALL-YR2        PIC 9(14) VALUE ZEROS.
025500 77 CUM-ALL-YR3        PIC 9(14) VALUE ZEROS.
025600 77 CUM-ALL-YR4        PIC 9(14) VALUE ZEROS.
025700 77 CUM-ALL-YR5        PIC 9(14) VALUE ZEROS.
025800 77 CUM-ALL-YR6        PIC 9(14) VALUE ZEROS.
025900 77 CUM-ALL-YR7        PIC 9(14) VALUE ZEROS.
026000 77 CUM-ALL-YR8        PIC 9(14) VALUE ZEROS.
026100 77 CUM-ALL-YR9        PIC 9(14) VALUE ZEROS.
026200 77 CUM-ALL-YR10       PIC 9(14) VALUE ZEROS.
026300 77 CUM-WITH-DECYR1     PIC 9(14) VALUE ZEROS.
026400 77 CUM-WITH-DECYR2     PIC 9(14) VALUE ZEROS.
026500 77 CUM-WITH-DECYR3     PIC 9(14) VALUE ZEROS.
026600 77 CUM-WITH-DECYR4     PIC 9(14) VALUE ZEROS.
026700 77 CUM-WITH-DECYR5     PIC 9(14) VALUE ZEROS.
026800 77 CUM-WITH-DECYR6     PIC 9(14) VALUE ZEROS.
026900 77 CUM-WITH-DECYR7     PIC 9(14) VALUE ZEROS.
027000 77 CUM-WITH-DECYR8     PIC 9(14) VALUE ZEROS.
027100 77 CUM-WITH-DECYR9     PIC 9(14) VALUE ZEROS.
027200 77 CUM-WITH-DECYR10    PIC 9(14) VALUE ZEROS.
027300 77 LAST-RECORD        PIC X VALUE 'N'.
027400 77 HOLD-ID            PIC X(31) VALUE ZEROS.
027500 PROCEDURE DIVISION.
027600 MAIN-LINE-ROUTINE.
027700 OPEN INPUT INDWT JCL-DATA
027800 OUTPUT FETCH.
027900 READ JCL-DATA.
028000 READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
028100 MOVE SPACES TO DWT-FET-REC.
028200 PERFORM FIX-UP-N1-N2.
028300 PERFORM DETERMINE-REC UNTIL LAST-RECORD = 'Y'.
028400 PERFORM WRITE-FETCH.
028500 CLOSE INDWT FETCH.
028600 STOP RUN.
028700
028800 *****
028900 ***DETERMINE-REC IS PROCESSED FIRST***
029000* SEE IF RECORD TYPE IS SAME YEAR OR BETWEEN THE YEARS ASKED
029100* FOR IN THE JCL. REMEMBER THAT FIX-UP-N1-N2 MODULE ADDED ONE
029200* TO THE LAST YEAR ASKED FOR AND SUBTRACTED ONE FROM THE FIRST
029300* YEAR ASKED FOR SO THIS QUESTION WOULD BE EASIER. IF THE
029400* PRODUCTION RECORDS IS ONE YOU WANT TO PROCESS, THEN SEE IF
029500* IF IT HAS ANY PRODUCTION (BY PERFORMING NON-ZERO-PROD-REC).
029600* IF IT DOES, DETERMINE WHICH YEAR IT IS (BY PERFORMING WHICH-
029700* YEAR) AND ADD ONE TO THE NUMBER OF WELLS FOR THAT YEAR AND
029800* SUM THE MONTHS OF PRODUCTION FOR THAT YEAR AND ADD IT TO THE
029900* ACCUMULATOR FOR THE PRODUCTION FOR THAT YEAR. THEN DETERMINE
030000* IF THIS RECORD HAS PRODUCTION IN DECEMBER > THAN 0, IF SO
030100* ADD ONE TO THE NUMBER OF DECEMBER WELLS FOR THAT YEAR AND ADD
030200* THE PRODUCTION TO THE SUM OF DECEMBER WELLS FOR THAT YEAR.
030300* WHEN END OF FILE IS DETECTED, THEN PERFORM WRITE-FETCH WHICH
030400* OUTPUTS ALL THE ANSWERS TO FETCH.
030500 *****
030600 DETERMINE-REC.
030700 IF I-REC-TYPE IS > N1 AND I-REC-TYPE IS < N2
030800 PERFORM NON-ZERO-PROD-REC.

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

```

030900      READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
031000 NON-ZERO-PROD-REC.
031100      IF      PROD-1G = ZEROS      AND      PROD-2G = ZEROS      AND
031200      PROD-3G = ZEROS      AND      PROD-4G = ZEROS      AND
031300      PROD-5G = ZEROS      AND      PROD-6G = ZEROS      AND
031400      PROD-7G = ZEROS      AND      PROD-8G = ZEROS      AND
031500      PROD-9G = ZEROS      AND      PROD-10G = ZEROS      AND
031600      PROD-11G = ZEROS      AND      PROD-12G = ZEROS
031700      NEXT SENTENCE
031800      ELSE PERFORM WHICH-YEAR.
031900 WHICH-YEAR.
032000      IF      I-REC-TYPE = N1-PLUS-1 ADD 1 TO ADD-YEAR1
032100      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
032200      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
032300      TO CUM-ALL-YR1
032400      ELSE IF I-REC-TYPE = N1-PLUS-2 ADD 1 TO ADD-YEAR2
032500      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
032600      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
032700      TO CUM-ALL-YR2
032800      ELSE IF I-REC-TYPE = N1-PLUS-3 ADD 1 TO ADD-YEAR3
032900      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
033000      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
033100      TO CUM-ALL-YR3
033200      ELSE IF I-REC-TYPE = N1-PLUS-4 ADD 1 TO ADD-YEAR4
033300      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
033400      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
033500      TO CUM-ALL-YR4
033600      ELSE IF I-REC-TYPE = N1-PLUS-5 ADD 1 TO ADD-YEAR5
033700      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
033800      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
033900      TO CUM-ALL-YR5
034000      ELSE IF I-REC-TYPE = N1-PLUS-6 ADD 1 TO ADD-YEAR6
034100      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
034200      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
034300      TO CUM-ALL-YR6
034400      ELSE IF I-REC-TYPE = N1-PLUS-7 ADD 1 TO ADD-YEAR7
034500      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
034600      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
034700      TO CUM-ALL-YR7
034800      ELSE IF I-REC-TYPE = N1-PLUS-8 ADD 1 TO ADD-YEAR8
034900      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
035000      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
035100      TO CUM-ALL-YR8
035200      ELSE IF I-REC-TYPE = N1-PLUS-9 ADD 1 TO ADD-YEAR9
035300      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
035400      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
035500      TO CUM-ALL-YR9
035600      ELSE IF I-REC-TYPE = N1-PLUS-10 ADD 1 TO ADD-YEAR10
035700      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
035800      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
035900      TO CUM-ALL-YR10.
036000      IF      I-REC-TYPE = N1-PLUS-1 AND PROD-12G > 0
036100      ADD 1 TO ADD-DECW1
036200      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
036300      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
036400      TO CUM-WITH-DECYR1
036500      ELSE IF I-REC-TYPE = N1-PLUS-2 AND PROD-12G > 0
036600      ADD 1 TO ADD-DECW2
036700      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
036800      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
036900      TO CUM-WITH-DECYR2
037000      ELSE IF I-REC-TYPE = N1-PLUS-3 AND PROD-12G > 0
037100      ADD 1 TO ADD-DECW3
037200      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
037300      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
037400      TO CUM-WITH-DECYR3
037500      ELSE IF I-REC-TYPE = N1-PLUS-4 AND PROD-12G > 0
037600      ADD 1 TO ADD-DECW4
037700      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
037800      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
037900      TO CUM-WITH-DECYR4
038000      ELSE IF I-REC-TYPE = N1-PLUS-5 AND PROD-12G > 0
038100      ADD 1 TO ADD-DECW5
038200      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
038300      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
038400      TO CUM-WITH-DECYR5
038500      ELSE IF I-REC-TYPE = N1-PLUS-6 AND PROD-12G > 0

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

```

038600      ADD 1 TO ADD-DECW6
038700      ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
038800      PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
038900      TO CUM-WITH-DECYR6
039000      ELSE IF I-REC-TYPE = N1-PLUS-7 AND PROD-12G > 0
039100          ADD 1 TO ADD-DECW7
039200          ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
039300          PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
039400          TO CUM-WITH-DECYR7
039500      ELSE IF I-REC-TYPE = N1-PLUS-8 AND PROD-12G > 0
039600          ADD 1 TO ADD-DECW8
039700          ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
039800          PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
039900          TO CUM-WITH-DECYR8
040000      ELSE IF I-REC-TYPE = N1-PLUS-9 AND PROD-12G > 0
040100          ADD 1 TO ADD-DECW9
040200          ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
040300          PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
040400          TO CUM-WITH-DECYR9
040500      ELSE IF I-REC-TYPE = N1-PLUS-10 AND PROD-12G > 0
040600          ADD 1 TO ADD-DECW10
040700          ADD PROD-1G PROD-2G PROD-3G PROD-4G PROD-5G PROD-6G
040800          PROD-7G PROD-8G PROD-9G PROD-10G PROD-11G PROD-12G
040900          TO CUM-WITH-DECYR10.
041000      WRITE-FETCH.
041100      MOVE SPACES TO DWT-FET-REC-STATE.
041200      MOVE FOR-OUT-MORE TO OUT-MORE.
041300      MOVE FOR-OUT-MORE1 TO OUT-MORE1.
041400      MOVE I-STATE TO OUT-I-STATE.
041500      MOVE 'STATE CODE = ' TO OUT-ST-CODE.
041600      WRITE DWT-FET-REC-STATE.
041700      MOVE SPACES TO DWT-FET-REC-STATE.
041800      MOVE N1-PLUS-1 TO YEAR1.
041900      MOVE N1-PLUS-2 TO YEAR2.
042000      MOVE N1-PLUS-3 TO YEAR3.
042100      MOVE N1-PLUS-4 TO YEAR4.
042200      MOVE N1-PLUS-5 TO YEAR5.
042300      MOVE N1-PLUS-6 TO YEAR6.
042400      MOVE N1-PLUS-7 TO YEAR7.
042500      MOVE N1-PLUS-8 TO YEAR8.
042600      MOVE N1-PLUS-9 TO YEAR9.
042700      MOVE N1-PLUS-10 TO YEAR10.
042800      WRITE DWT-FET-REC FROM DWT-FET-REC-HEADER
042900      AFTER ADVANCING 2 LINES.
043000      MOVE ADD-YEAR1 TO WELLSYR1.
043100      MOVE ADD-YEAR2 TO WELLSYR2.
043200      MOVE ADD-YEAR3 TO WELLSYR3.
043300      MOVE ADD-YEAR4 TO WELLSYR4.
043400      MOVE ADD-YEAR5 TO WELLSYR5.
043500      MOVE ADD-YEAR6 TO WELLSYR6.
043600      MOVE ADD-YEAR7 TO WELLSYR7.
043700      MOVE ADD-YEAR8 TO WELLSYR8.
043800      MOVE ADD-YEAR9 TO WELLSYR9.
043900      MOVE ADD-YEAR10 TO WELLSYR10.
044000      WRITE DWT-FET-REC AFTER ADVANCING 1 LINES.
044100      MOVE ADD-DECW1 TO WELLSYR1.
044200      MOVE ADD-DECW2 TO WELLSYR2.
044300      MOVE ADD-DECW3 TO WELLSYR3.
044400      MOVE ADD-DECW4 TO WELLSYR4.
044500      MOVE ADD-DECW5 TO WELLSYR5.
044600      MOVE ADD-DECW6 TO WELLSYR6.
044700      MOVE ADD-DECW7 TO WELLSYR7.
044800      MOVE ADD-DECW8 TO WELLSYR8.
044900      MOVE ADD-DECW9 TO WELLSYR9.
045000      MOVE ADD-DECW10 TO WELLSYR10.
045100      WRITE DWT-FET-REC AFTER ADVANCING 1 LINES.
045200      DIVIDE ADD-DECW1 BY ADD-YEAR1 GIVING PERCENT-YR1 ROUNDED.
045300      MOVE PERCENT-YR1 TO OUTYR1.
045400      DIVIDE ADD-DECW2 BY ADD-YEAR2 GIVING PERCENT-YR2 ROUNDED.
045500      MOVE PERCENT-YR2 TO OUTYR2.
045600      DIVIDE ADD-DECW3 BY ADD-YEAR3 GIVING PERCENT-YR3 ROUNDED.
045700      MOVE PERCENT-YR3 TO OUTYR3.
045800      DIVIDE ADD-DECW4 BY ADD-YEAR4 GIVING PERCENT-YR4 ROUNDED.
045900      MOVE PERCENT-YR4 TO OUTYR4.
046000      DIVIDE ADD-DECW5 BY ADD-YEAR5 GIVING PERCENT-YR5 ROUNDED.
046100      MOVE PERCENT-YR5 TO OUTYR5.
046200      DIVIDE ADD-DECW6 BY ADD-YEAR6 GIVING PERCENT-YR6 ROUNDED.

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

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046300      MOVE PERCENT-YR6 TO OUTYR6.
046400      DIVIDE ADD-DECW7 BY ADD-YEAR7 GIVING PERCENT-YR7 ROUNDED.
046500      MOVE PERCENT-YR7 TO OUTYR7.
046600      DIVIDE ADD-DECW8 BY ADD-YEAR8 GIVING PERCENT-YR8 ROUNDED.
046700      MOVE PERCENT-YR8 TO OUTYR8.
046800      DIVIDE ADD-DECW9 BY ADD-YEAR9 GIVING PERCENT-YR9 ROUNDED.
046900      MOVE PERCENT-YR9 TO OUTYR9.
047000      DIVIDE ADD-DECW10 BY ADD-YEAR10
047100          GIVING PERCENT-YR10 ROUNDED.
047200      MOVE PERCENT-YR10 TO OUTYR10.
047300      WRITE DWT-FET-REC-PCT AFTER ADVANCING 1 LINES.
047400      ADD PERCENT-YR1 PERCENT-YR2 PERCENT-YR3 PERCENT-YR4
047500          PERCENT-YR5 PERCENT-YR6 PERCENT-YR7 PERCENT-YR8
047600          PERCENT-YR9 PERCENT-YR10 GIVING SUM-PERCENT.
047700      DIVIDE SUM-PERCENT BY 10 GIVING AVG-PERCENT ROUNDED.
047800      MOVE SPACES TO DWT-FET-REC-AVG.
047900      MOVE AVG-PERCENT TO OUT-PCT-AVG.
048000      MOVE 'AVERAGE PERCENT = ' TO OUT-AVG5.
048100      WRITE DWT-FET-REC-AVG AFTER ADVANCING 1 LINES.
048200      MOVE SPACES TO DWT-FET-REC-PCT.
048300      MOVE CUM-ALL-YR1 TO OUT-CUM-ALL.
048400      MOVE CUM-WITH-DECYR1 TO OUT-CUM-DEC.
048500      DIVIDE CUM-WITH-DECYR1 BY CUM-ALL-YR1
048600          GIVING PROD-PCT ROUNDED.
048700      ADD PROD-PCT TO CUM-PROD-PCT.
048800      MOVE N1-PLUS-1 TO OUT-YEAR.
048900      MOVE '19' TO OUT-YEAR19.
049000      MOVE PROD-PCT TO OUT-PCT.
049100      MOVE ZEROS TO PROD-PCT.
049200      WRITE DWT-FET-REC-PROD AFTER ADVANCING 4 LINES.
049300      MOVE SPACES TO DWT-FET-REC-PCT.
049400      WRITE DWT-FET-REC-PCT.
049500      MOVE CUM-ALL-YR2 TO OUT-CUM-ALL.
049600      MOVE CUM-WITH-DECYR2 TO OUT-CUM-DEC.
049700      DIVIDE CUM-WITH-DECYR2 BY CUM-ALL-YR2
049800          GIVING PROD-PCT ROUNDED.
049900      ADD PROD-PCT TO CUM-PROD-PCT.
050000      MOVE N1-PLUS-2 TO OUT-YEAR.
050100      MOVE '19' TO OUT-YEAR19.
050200      MOVE PROD-PCT TO OUT-PCT.
050300      MOVE ZEROS TO PROD-PCT.
050400      WRITE DWT-FET-REC-PROD.
050500      MOVE SPACES TO DWT-FET-REC-PCT.
050600      WRITE DWT-FET-REC-PCT.
050700      MOVE CUM-ALL-YR3 TO OUT-CUM-ALL.
050800      MOVE CUM-WITH-DECYR3 TO OUT-CUM-DEC.
050900      DIVIDE CUM-WITH-DECYR3 BY CUM-ALL-YR3
051000          GIVING PROD-PCT ROUNDED.
051100      ADD PROD-PCT TO CUM-PROD-PCT.
051200      MOVE N1-PLUS-3 TO OUT-YEAR.
051300      MOVE '19' TO OUT-YEAR19.
051400      MOVE PROD-PCT TO OUT-PCT.
051500      MOVE ZEROS TO PROD-PCT.
051600      WRITE DWT-FET-REC-PROD.
051700      MOVE SPACES TO DWT-FET-REC-PCT.
051800      WRITE DWT-FET-REC-PCT.
051900      MOVE CUM-ALL-YR4 TO OUT-CUM-ALL.
052000      MOVE CUM-WITH-DECYR4 TO OUT-CUM-DEC.
052100      DIVIDE CUM-WITH-DECYR4 BY CUM-ALL-YR4
052200          GIVING PROD-PCT ROUNDED.
052300      ADD PROD-PCT TO CUM-PROD-PCT.
052400      MOVE N1-PLUS-4 TO OUT-YEAR.
052500      MOVE '19' TO OUT-YEAR19.
052600      MOVE PROD-PCT TO OUT-PCT.
052700      MOVE ZEROS TO PROD-PCT.
052800      WRITE DWT-FET-REC-PROD.
052900      MOVE SPACES TO DWT-FET-REC-PCT.
053000      WRITE DWT-FET-REC-PCT.
053100      MOVE CUM-ALL-YR5 TO OUT-CUM-ALL.
053200      MOVE CUM-WITH-DECYR5 TO OUT-CUM-DEC.
053300      DIVIDE CUM-WITH-DECYR5 BY CUM-ALL-YR5
053400          GIVING PROD-PCT ROUNDED.
053500      ADD PROD-PCT TO CUM-PROD-PCT.
053600      MOVE N1-PLUS-5 TO OUT-YEAR.
053700      MOVE '19' TO OUT-YEAR19.
053800      MOVE PROD-PCT TO OUT-PCT.
053900      MOVE ZEROS TO PROD-PCT.

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

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054000 WRITE DWT-FET-REC-PROD.
054100 MOVE SPACES TO DWT-FET-REC-PCT.
054200 WRITE DWT-FET-REC-PCT.
054300 MOVE CUM-ALL-YR6 TO OUT-CUM-ALL.
054400 MOVE CUM-WITH-DECYR6 TO OUT-CUM-DEC.
054500 DIVIDE CUM-WITH-DECYR6 BY CUM-ALL-YR6
054600     GIVING PROD-PCT ROUNDED.
054700 ADD PROD-PCT TO CUM-PROD-PCT.
054800 MOVE N1-PLUS-6 TO OUT-YEAR.
054900 MOVE '19' TO OUT-YEAR19.
055000 MOVE PROD-PCT TO OUT-PCT.
055100 MOVE ZEROS TO PROD-PCT.
055200 WRITE DWT-FET-REC-PROD.
055300 MOVE SPACES TO DWT-FET-REC-PCT.
055400 WRITE DWT-FET-REC-PCT.
055500 MOVE CUM-ALL-YR7 TO OUT-CUM-ALL.
055600 MOVE CUM-WITH-DECYR7 TO OUT-CUM-DEC.
055700 DIVIDE CUM-WITH-DECYR7 BY CUM-ALL-YR7
055800     GIVING PROD-PCT ROUNDED.
055900 ADD PROD-PCT TO CUM-PROD-PCT.
056000 MOVE N1-PLUS-7 TO OUT-YEAR.
056100 MOVE '19' TO OUT-YEAR19.
056200 MOVE PROD-PCT TO OUT-PCT.
056300 MOVE ZEROS TO PROD-PCT.
056400 WRITE DWT-FET-REC-PROD.
056500 MOVE SPACES TO DWT-FET-REC-PCT.
056600 WRITE DWT-FET-REC-PCT.
056700 MOVE CUM-ALL-YR8 TO OUT-CUM-ALL.
056800 MOVE CUM-WITH-DECYR8 TO OUT-CUM-DEC.
056900 DIVIDE CUM-WITH-DECYR8 BY CUM-ALL-YR8
057000     GIVING PROD-PCT ROUNDED.
057100 ADD PROD-PCT TO CUM-PROD-PCT.
057200 MOVE N1-PLUS-8 TO OUT-YEAR.
057300 MOVE '19' TO OUT-YEAR19.
057400 MOVE PROD-PCT TO OUT-PCT.
057500 MOVE ZEROS TO PROD-PCT.
057600 WRITE DWT-FET-REC-PROD.
057700 MOVE SPACES TO DWT-FET-REC-PCT.
057800 WRITE DWT-FET-REC-PCT.
057900 MOVE CUM-ALL-YR9 TO OUT-CUM-ALL.
058000 MOVE CUM-WITH-DECYR9 TO OUT-CUM-DEC.
058100 DIVIDE CUM-WITH-DECYR9 BY CUM-ALL-YR9
058200     GIVING PROD-PCT ROUNDED.
058300 ADD PROD-PCT TO CUM-PROD-PCT.
058400 MOVE N1-PLUS-9 TO OUT-YEAR.
058500 MOVE '19' TO OUT-YEAR19.
058600 MOVE PROD-PCT TO OUT-PCT.
058700 MOVE ZEROS TO PROD-PCT.
058800 WRITE DWT-FET-REC-PROD.
058900 MOVE SPACES TO DWT-FET-REC-PCT.
059000 WRITE DWT-FET-REC-PCT.
059100 MOVE CUM-ALL-YR10 TO OUT-CUM-ALL.
059200 MOVE CUM-WITH-DECYR10 TO OUT-CUM-DEC.
059300 DIVIDE CUM-WITH-DECYR10 BY CUM-ALL-YR10
059400     GIVING PROD-PCT ROUNDED.
059500 ADD PROD-PCT TO CUM-PROD-PCT.
059600 MOVE N1-PLUS-10 TO OUT-YEAR.
059700 MOVE '19' TO OUT-YEAR19.
059800 MOVE PROD-PCT TO OUT-PCT.
059900 MOVE ZEROS TO PROD-PCT.
060000 WRITE DWT-FET-REC-PROD.
060100 DIVIDE 10 INTO CUM-PROD-PCT ROUNDED.
060200 MOVE SPACES TO DWT-FET-REC-AVG.
060300 MOVE 'AVERAGE PERCENT =' TO OUT-AVGS.
060400 MOVE CUM-PROD-PCT TO OUT-PCT-AVG.
060500 WRITE DWT-FET-REC-AVG.
060600 FIX-UP-N1-N2.
060700*****
060800* FOR COMPARING JCL DATA TO INPUT DATA AND FOR DATA OUTPUT.
060900*****
061000 SUBTRACT 1 FROM N1.
061100 ADD 1 TO N2.
061200 ADD 1, N1 GIVING N1-PLUS-1.
061300 ADD 2, N1 GIVING N1-PLUS-2.
061400 ADD 3, N1 GIVING N1-PLUS-3.
061500 ADD 4, N1 GIVING N1-PLUS-4.
061600 ADD 5, N1 GIVING N1-PLUS-5.

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Table B13. COBOL Program Listing for DWTLFAC (Continued)

```

061700      ADD 6, N1 GIVING N1-PLUS-6.
061800      ADD 7, N1 GIVING N1-PLUS-7.
061900      ADD 8, N1 GIVING N1-PLUS-8.
062000      ADD 9, N1 GIVING N1-PLUS-9.
062100      ADD 10, N1 GIVING N1-PLUS-10.

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Table B14. COBOL Program Listing for NEWREC

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000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     NEWREC.
000400 REMARKS. REWRITE DWIGHTS FILE KEEPING ONLY THE PRODUCTION
000500     RECORDS THAT ACTUALLY HAVE PRODUCTION FOR EACH WELL.
000600     THE FIRST NON ZERO PRODUCTION RECORD AFTER THE ID
000700     RECORD WILL HAVE AN 'N' PLACED IN THE FIRST COLUMN
000800     AND WHAT EVER IS FOUND IN THE GAS CUM OF THE ID
000900     RECORD WILL BE WRITTEN IN COLUMNS 35/47 OF THE FIRST
001000     NON-ZERO PRODUCTION RECORD. 0'S ARE WRITTEN TO EACH
001100     ADDITIONAL PRODUCTION RECORD WHERE THE GAS CUM IS ON
001200     THE FIRST RECORD AND AN 'A' IS PLACED IN COLUMN ONE
001300     FOR THESE ADDITIONAL RECORDS. THIS GETS RID OF ALL
001400     RECORDS NOT NEEDED TO PROCESS THE GASCAP VINTAGE
001500     PROGRAM MUCH MORE QUICKLY.
001600 AUTHOR.     FR8.
001700 DATE-COMPILED. 06/03/92.
001800 ENVIRONMENT DIVISION.
001900 CONFIGURATION SECTION.
002000 SOURCE-COMPUTER. IBM-370-168.
002100 OBJECT-COMPUTER. IBM-370-168.
002200 INPUT-OUTPUT SECTION.
002300 FILE-CONTROL.
002400     SELECT INDWT ASSIGN TO UT-S-INDWT.
002500     SELECT DWTMOD ASSIGN TO UT-S-DWTMOD.
002600 DATA DIVISION.
002700 FILE SECTION.
002800 FD      INDWT
002900     RECORD CONTAINS 466 CHARACTERS
003000     BLOCK CONTAINS 0 CHARACTERS
003100     RECORDING MODE IS F
003200     LABEL RECORDS ARE STANDARD.
003300 01     ID-REC.
003400     05 FILLER                PIC X.
003500     05 I-ID                  PIC X(31).
003600     05 I-REC-TYPE            PIC 99.
003700     05 FILLER                PIC X(225).
003800     05 I-GCUM                PIC 9(13).
003900     05 FILLER                PIC X(194).
004000 01     PROD-REC.
004100     05 P-NEW-WELL            PIC X.
004200     05 P-ID                  PIC X(31).
004300     05 P-REC-TYPE            PIC 99.
004400     05 P-GCUM                PIC 9(13).
004500     05 PROD-1O                PIC 9(7).
004600     05 WATER-1                PIC 9(7).
004700     05 PROD-1G                PIC 9(9).
004800     05 FWELL-2                PIC 9(3).
004900     05 LWELL-2                PIC 9(3).
005000     05 ALWBL-2                PIC 9(7).
005100     05 PROD-2O                PIC 9(7).
005200     05 WATER-2                PIC 9(7).
005300     05 PROD-2G                PIC 9(9).
005400     05 FWELL-3                PIC 9(3).
005500     05 LWELL-3                PIC 9(3).
005600     05 ALWBL-3                PIC 9(7).
005700     05 PROD-3O                PIC 9(7).
005800     05 WATER-3                PIC 9(7).
005900     05 PROD-3G                PIC 9(9).
006000     05 FWELL-4                PIC 9(3).
006100     05 LWELL-4                PIC 9(3).
006200     05 ALWBL-4                PIC 9(7).
006300     05 PROD-4O                PIC 9(7).
006400     05 WATER-4                PIC 9(7).
006500     05 PROD-4G                PIC 9(9).

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Table B14. COBOL Program Listing for NEWREC (Continued)

```

006600      05  FWELL-5          PIC 9(3).
006700      05  LWELL-5          PIC 9(3).
006800      05  ALWBL-5          PIC 9(7).
006900      05  PROD-50          PIC 9(7).
007000      05  WATER-5          PIC 9(7).
007100      05  PROD-5G          PIC 9(9).
007200      05  FWELL-6          PIC 9(3).
007300      05  LWELL-6          PIC 9(3).
007400      05  ALWBL-6          PIC 9(7).
007500      05  PROD-60          PIC 9(7).
007600      05  WATER-6          PIC 9(7).
007700      05  PROD-6G          PIC 9(9).
007800      05  FWELL-7          PIC 9(3).
007900      05  LWELL-7          PIC 9(3).
008000      05  ALWBL-7          PIC 9(7).
008100      05  PROD-70          PIC 9(7).
008200      05  WATER-7          PIC 9(7).
008300      05  PROD-7G          PIC 9(9).
008400      05  FWELL-8          PIC 9(3).
008500      05  LWELL-8          PIC 9(3).
008600      05  ALWBL-8          PIC 9(7).
008700      05  PROD-80          PIC 9(7).
008800      05  WATER-8          PIC 9(7).
008900      05  PROD-8G          PIC 9(9).
009000      05  FWELL-9          PIC 9(3).
009100      05  LWELL-9          PIC 9(3).
009200      05  ALWBL-9          PIC 9(7).
009300      05  PROD-90          PIC 9(7).
009400      05  WATER-9          PIC 9(7).
009500      05  PROD-9G          PIC 9(9).
009600      05  FWELL-10         PIC 9(3).
009700      05  LWELL-10         PIC 9(3).
009800      05  ALWBL-10         PIC 9(7).
009900      05  PROD-100        PIC 9(7).
010000      05  WATER-10        PIC 9(7).
010100      05  PROD-10G        PIC 9(9).
010200      05  FWELL-11        PIC 9(3).
010300      05  LWELL-11        PIC 9(3).
010400      05  ALWBL-11        PIC 9(7).
010500      05  PROD-110        PIC 9(7).
010600      05  WATER-11        PIC 9(7).
010700      05  PROD-11G        PIC 9(9).
010800      05  FWELL-12        PIC 9(3).
010900      05  LWELL-12        PIC 9(3).
011000      05  ALWBL-12        PIC 9(7).
011100      05  PROD-120        PIC 9(7).
011200      05  WATER-12        PIC 9(7).
011300      05  PROD-12G        PIC 9(9).
011400  FD  DWTMOD
011500      RECORD CONTAINS 466 CHARACTERS
011600      BLOCK CONTAINS 0 CHARACTERS
011700      RECORDING MODE IS F
011800      LABEL RECORDS ARE STANDARD.
011900  01  DWT-MOD-REC.
012000      05  O-ALL          PIC X(466).
012100  WORKING-STORAGE SECTION.
012200  77  LAST-RECORD        PIC X          VALUE 'N'.
012300  77  NEW-WELL-INDICATOR PIC X          VALUE 'N'.
012400  77  MORE-WELL-RECS     PIC X          VALUE 'A'.
012500  77  FIRST-YEAR-OF-PROD PIC X          VALUE 'Y'.
012600  77  HOLD-ID           PIC X(31)       VALUE SPACES.
012700  77  HOLD-GCUM         PIC 9(13)       VALUE ZEROS.
012800  PROCEDURE DIVISION.
012900  MAIN-LINE-ROUTINE.
013000      OPEN INPUT INDWT
013100      OUTPUT DWTMOD.
013200      READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
013300      MOVE SPACES TO DWT-MOD-REC.
013400      PERFORM DETERMINE-PROCESS UNTIL LAST-RECORD = 'Y'.
013500      CLOSE INDWT DWTMOD.
013600      STOP RUN.
013700
013800*****
013900* IF THE RECORD TYPE IS 00 (ID RECORD) THEN MOVE THE ID TO *
014000* HOLD, MOVE THE GCUM (GAS CUM PRIOR TO RECORDS) TO HOLD, AND *
014100* MOVE 'Y' TO INDICATOR, ELSE IF A PRODUCTION RECORD (> 49) *
014200* AND IT IS THE SAME ID AS THE ID IN THE HOLD AREA, THEN SEE *

```

Table B14. COBOL Program Listing for NEWREC (Continued)

```

014300* IF IT HAS PRODUCTION; ELSE IF IT IS A PRODUCTION RECORD AND *
014400* IT IS NOT THE SAME ID AS IN THE HOLD AREA, THEN DISPLAY THE *
014500* THE MESSAGE.
014600*****
014700
014800 DETERMINE-PROCESS.
014900     IF I-REC-TYPE = 00
015000         MOVE I-ID TO HOLD-ID
015100         MOVE I-GCUM TO HOLD-GCUM
015200         MOVE 'Y' TO FIRST-YEAR-OF-PROD
015300     ELSE IF I-REC-TYPE > 49 AND P-ID = HOLD-ID
015400         PERFORM NON-ZERO-PROD-REC
015500     ELSE IF I-REC-TYPE > 49 AND P-ID NOT = HOLD-ID
015600         DISPLAY 'HAS NO 00 REC ' P-ID.
015700     READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
015800
015900*****
016000* IF THE PRODUCTION RECORD HAS NO PRODUCTION FOR EVERY MONTH, *
016100* THEN JUST READ ON, ELSE THE RECORD HAD PRODUCTION FOR SOME *
016200* MONTH AND NOW YOU WRITE THE GCUM - MAYBE. (SEE WRITE-GCUM) *
016300*****
016400
016500 NON-ZERO-PROD-REC.
016600     IF PROD-1G = ZEROS AND PROD-2G = ZEROS AND
016700         PROD-3G = ZEROS AND PROD-4G = ZEROS AND
016800         PROD-5G = ZEROS AND PROD-6G = ZEROS AND
016900         PROD-7G = ZEROS AND PROD-8G = ZEROS AND
017000         PROD-9G = ZEROS AND PROD-10G = ZEROS AND
017100         PROD-11G = ZEROS AND PROD-12G = ZEROS
017200         NEXT SENTENCE
017300     ELSE PERFORM WRITE-GCUM.
017400
017500*****
017600* IF IT IS THE FIRST PRODUCTION RECORD FOR A WELL, MOVE THE *
017700* GAS CUM FOUND IN HOLD TO THE OUT, MOVE 'N' TO 1ST COLUMN, *
017800* MOVE THE PRODUCTION RECORD TO OUT, AND WRITE. RESET THE FLAG*
017900* FOR FIRST YEAR OF PRODUCTION AND MOVE ZEROS TO THE HOLD CUM;*
018000* OTHERWISE IT IS NOT THE FIRST YEAR OF PRODUCTION SO YOU ZERO*
018100* OUT THE PLACE WHERE GAS CUM WOULD GO, MOVE 'A' TO THE FIRST *
018200* COLUMN, MOVE THE PRODUCTION RECORD TO THE OUT AND WRITE.
018300*****
018400
018500 WRITE-GCUM.
018600     IF FIRST-YEAR-OF-PROD = 'Y'
018700         MOVE HOLD-GCUM TO P-GCUM
018800         MOVE NEW-WELL-INDICATOR TO P-NEW-WELL
018900         MOVE PROD-REC TO DWT-MOD-REC
019000         WRITE DWT-MOD-REC
019100         MOVE 'N' TO FIRST-YEAR-OF-PROD
019200         MOVE ZEROS TO HOLD-GCUM
019300     ELSE MOVE ZEROS TO P-GCUM
019400         MOVE MORE-WELL-RECS TO P-NEW-WELL
019500         MOVE PROD-REC TO DWT-MOD-REC
019600         WRITE DWT-MOD-REC.

```

Table B15. COBOL Program Listing for OFPFLDS

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     OFPFLDS.
000400 REMARKS. ALL RECORDS FROM DWIGHT'S OIL FEDERAL PACIFIC FILE
000500     ARE WRITTEN FOR SELECTED WELLS AND A FIELD CONTAINED IN
000600     FLDIDS FILE. THESE RECORDS WILL LATER BE CONCATENATED
000700     TO THE CALIFORNIA GAS FILE. RUN PROGRAMS DWTIDPD AND THEN
000800     DWTGOR TO GET THE LIST OF ID'S TO USE IN THE FLDSID FILE.
000900*****
001000* THIS PROGRAM SIMPLY LOOKS AT THE FLDIDS FILE (INSTREAM JCL) *
001100* AND READS ONE AT A TIME. IT ASKS THE DWIGHT'S FILE IF THEY *
001200* ARE THE SAME. IF THEY ARE, THE ENTIRE RECORD IS WRITTEN, IF *
001300* IT DOES NOT MATCH, YOU JUST KEEP ON READING. THE LAST INPUT *
001400* LINE OF THE INSTREAM JCL MUST BE 9 9'S, THE FIRST MUST BE *
001500* THE FIELD ID YOU WANT TO KEEP, IN BETWEEN ARE THE WELLS. *
001600*****

```

Table B15. COBOL Program Listing for OFPFLDS (Continued)

```

001700 AUTHOR. FR8.
001800 DATE-COMPILED.
001900 06/25/92.
002000 ENVIRONMENT DIVISION.
002100 CONFIGURATION SECTION.
002200 SOURCE-COMPUTER. IBM-370-168.
002300 OBJECT-COMPUTER. IBM-370-168.
002400 INPUT-OUTPUT SECTION.
002500 FILE-CONTROL.
002600 SELECT INDWT ASSIGN TO UT-S-INDWT.
002700 SELECT DWTMOD ASSIGN TO UT-S-DWTMOD.
002800 SELECT FLDIDS ASSIGN TO UT-S-FLDIDS.
002900 DATA DIVISION.
003000 FILE SECTION.
003100 FD INDWT
003200 RECORD CONTAINS 466 CHARACTERS
003300 BLOCK CONTAINS 0 CHARACTERS
003400 RECORDING MODE IS F
003500 LABEL RECORDS ARE STANDARD.
003600 01 DWT-REC.
003700 05 I-FLD-ID.
003800 10 FLD-ID PIC X(10).
003900 10 REST-ID PIC X(22).
004000 05 ALL-ID REDEFINES I-FLD-ID PIC X(32).
004100 05 REST-DWT PIC X(434).
004200 FD DWTMOD
004300 RECORD CONTAINS 466 CHARACTERS
004400 BLOCK CONTAINS 0 CHARACTERS
004500 RECORDING MODE IS F
004600 LABEL RECORDS ARE STANDARD.
004700 01 DWT-MOD-REC.
004800 05 O-ALL-REC PIC X(466).
004900 FD FLDIDS
005000 RECORD CONTAINS 80 CHARACTERS
005100 BLOCK CONTAINS 0 CHARACTERS
005200 RECORDING MODE IS F
005300 LABEL RECORDS ARE STANDARD.
005400 01 ID-REC.
005500 05 OIL-ID PIC X(32).
005600 05 FILLER PIC X(48).
005700 WORKING-STORAGE SECTION.
005800 77 LAST-RECORD PIC X VALUE 'N'.
005900 77 OIL-ID36 PIC X(10) VALUE SPACES.
006000
006100 PROCEDURE DIVISION.
006200 MAIN-LINE-ROUTINE.
006300 OPEN INPUT INDWT FLDIDS
006400 OUTPUT DWTMOD.
006500 PERFORM READ-OIL-IDS.
006600 MOVE FLD-ID TO OIL-ID36.
006700 READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
006800 PERFORM FIND-OIL-FIELDS UNTIL LAST-RECORD = 'Y'.
006900 CLOSE INDWT DWTMOD FLDIDS.
007000 STOP RUN.
007100
007200 FIND-OIL-FIELDS.
007300 IF FLD-ID = OIL-ID36 OR ALL-ID = OIL-ID
007400 PERFORM WRITE-DWT-REC UNTIL ALL-ID NOT = OIL-ID
007500 PERFORM READ-OIL-IDS
007600 ELSE READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
007700 WRITE-DWT-REC.
007800 MOVE SPACES TO DWT-MOD-REC.
007900 MOVE DWT-REC TO DWT-MOD-REC.
008000 WRITE DWT-MOD-REC.
008100 READ INDWT AT END MOVE 'Y' TO LAST-RECORD.
008200 READ-OIL-IDS.
008300 READ FLDIDS.
008400 IF FLD-ID = '999999999'
008500 CLOSE INDWT DWTMOD.
008600 STOP RUN.

```

Table B16. COBOL Program Listing for REPLACE

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300 REPLACE.
000400 REMARKS. ***THIS PROGRAM FOR ALL DWIGHT'S OIL STATES ONLY.***
000500 *****USE REPLACE FOR ALL GAS STATES.*****
000600 THIS PROGRAM ACCESSES DWIGHT'S SORTED TAPE TO CHECK THE
000700 SORT KEY (COMPOSED OF FIELD AND OPERATOR ID'S) AND THE
000800 DWIGHT'S ORIGINAL DATA FIELDS OF FIELD AND OPERATOR ID
000900 (FOUND ONLY ON THE 00 TYPE RECORD) AND CHECKS EACH OF
001000 THESE DATA FIELDS FOR NON-NUMERIC DATA. WHEN NON-NUMERIC
001100 DATA IS ENCOUNTERED, IT IS REPLACED WITH ZEROS. IN 00
001200 TYPE RECORDS (PRODUCTION), THE FLOWING AND LIFTING
001300 WELLS ARE CHECKED FOR 999. WHEN 999 OCCURS, THE 999 IS
001400 REPLACED WITH ZEROS.
001500 AUTHOR. FR8.
001600 DATE-WRITTEN. JUNE 1981.
001700 DATE-COMPILED. JUNE 6, 1986
001800 INSTALLATION. DALLAS FIELD OFFICE,DOE/EIA.
001900 ENVIRONMENT DIVISION.
002000 CONFIGURATION SECTION.
002100 SOURCE-COMPUTER. IBM-370-168.
002200 OBJECT-COMPUTER. IBM-370-168.
002300 SPECIAL-NAMES.
002400 C01 IS TOP-PAGE.
002500 INPUT-OUTPUT SECTION.
002600 FILE-CONTROL.
002700 SELECT AFIL ASSIGN TO UT-S-AFILE.
002800 SELECT LIST ASSIGN TO UT-S-LIST.
002900 SELECT PRINT ASSIGN TO UT-S-PRINT.
003000 SELECT WELL ASSIGN TO UT-S-WELL.
003100 DATA DIVISION.
003200 FILE SECTION.
003300 FD AFIL
003400 RECORD CONTAINS 466 CHARACTERS
003500 BLOCK CONTAINS 27960 CHARACTERS
003600 LABEL RECORDS ARE STANDARD.
003700 01 ID-REC.
003800 05 FILLER PIC X.
003900 05 K-FLD-ID PIC 9(9).
004000 05 K-OPR-ID PIC 9(6).
004100 05 I-STATE PIC 99.
004200 05 I-DT PIC X(3).
004300 05 I-WELL-ID PIC X(11).
004400 05 I-REC-TYPE PIC 99.
004500 05 FILLER PIC X.
004600 05 I-COUN-C PIC X(3).
004700 05 I-FDISC-M PIC X(2).
004800 05 I-FDISC-D PIC X(2).
004900 05 I-FDISC-Y PIC X(2).
005000 05 I-FLD-ID PIC 9(9).
005100 05 I-FLD-NAM PIC X(38).
005200 05 I-G-GATH PIC X(5).
005300 05 I-O-GATH PIC X(5).
005400 05 I-U-PERF PIC 9(5).
005500 05 I-L-PERF PIC 9(5).
005600 05 I-STATUS PIC X(2).
005700 05 I-OPROD-M PIC 99.
005800 05 I-OPROD-D PIC 99.
005900 05 I-OPROD-Y PIC 99.
006000 05 I-TOTDPTH PIC 9(5).
006100 05 I-SPGG PIC 9V99.
006200 05 I-SPGO PIC 99V9.
006300 05 I-GOR PIC 9(4).
006400 05 I-NGW PIC 9V999.
006500 05 I-LOCATION PIC X(11).
006600 05 I-COUN-NAM PIC X(15).
006700 05 I-OPER-NAME PIC X(24).
006800 05 I-OPER-ID PIC 9(6).
006900 05 I-WELL-NAM PIC X(36).
007000 05 I-WELL-NUM PIC X(6).
007100 05 I-STAT-M PIC X(2).
007200 05 I-STAT-D PIC X(2).
007300 05 I-STAT-Y PIC X(2).
007400 05 FILLER PIC X(4).
007500 05 I-CUM-OIL PIC 9(13).
007600 05 I-CUM-GAS PIC 9(13).
007700 05 I-TGRAD PIC 9V999.

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Table B16. COBOL Program Listing for REPLACE (Continued)

007800	05	FILLER	PIC X.
007900	05	I-TEMPC	PIC 9(3).
008000	05	I-PRSC	PIC 9(3).
008100	05	FILLER	PIC X.
008200	05	I-OCUM-Y	PIC 99.
008300	05	I-OCUM-M	PIC 99.
008400	05	I-GCUM-Y	PIC 99.
008500	05	I-GCUM-M	PIC 99.
008600	05	I-GPROD-M	PIC 99.
008700	05	I-GPROD-Y	PIC 99.
008800	05	I-API-NUM	PIC X(7).
008900	05	FILLER	PIC X(163).
009000	01	PROD-REC.	
009100	05	FILLER	PIC X.
009200	05	FLD-ID	PIC 9(09).
009300	05	OPR-ID	PIC 9(06).
009400	05	FILLER	PIC X(16).
009500	05	REC-TYP	PIC 99.
009600	05	FWELL-1	PIC 9(3).
009700	05	LWELL-1	PIC 9(3).
009800	05	ALWBL-1	PIC 9(7).
009900	05	OIL-PROD-1	PIC 9(7).
010000	05	WATER-1	PIC 9(7).
010100	05	CAS-PROD-1	PIC 9(9).
010200	05	FWELL-2	PIC 9(3).
010300	05	LWELL-2	PIC 9(3).
010400	05	ALWBL-2	PIC 9(7).
010500	05	OIL-PROD-2	PIC 9(7).
010600	05	WATER-2	PIC 9(7).
010700	05	CAS-PROD-2	PIC 9(9).
010800	05	FWELL-3	PIC 9(3).
010900	05	LWELL-3	PIC 9(3).
011000	05	ALWBL-3	PIC 9(7).
011100	05	OIL-PROD-3	PIC 9(7).
011200	05	WATER-3	PIC 9(7).
011300	05	CAS-PROD-3	PIC 9(9).
011400	05	FWELL-4	PIC 9(3).
011500	05	LWELL-4	PIC 9(3).
011600	05	ALWBL-4	PIC 9(7).
011700	05	OIL-PROD-4	PIC 9(7).
011800	05	WATER-4	PIC 9(7).
011900	05	CAS-PROD-4	PIC 9(9).
012000	05	FWELL-5	PIC 9(3).
012200	05	ALWBL-5	PIC 9(7).
012300	05	OIL-PROD-5	PIC 9(7).
012100	05	LWELL-5	PIC 9(3).
012400	05	WATER-5	PIC 9(7).
012500	05	CAS-PROD-5	PIC 9(9).
012600	05	FWELL-6	PIC 9(3).
012700	05	LWELL-6	PIC 9(3).
012800	05	ALWBL-6	PIC 9(7).
012900	05	OIL-PROD-6	PIC 9(7).
013000	05	WATER-6	PIC 9(7).
013100	05	CAS-PROD-6	PIC 9(9).
013200	05	FWELL-7	PIC 9(3).
013300	05	LWELL-7	PIC 9(3).
013400	05	ALWBL-7	PIC 9(7).
013500	05	OIL-PROD-7	PIC 9(7).
013600	05	WATER-7	PIC 9(7).
013700	05	CAS-PROD-7	PIC 9(9).
013800	05	FWELL-8	PIC 9(3).
013900	05	LWELL-8	PIC 9(3).
014000	05	ALWBL-8	PIC 9(7).
014100	05	OIL-PROD-8	PIC 9(7).
014200	05	WATER-8	PIC 9(7).
014300	05	CAS-PROD-8	PIC 9(9).
014400	05	FWELL-9	PIC 9(3).
014500	05	LWELL-9	PIC 9(3).
014600	05	ALWBL-9	PIC 9(7).
014700	05	OIL-PROD-9	PIC 9(7).
014800	05	WATER-9	PIC 9(7).
014900	05	CAS-PROD-9	PIC 9(9).
015000	05	FWELL-10	PIC 9(3).
015100	05	LWELL-10	PIC 9(3).
015200	05	ALWBL-10	PIC 9(7).
015300	05	OIL-PROD-10	PIC 9(7).
015400	05	WATER-10	PIC 9(7).

Table B16. COBOL Program Listing for REPLACE (Continued)

```

015500      05  CAS-PROD-10      PIC 9(9).
015600      05  FWELL-11         PIC 9(3).
015700      05  LWELL-11         PIC 9(3).
015800      05  ALWBL-11         PIC 9(7).
015900      05  OIL-PROD-11      PIC 9(7).
016000      05  WATER-11         PIC 9(7).
016100      05  CAS-PROD-11      PIC 9(9).
016200      05  FWELL-12         PIC 9(3).
016300      05  LWELL-12         PIC 9(3).
016400      05  ALWBL-12         PIC 9(7).
016500      05  OIL-PROD-12      PIC 9(7).
016600      05  WATER-12         PIC 9(7).
016700      05  CAS-PROD-12      PIC 9(9).
016800
016900 FD   WELL
017000      RECORD CONTAINS 133 CHARACTERS
017100      BLOCK CONTAINS 1330 CHARACTERS
017200      LABEL RECORDS ARE STANDARD.
017300 01   WELL-LINE.
017400      05  CARRIAGE-CONTROL  PIC X.
017500      05  O-FLD-ID-WELL     PIC X(9).
017600      05  FILLER             PIC X(3).
017700      05  O-OPR-ID-WELL     PIC X(6).
017800      05  FILLER             PIC X.
017900      05  O-F1              PIC 999.
018000      05  FILLER             PIC X.
018100      05  O-L1              PIC 999.
018200      05  FILLER             PIC XX.
018300      05  O-F2              PIC 999.
018400      05  FILLER             PIC X.
018500      05  O-L2              PIC 999.
018600      05  FILLER             PIC XX.
018700      05  O-F3              PIC 999.
018800      05  FILLER             PIC X.
018900      05  O-L3              PIC 999.
019000      05  FILLER             PIC XX.
019100      05  O-F4              PIC 999.
019200      05  FILLER             PIC X.
019300      05  O-L4              PIC 999.
019400      05  FILLER             PIC XX.
019500      05  O-F5              PIC 999.
019600      05  FILLER             PIC X.
019700      05  O-L5              PIC 999.
019800      05  FILLER             PIC XX.
019900      05  O-F6              PIC 999.
020000      05  FILLER             PIC X.
020100      05  O-L6              PIC 999.
020200      05  FILLER             PIC XX.
020300      05  O-F7              PIC 999.
020400      05  FILLER             PIC X.
020500      05  O-L7              PIC 999.
020600      05  FILLER             PIC XX.
020700      05  O-F8              PIC 999.
020800      05  FILLER             PIC X.
020900      05  O-L8              PIC 999.
021000      05  FILLER             PIC XX.
021100      05  O-F9              PIC 999.
021200      05  FILLER             PIC X.
021300      05  O-L9              PIC 999.
021400      05  FILLER             PIC XX.
021500      05  O-F10             PIC 999.
021600      05  FILLER             PIC X.
021700      05  O-L10             PIC 999.
021800      05  FILLER             PIC XX.
021900      05  O-F11             PIC 999.
022000      05  FILLER             PIC X.
022100      05  O-L11             PIC 999.
022200      05  FILLER             PIC XX.
022300      05  O-F12             PIC 999.
022400      05  FILLER             PIC X.
022500      05  O-L12             PIC 999.
022600      05  FILLER             PIC X(7).
022700
022800 FD   LIST
022900      RECORD CONTAINS 82 CHARACTERS
023000      BLOCK CONTAINS 820 CHARACTERS
023100      LABEL RECORDS ARE STANDARD.

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Table B16. COBOL Program Listing for REPLACE (Continued)

```

023200 01 ZERO-LINE.
023300 05 CARRIAGE-CONTROL PIC X.
023400 05 O-FLD-ID1 PIC X(9).
023500 05 FILLER PIC X(3).
023600 05 O-OPR-ID1 PIC X(6).
023700 05 FILLER PIC X(3).
023800 05 O-FLD-ID2 PIC X(9).
023900 05 FILLER PIC X(3).
024000 05 O-OPR-ID2 PIC X(6).
024100 05 FILLER PIC X(3).
024200 05 O-FLD-ID3 PIC X(9).
024300 05 FILLER PIC X(3).
024400 05 O-OPR-ID3 PIC X(6).
024500 05 FILLER PIC X(3).
024600 05 O-FLD-ID4 PIC X(9).
024700 05 FILLER PIC X(3).
024800 05 O-OPR-ID4 PIC X(6).
024900 FD PRINT
025000 RECORD CONTAINS 466 CHARACTERS
025100 BLOCK CONTAINS 27960 CHARACTERS
025200 RECORDING MODE IS F
025300 LABEL RECORDS ARE STANDARD.
025400 01 TAPE-LINE.
025500 05 OUT-TAPE PIC X(466).
025600 WORKING-STORAGE SECTION.
025700 77 LAST-REC PIC X.
025800 PROCEDURE DIVISION.
025900 MAIN-LINE-ROUTINE.
026000 OPEN INPUT AFIL
026100 OUTPUT LIST OUTPUT PRINT OUTPUT WELL.
026200 READ AFIL AT END MOVE 'Y' TO LAST-REC.
026300 PERFORM DETERMINE-PROCESS UNTIL LAST-REC = 'Y'.
026400 CLOSE AFIL, LIST, PRINT, WELL.
026500 STOP RUN.
026600
026700 DETERMINE-PROCESS.
026800 MOVE SPACES TO ZERO-LINE.
026900 IF I-REC-TYPE = 00
027000 PERFORM BLANKS-TO-ZEROS-BOTH
027100 ELSE PERFORM BLANKS-TO-ZEROS.
027200 READ AFIL AT END MOVE 'Y' TO LAST-REC.
027300 BLANKS-TO-ZEROS-BOTH.
027400 IF K-FLD-ID IS NOT NUMERIC
027500 MOVE K-FLD-ID TO O-FLD-ID1
027600 MOVE ZEROS TO K-FLD-ID
027700 MOVE K-FLD-ID TO O-FLD-ID2.
027800 IF K-OPR-ID IS NOT NUMERIC
027900 MOVE K-OPR-ID TO O-OPR-ID1
028000 MOVE ZEROS TO K-OPR-ID
028100 MOVE K-OPR-ID TO O-OPR-ID2.
028200 IF I-FLD-ID IS NOT NUMERIC
028300 MOVE I-FLD-ID TO O-FLD-ID3
028400 MOVE ZEROS TO I-FLD-ID
028500 MOVE I-FLD-ID TO O-FLD-ID4.
028600 IF I-OPER-ID IS NOT NUMERIC
028700 MOVE I-OPER-ID TO O-OPR-ID3
028800 MOVE ZEROS TO I-OPER-ID
028900 MOVE I-OPER-ID TO O-OPR-ID4.
029000 MOVE ID-REC TO TAPE-LINE.
029100 WRITE TAPE-LINE.
029200 BLANKS-TO-ZEROS.
029300 MOVE SPACES TO ZERO-LINE.
029400 IF FLD-ID IS NOT NUMERIC
029500 MOVE FLD-ID TO O-FLD-ID1
029600 MOVE ZEROS TO FLD-ID
029700 MOVE FLD-ID TO O-FLD-ID2.
029800 IF OPR-ID IS NOT NUMERIC
029900 MOVE OPR-ID TO O-OPR-ID1
030000 MOVE ZEROS TO OPR-ID
030100 MOVE OPR-ID TO O-OPR-ID2.
030200 IF REC-TYP > 50
030300 PERFORM 999-TO-ZEROS.
030400 MOVE PROD-REC TO TAPE-LINE.
030500 WRITE TAPE-LINE.
030600 999-TO-ZEROS.
030700 MOVE SPACES TO WELL-LINE.
030800 IF FWELL-1 = 999

```


Table B16. COBOL Program Listing for REPLACE (Continued)

```

030900      MOVE FWELL-1 TO O-F1
031000      MOVE ZEROS TO FWELL-1.
031100      IF LWELL-1 = 999
031200      MOVE LWELL-1 TO O-L1
031300      MOVE ZEROS TO LWELL-1.
031400      IF FWELL-2 = 999
031500      MOVE FWELL-2 TO O-F2
031600      MOVE ZEROS TO FWELL-2.
031700      IF LWELL-2 = 999
031800      MOVE LWELL-2 TO O-L2
031900      MOVE ZEROS TO LWELL-2.
032000      IF FWELL-3 = 999
032100      MOVE FWELL-3 TO O-F3
032200      MOVE ZEROS TO FWELL-3.
032300      IF LWELL-3 = 999
032400      MOVE LWELL-3 TO O-L3
032500      MOVE ZEROS TO LWELL-3.
032600      IF FWELL-4 = 999
032700      MOVE FWELL-4 TO O-F4
032800      MOVE ZEROS TO FWELL-4.
032900      IF LWELL-4 = 999
033000      MOVE LWELL-4 TO O-L4
033100      MOVE ZEROS TO LWELL-4.
033200      IF FWELL-5 = 999
033300      MOVE FWELL-5 TO O-F5
033400      MOVE ZEROS TO FWELL-5.
033500      IF LWELL-5 = 999
033600      MOVE LWELL-5 TO O-L5
033700      MOVE ZEROS TO LWELL-5.
033800      IF FWELL-6 = 999
033900      MOVE FWELL-6 TO O-F6
034000      MOVE ZEROS TO FWELL-6.
034100      IF LWELL-6 = 999
034200      MOVE LWELL-6 TO O-L6
034300      MOVE ZEROS TO LWELL-6.
034400      IF FWELL-7 = 999
034500      MOVE FWELL-7 TO O-F7
034600      MOVE ZEROS TO FWELL-7.
034700      IF LWELL-7 = 999
034800      MOVE LWELL-7 TO O-L7
034900      MOVE ZEROS TO LWELL-7.
035000      IF FWELL-8 = 999
035100      MOVE FWELL-8 TO O-F8
035200      MOVE ZEROS TO FWELL-8.
035300      IF LWELL-8 = 999
035400      MOVE LWELL-8 TO O-L8
035500      MOVE ZEROS TO LWELL-8.
035600      IF FWELL-9 = 999
035700      MOVE FWELL-9 TO O-F9
035800      MOVE ZEROS TO FWELL-9.
035900      IF LWELL-9 = 999
036000      MOVE LWELL-9 TO O-L9
036100      MOVE ZEROS TO LWELL-9.
036200      IF FWELL-10 = 999
036300      MOVE FWELL-10 TO O-F10
036400      MOVE ZEROS TO FWELL-10.
036500      IF LWELL-10 = 999
036600      MOVE LWELL-10 TO O-L10
036700      MOVE ZEROS TO LWELL-10.
036800      IF FWELL-11 = 999
036900      MOVE FWELL-11 TO O-F11
037000      MOVE ZEROS TO FWELL-11.
037100      IF LWELL-11 = 999
037200      MOVE LWELL-11 TO O-L11
037300      MOVE ZEROS TO LWELL-11.
037400      IF FWELL-12 = 999
037500      MOVE FWELL-12 TO O-F12
037600      MOVE ZEROS TO FWELL-12.
037700      IF LWELL-12 = 999
037800      MOVE LWELL-12 TO O-L12
037900      MOVE ZEROS TO LWELL-12.

```

Table B17. COBOL Program Listing for REPLACEG

```

000100 IDENTIFICATION DIVISION.
000200 PROGRAM-ID.
000300     REPLACEG.
000400 REMARKS. ***THIS PROGRAM FOR ALL DWIGHT'S GAS STATES ONLY.***
000500     *****USE REPLACE FOR ALL OIL STATES.*****
000600     THIS PROGRAM ACCESSES DWIGHT'S SORTED TAPE TO CHECK THE
000700     SORT KEY (COMPOSED OF FIELD AND OPERATOR ID'S) AND THE
000800     DWIGHT'S ORIGINAL DATA FIELDS OF FIELD AND OPERATOR ID
000900     (FOUND ONLY ON THE 00 TYPE RECORD) AND CHECKS EACH OF
001000     THESE DATA FIELDS FOR NON-NUMERIC DATA. WHEN NON-NUMERIC
001100     DATA IS ENCOUNTERED, IT IS REPLACED WITH ZEROS. SINCE
001200     GAS FILES ARE BY WELL, THERE IS NO NEED TO CHECK FOR 999
001300     OCCURRING IN FLOWING AND LIFTING WELLS.
001400 AUTHOR.    FR8.
001500 DATE-WRITTEN. JUNE 11, 1981.
001600 INSTALLATION. DALLAS FIELD OFFICE,DOE/EIA.
001700 ENVIRONMENT DIVISION.
001800 CONFIGURATION SECTION.
001900 SOURCE-COMPUTER. IBM-370-168.
002000 OBJECT-COMPUTER. IBM-370-168.
002100 INPUT-OUTPUT SECTION.
002200 FILE-CONTROL.
002300     SELECT  AFILE ASSIGN TO UT-S-AFILE.
002400     SELECT  LIST ASSIGN TO UT-S-LIST.
002500     SELECT  PRINT ASSIGN TO UT-S-PRINT.
002600 DATA DIVISION.
002700 FILE SECTION.
002800 FD  AFILE
002900     RECORD CONTAINS 466 CHARACTERS
003000     BLOCK CONTAINS 27960 CHARACTERS
003100     LABEL RECORDS ARE STANDARD.
003200 01  ID-REC.
003300     05  FILLER                PIC X.
003400     05  K-FLD-ID              PIC 9(9).
003500     05  K-OPR-ID              PIC 9(6).
003600     05  I-STATE                PIC 99.
003700     05  I-DT                  PIC X(3).
003800     05  I-WELL-ID             PIC X(11).
003900     05  I-REC-TYPE            PIC 99.
004000     05  FILLER                PIC X.
004100     05  I-COUN-C              PIC X(3).
004200     05  I-FDISC-M             PIC X(2).
004300     05  I-FDISC-D             PIC X(2).
004400     05  I-FDISC-Y             PIC X(2).
004500     05  I-FLD-ID              PIC 9(9).
004600     05  I-FLD-NAM             PIC X(38).
004700     05  I-G-GATH              PIC X(5).
004800     05  I-O-GATH              PIC X(5).
004900     05  I-U-PERF              PIC 9(5).
005000     05  I-L-PERF              PIC 9(5).
005100     05  I-STATUS              PIC X(2).
005200     05  I-OPROD-M             PIC 99.
005300     05  I-OPROD-D             PIC 99.
005400     05  I-OPROD-Y             PIC 99.
005500     05  I-TOTDPTH             PIC 9(5).
005600     05  I-SPGG                PIC 9V99.
005700     05  I-SPGO                PIC 99V9.
005800     05  I-GOR                 PIC 9(4).
005900     05  I-NGW                 PIC 9V999.
006000     05  I-LOCATION              PIC X(11).
006100     05  I-COUN-NAM            PIC X(15).
006200     05  I-OPER-NAME           PIC X(24).
006300     05  I-OPER-ID             PIC 9(6).
006400     05  I-WELL-NAM            PIC X(36).
006500     05  I-WELL-NUM            PIC X(6).
006600     05  I-STAT-M              PIC X(2).
006700     05  I-STAT-D              PIC X(2).
006800     05  I-STAT-Y              PIC X(2).
006900     05  FILLER                PIC X(4).
007000     05  I-CUM-OIL            PIC 9(13).
007100     05  I-CUM-GAS             PIC 9(13).
007200     05  I-TGRAD               PIC 9V999.
007300     05  FILLER                PIC X.
007400     05  I-TEMPC               PIC 9(3).
007500     05  I-PRSC                PIC 9(3).
007600     05  FILLER                PIC X.
007700     05  I-OCUM-Y             PIC 99.

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Table B17. COBOL Program Listing for REPLACEG (Continued)

007800	05	I-OCUM-M	PIC 99.
007900	05	I-GCUM-Y	PIC 99.
008000	05	I-GCUM-M	PIC 99.
008100	05	I-GPROD-M	PIC 99.
008200	05	I-GPROD-Y	PIC 99.
008300	05	I-API-NUM	PIC X(7).
008400	05	FILLER	PIC X(163).
008500	01	PROD-REC.	
008600	05	FILLER	PIC X.
008700	05	FLD-ID	PIC 9(09).
008800	05	OPR-ID	PIC 9(06).
008900	05	FILLER	PIC X(16).
009000	05	REC-TYP	PIC 99.
009100	05	FWELL-1	PIC 9(3).
009200	05	LWELL-1	PIC 9(3).
009300	05	ALWBL-1	PIC 9(7).
009400	05	OIL-PROD-1	PIC 9(7).
009500	05	WATER-1	PIC 9(7).
009600	05	CAS-PROD-1	PIC 9(9).
009700	05	FWELL-2	PIC 9(3).
009800	05	LWELL-2	PIC 9(3).
009900	05	ALWBL-2	PIC 9(7).
010000	05	OIL-PROD-2	PIC 9(7).
010100	05	WATER-2	PIC 9(7).
010200	05	CAS-PROD-2	PIC 9(9).
010300	05	FWELL-3	PIC 9(3).
010400	05	LWELL-3	PIC 9(3).
010500	05	ALWBL-3	PIC 9(7).
010600	05	OIL-PROD-3	PIC 9(7).
010700	05	WATER-3	PIC 9(7).
010800	05	CAS-PROD-3	PIC 9(9).
010900	05	FWELL-4	PIC 9(3).
011000	05	LWELL-4	PIC 9(3).
011100	05	ALWBL-4	PIC 9(7).
011200	05	OIL-PROD-4	PIC 9(7).
011300	05	WATER-4	PIC 9(7).
011400	05	CAS-PROD-4	PIC 9(9).
011500	05	FWELL-5	PIC 9(3).
011600	05	LWELL-5	PIC 9(3).
011700	05	ALWBL-5	PIC 9(7).
011800	05	OIL-PROD-5	PIC 9(7).
011900	05	WATER-5	PIC 9(7).
012000	05	CAS-PROD-5	PIC 9(9).
012100	05	FWELL-6	PIC 9(3).
012200	05	LWELL-6	PIC 9(3).
012300	05	ALWBL-6	PIC 9(7).
012400	05	OIL-PROD-6	PIC 9(7).
012500	05	WATER-6	PIC 9(7).
012600	05	CAS-PROD-6	PIC 9(9).
012700	05	FWELL-7	PIC 9(3).
012800	05	LWELL-7	PIC 9(3).
012900	05	ALWBL-7	PIC 9(7).
013000	05	OIL-PROD-7	PIC 9(7).
013100	05	WATER-7	PIC 9(7).
013200	05	CAS-PROD-7	PIC 9(9).
013300	05	FWELL-8	PIC 9(3).
013400	05	LWELL-8	PIC 9(3).
013500	05	ALWBL-8	PIC 9(7).
013600	05	OIL-PROD-8	PIC 9(7).
013700	05	WATER-8	PIC 9(7).
013800	05	CAS-PROD-8	PIC 9(9).
013900	05	FWELL-9	PIC 9(3).
014000	05	LWELL-9	PIC 9(3).
014100	05	ALWBL-9	PIC 9(7).
014200	05	OIL-PROD-9	PIC 9(7).
014300	05	WATER-9	PIC 9(7).
014400	05	CAS-PROD-9	PIC 9(9).
014500	05	FWELL-10	PIC 9(3).
014600	05	LWELL-10	PIC 9(3).
014700	05	ALWBL-10	PIC 9(7).
014800	05	OIL-PROD-10	PIC 9(7).
014900	05	WATER-10	PIC 9(7).
015000	05	CAS-PROD-10	PIC 9(9).
015100	05	FWELL-11	PIC 9(3).
015200	05	LWELL-11	PIC 9(3).
015300	05	ALWBL-11	PIC 9(7).
015400	05	OIL-PROD-11	PIC 9(7).

Table B17. COBOL Program Listing for REPLACEG (Continued)

```

015500      05  WATER-11          PIC 9(7).
015600      05  CAS-PROD-11       PIC 9(9).
015700      05  FWELL-12         PIC 9(3).
015800      05  LWELL-12         PIC 9(3).
015900      05  ALWBL-12         PIC 9(7).
016000      05  OIL-PROD-12      PIC 9(7).
016100      05  WATER-12         PIC 9(7).
016200      05  CAS-PROD-12      PIC 9(9).
016300
016400 FD   LIST
016500      RECORD CONTAINS 82 CHARACTERS
016600      BLOCK CONTAINS 820 CHARACTERS
016700      LABEL RECORDS ARE STANDARD.
016800 01   ZERO-LINE.
016900      05  CARRIAGE-CONTROL   PIC X.
017000      05  O-FLD-ID1         PIC X(9).
017100      05  FILLER            PIC X(3).
017200      05  O-OPR-ID1         PIC X(6).
017300      05  FILLER            PIC X(3).
017400      05  O-FLD-ID2         PIC X(9).
017500      05  FILLER            PIC X(3).
017600      05  O-OPR-ID2         PIC X(6).
017700      05  FILLER            PIC X(3).
017800      05  O-FLD-ID3         PIC X(9).
017900      05  FILLER            PIC X(3).
018000      05  O-OPR-ID3         PIC X(6).
018100      05  FILLER            PIC X(3).
018200      05  O-FLD-ID4         PIC X(9).
018300      05  FILLER            PIC X(3).
018400      05  O-OPR-ID4         PIC X(6).
018500 FD   PRINT
018600      RECORD CONTAINS 466 CHARACTERS
018700      BLOCK CONTAINS 27960 CHARACTERS
018800      RECORDING MODE IS F
018900      LABEL RECORDS ARE STANDARD.
019000 01   TAPE-LINE.
019100      05  OUT-TAPE           PIC X(466).
019200 WORKING-STORAGE SECTION.
019300 77   LAST-REC              PIC X.
019400 PROCEDURE DIVISION.
019500 MAIN-LINE-ROUTINE.
019600      OPEN INPUT AFILF
019700      OUTPUT LIST OUTPUT PRINT.
019800      READ AFILF AT END MOVE 'Y' TO LAST-REC.
019900      PERFORM DETERMINE-PROCESS UNTIL LAST-REC = 'Y'.
020000      CLOSE AFILF, LIST, PRINT.
020100      STOP RUN.
020200
020300 DETERMINE-PROCESS.
020400      IF I-REC-TYPE = 00
020500          PERFORM BLANKS-TO-ZEROS-BOTH
020600      ELSE PERFORM BLANKS-TO-ZEROS.
020700      READ AFILF AT END MOVE 'Y' TO LAST-REC.
020800 BLANKS-TO-ZEROS-BOTH.
020900      MOVE SPACES TO ZERO-LINE.
021000      IF K-FLD-ID IS NOT NUMERIC
021100          MOVE K-FLD-ID TO O-FLD-ID1
021200          MOVE ZEROS TO K-FLD-ID
021300          MOVE K-FLD-ID TO O-FLD-ID2.
021400      IF K-OPR-ID IS NOT NUMERIC
021500          MOVE K-OPR-ID TO O-OPR-ID1
021600          MOVE ZEROS TO K-OPR-ID
021700          MOVE K-OPR-ID TO O-OPR-ID2.
021800      IF I-FLD-ID IS NOT NUMERIC
021900          MOVE I-FLD-ID TO O-FLD-ID3
022000          MOVE ZEROS TO I-FLD-ID
022100          MOVE I-FLD-ID TO O-FLD-ID4.
022200      IF I-OPER-ID IS NOT NUMERIC
022300          MOVE I-OPER-ID TO O-OPR-ID3
022400          MOVE ZEROS TO I-OPER-ID
022500          MOVE I-OPER-ID TO O-OPR-ID4.
022600      IF ZERO-LINE NOT = SPACES
022700          WRITE ZERO-LINE.
022800      MOVE ID-REC TO TAPE-LINE.
022900      WRITE TAPE-LINE.
023000 BLANKS-TO-ZEROS.
023100      MOVE SPACES TO ZERO-LINE.

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Table B17. COBOL Program Listing for REPLACEG (Continued)

```

023200     IF FLD-ID IS NOT NUMERIC
023300     MOVE FLD-ID TO O-FLD-ID1
023400     MOVE ZEROS TO FLD-ID
023500     MOVE FLD-ID TO O-FLD-ID2.
023600     IF OPR-ID IS NOT NUMERIC
023700     MOVE OPR-ID TO O-OPR-ID1
023800     MOVE ZEROS TO OPR-ID
023900     MOVE OPR-ID TO O-OPR-ID2.
024000     IF ZERO-LINE NOT = SPACES
024100     WRITE ZERO-LINE.
024200     MOVE PROD-REC TO TAPE-LINE.
024300     WRITE TAPE-LINE.

```

Table B18. FORTRAN Program Listing for VINTPEAK

```

1  *****
2  ***   FORTRAN PROGRAM NAME VINTPEAK, BASED ON DWTRTXE
3  ***   PROGRAMMED BY C.BASNETT ON 22 MARCH 1990
4  ***   (PROGRAM LINEAGE: DWTRTXE<DWTRTXB<DWTRTX8+DWTRTXA)
5  ***   MODIFIED ON 12 NOVEMBER 1992 BY VELTON T. FUNK
6  ***   CALCULATES PRODUCTION, DAILY RATE, PEAK RATE, ETC.
7  ***   BY YEAR OF FIRST PRODUCTION BASED ON DWT TAPE DATA.
8  *****
9  *****      INPUT DATA*      *****
10 *****
11 *VARIABLE  SOURCE      DESCRIPTION
12 * ISW      JCL, SWITCH VARIABLE, ALLOWS FIELD DATA TO BE PRINTED
13 * STPB     JCL, STATES PRESSURE BASE, PSIA
14 * WELLDID  EDITED DWIGHTS--ALPHA CHARACTER, N=NEW RECORD
15 * IFLD     EDITED DWIGHTS--NUMERIC FIELD CODE
16 * ST       EDITED DWIGHTS--NUMERIC STATE CODE
17 * ITYPE    EDITED DWIGHTS--NUMERIC RECORD TYPE
18 * GCUM     EDITED DWIGHTS--NUMERIC CUMULATIVE PRODUCTION, MCF
19 * PROD(Y,M) EDITED DWIGHTS--NUMERIC MONTHLY PRODUCTION, MCF
20 *****      OUTPUT DATA-- RAWDATA.STDATE*      *****
21 *VARIABLE      DESCRIPTION*
22 * ST           NUMERIC STATE CODE-- DWIGHTS
23 * MYR          2 DIGIT VINTAGE YEAR
24 * IYR          4 DIGIT YEAR
25 * TPROD(MYR,IYR,K) PRODUCTION FOR MONTH (K), MCF BY VINTAGE
26 * DRATE(MYR,IYR,K) PRODUCTION RATE FOR MONTH K. MCF/DAY
27 * PEAK(MYR,IYR)   PEAK PRODUCTION RATE BY VINTAGE BY YEAR, MCF/DAY*
28 * PEAKCM(MYR,IYR) CUMULATIVE PRODUCTION ASSOCIATED WITH PEAK, MCF
29 * VMCUM(MYR,IYR,K) MID MONTH CUMULATIVE PRODUCTION, MCF
30 * VCUM(MYR,IYR,K) CUMULATIVE PRODUCTION TO END OF MONTH, MCF
31 * TPRODC(MYR,IYR,K) NUMBER OF WELLS PRODUCING
32 *****
33 *****      VARIABLE USED WITHIN THE PROGRAM      *****
34 * HFLD       NOT USED-RETAINED IFLD- FOR FIELD LEVEL DATA
35 * TGCUM      NOT USED IN THIS VERSION-TOTAL CUM PRIOR TO RECORD*
36 * TOTCUM     NOT USED-SET TO 0 AND NEVER TOUCHED AGAIN
37 * SUM(IY,J)   SUMS PROD BY YR AND MONTH ALL VINTAGES
38 * SUMC(IY,J)  SUMS WELLS BY YR AND MONTH ALL VINTAGES
39 * PRECUM(MY)  CUM PRIOR TO RECORDS + PROD. PRIOR TO VINTAGE
40 * FPCUM(MY)   SUMS CUM PRIOR TO RECORD BY FIELD & VINTAGE, MCF
41 * APROD(MY)   SUMS ANNUAL PROD BY YEAR FOR ALL VINTAGES,MCF
42 * PEAKT(MY)   SUM OF THE PEAKS FOR ALL VINTAGE YEARS, MCF/DAY
43 * PEAKCT(MY)  NOT USED--SUMS TGCUMS
44 * FPEAK(MY,IY) SUMS WELL PEAKS WITHIN A FIELD, MCF/DAY
45 * FPROD(MY,IY,J) SUMS WELL PROD. INTO FIELD PROD., MCF
46 * FPRODC(MY,IY,J) SUMS COMPLETIONS WITHIN A FIELD BY VINTAGE & YR
47 * WCUM(MY,IY,J) CUMULATIVE PRODUCTION, MCF
48 * FDRATE(MY,IY,J) SUMS WELL PROD RATES INTO FIELD PROD RATE, MCF/DAY*
49 * TPROD(MY,IY,13) ANNUAL SUM OF PROD
50 * FPROD(MY,IY,13) ANNUAL SUM OF WELL PROD INTO FIELD PROD' MCF
51 *****
52      DOUBLE PRECISION GCUM,HPROD,TGCUM,TOTCUM,PRECUM(69:91),
53      + PKCUM(69:91,69:91),PROD(50:91,13),DPROD(12),
54      + APROD(69:91),PEAKCT(69:91),PEAKCM(69:91,69:91),
55      + PEAKT(69:91),PEAK(69:91,69:91),DRATE(69:91,69:91,13),
56      + TPROD(69:91,69:91,13),SUM(69:91,12),
57      + VCUM(69:91,69:91,12),VMCUM(69:91,69:91,13),
58      + FDRATE(69:91,69:91,12),FPEAK(69:91,69:91),

```

Table B18. FORTRAN Program Listing for VINTPEAK (Continued)

```

59      +      FPROD(69:91,69:91,13),WCUM(69:91,69:91,12),FPCUM(69:91)
60      INTEGER LEAPYR,ST,TYPE,
61      +      DAYS(12),TPRODC(69:91,69:91,12),SUMC(69:91,12),
62      +      FPRODC(69:91,69:91,12),HFLD,PKMO
63      CHARACTER DT(3),IFLDN(38),WELLID(1)
64      DATA DAYS/31,28,31,30,31,30,31,31,30,31,30,31/
65
66      ***INPUT STATE PRESSURE BASE FROM JCL, ALSO
67      ***      IF IPRSW = 1 THEN PRINT PRODUCTION TABLES BY FIELD
68      READ(1,3) STPB,IPRSW
69      3 FORMAT (1X,5X,F6.3,1X,I1,66X)
70      PRINT *, 'STPB= ',STPB, 'IPRSW= ',IPRSW
71      C      WRITE(4,4) STPB
72      4 FORMAT (1X, 'STPB= ',F6.3,68X)
73      IF (IPRSW.NE.0) IPRSW = 1
74
75      ***INITIALIZATION OF VARIABLES:
76      ISW=0
77      N=0
78      IFLD = 0
79      HFLD = 0
80      GCUM = 0.
81      TGCUM = 0.
82      TOTCUM = 0.
83      DO 10 IY=69,91
84      DO 5 J=1,12
85      SUM(IY,J)=0.0
86      SUMC(IY,J)=0
87      PROD(IY,J)=0.0
88      5      CONTINUE
89      10 CONTINUE
90      DO 60 MY=69,91
91      PRECUM(MY) = 0.0
92      FPCUM(MY) = 0.0
93      APROD(MY) = 0.0
94      PEAKT(MY) = 0.0
95      PEAKCT(MY) = 0.0
96      DO 30 IY=69,91
97      FPEAK(MY,IY)=0.0
98      PEAK(MY,IY)=0.0
99      PEAKCM(MY,IY)=0.0
100     DO 20 J=1,12
101     TPROD(MY,IY,J)=0.0
102     TPRODC(MY,IY,J)=0
103     FPROD(MY,IY,J)=0.0
104     FPRODC(MY,IY,J)=0
105     WCUM(MY,IY,J)=0.0
106     VCUM(MY,IY,J)=0.0
107     VMCUM(MY,IY,J)=0.0
108     FDRATE(MY,IY,J)=0.0
109     20      CONTINUE
110     TPROD(MY,IY,13)=0.0
111     VMCUM(MY,IY,13)=0.0
112     FPROD(MY,IY,13)=0.0
113     30      CONTINUE
114     60 CONTINUE
115
116     *****
117     * 99 -READ DWIGHT'S DATA FROM TAPE. *
118     *****
119     ***VALUES INPUT:
120     ***      IFLD      FIELD CODE
121     ***      TYPE      DWT RECORD TYPE
122     *****
123     912 READ(3,100,END=599)
124     +WELLID,IFLD,ST,ITYPE,GCUM,(PROD(ITYPE,K),K=1,12)
125     IF (WELLID(1).NE.'N') GOTO 912
126     IF (WELLID(1).EQ.'N') GOTO 911
127     99 READ(3,100,END=599)
128     +WELLID,IFLD,ST,ITYPE,GCUM,(PROD(ITYPE,K),K=1,12)
129     100 FORMAT (1A1,I9,6X,I2,14X,I2,F13.0,14X,F9.0,11(27X,F9.0))
130     C      PRINT *,WELLID,IFLD,ITYPE,GCUM,(PROD(ITYPE,K),K=1,12)
131     911 GCUM= GCUM * STPB/14.73
132     IF (ITYPE.GE.92) GOTO 99
133     IF (ITYPE.LE.50) GOTO 99
134
135     IF (WELLID(1).EQ.'N') GOTO 600

```

Table B18. FORTRAN Program Listing for VINTPEAK (Continued)

```

136
137 *****
138 ***PROCESS PRODUCTION RECORDS: *
139 *****
140 ***VALUES INPUT: *
141 *** PROD MONTHLY GAS PRODUCTION (MCF) *
142 *****
143 300 TYPE=ITYPE
144 IF (TYPE.LT.70) TYPE=69
145 C PRINT *,ST,MYR,WELLID,IFLD,ITYPE,GCUM,(PROD(TYPE,K),K=1,12)
146
147 ***CONVERT PROD. TO FED. PRESSURE BASE AND CALCULATE ANNUAL PROD.
148 PROD(TYPE,13)=0.0
149 DO 301 K = 1,12
150 IF (PROD(ITYPE,K).GT.0) THEN
151 PROD(TYPE,K) = (PROD(ITYPE,K) * STPB) / 14.73
152 PROD(TYPE,13) = PROD(TYPE,13) + PROD(TYPE,K)
153 END IF
154 301 CONTINUE
155 IF (PROD(TYPE,13).LE.0) GOTO 99
156
157 ***SET VINTAGE YEAR
158 IF (WELLID(1).EQ.'N') THEN
159 MYR=99
160 IF (TYPE.LT.MYR.AND.PROD(TYPE,13).GT.0) MYR=TYPE
161 ELSE
162 IF (WELLID(1).NE.'A') GOTO 99
163 END IF
164
165 ***ADD CUM-PRIOR-TO-RECS TO THAT FOR THE VINTAGE
166 C PRINT *, PRECUM(MYR), GCUM
167 PRECUM(MYR) = PRECUM(MYR) + GCUM
168 FPCUM(MYR) = FPCUM(MYR) + GCUM
169 GCUM=0.0
170
171 ***ADD PRODUCTION RECORDS PRIOR TO VINTAGE TO PRECUM
172 IF (ITYPE.LT.MYR) THEN
173 PRECUM(MYR) = PRECUM(MYR) + PROD(TYPE,13)
174 C PRINT *, MYR,WELLID,IFLD,ITYPE,TYPE,GCUM,(PROD(TYPE,K),K=1,12)
175 GO TO 99
176 END IF
177
178 ***PREPARE CUM TABLE BASED ON CONVERTED MONTHLY PROD.
179 *** WITH RUNNING CUM BY-MONTH. ADD MONTHLY PROD. TO EACH CUM CELL
180 DO 321 K = 1,12
181 WCUM(MYR,TYPE,K) = WCUM(MYR,TYPE,K) + PROD(TYPE,K)
182 FPROD(MYR,TYPE,K) = FPROD(MYR,TYPE,K) + PROD(TYPE,K)
183 IF (K.LT.12) THEN
184 K1=K+1
185 DO 320 K2 = K1,12
186 WCUM(MYR,TYPE,K2) = WCUM(MYR,TYPE,K2) + PROD(TYPE,K)
187 320 CONTINUE
188 ENDIF
189 IF (PROD(TYPE,K).GT.0)
190 + FPRODC(MYR,TYPE,K) = FPRODC(MYR,TYPE,K) + 1
191 321 CONTINUE
192 FPROD(MYR,TYPE,13) = 0.0
193 IF (TYPE.GE.91) GOTO 99
194 *** ADD THE PROD. CUMM FOR THE YEAR TO EACH CONSECUTIVE CUM CELL
195 *** THROUGH THE LAST PROD. YEAR.
196
197 IYR=TYPE+1
198 DO 330 J = IYR,91
199 DO 329 K = 1,12
200 WCUM(MYR,J,K) = WCUM(MYR,J,K) + PROD(TYPE,13)
201 329 CONTINUE
202 330 CONTINUE
203 GOTO 99
204
205 599 ISW=1
206
207
208 *****
209 ***PROCESS CURRENT FIELD'S PRODUCTION DATA. *
210 *****
211 500 DO 630 MYR = 69,91
212 DO 620 J = 69,91

```

Table B18. FORTRAN Program Listing for VINTPEAK (Continued)

```

213      DO 603 K = 1,12
214          FPROD(MYR,J,13) = FPROD(MYR,J,13) + FPROD(MYR,J,K)
215          WCUM(MYR,J,K) = WCUM(MYR,J,K) + FPCUM(MYR)
216          VCUM(MYR,J,K) = VCUM(MYR,J,K) + WCUM(MYR,J,K)
217      603      CONTINUE
218          HPEAK = 0.0
219          FPEAK(MYR,J) = 0.0
220          PKCUM(MYR,J) = 0.0
221          LEAPYR = (J/4) * 4
222          DAYS(2) = 28
223      ***      ..ADD FIELD PROD. TO VINTAGE TOTALS:
224          DO 610 K = 1,12
225              DPROD(K) = 0.0
226              IF (FPROD(MYR,J,K).GT.0) THEN
227                  TPROD (MYR,J,K) = TPROD (MYR,J,K) + FPROD(MYR,J,K)
228                  TPRODC(MYR,J,K) = TPRODC(MYR,J,K) + FPRODC(MYR,J,K)
229                  IF (K.EQ.2.AND.LEAPYR.EQ.J) DAYS(2) = 29
230              ***      ..CALCULATE DAILY RATES
231              ***      .. AND ADD TO VINTAGE TOTALS BY YEAR
232                  DPROD(K) = FPROD(MYR,J,K) / DAYS(K)
233                  FDRATE(MYR,J,K) = FDRATE(MYR,J,K) + DPROD(K)
234                  DRATE(MYR,J,K) = DRATE(MYR,J,K) + DPROD(K)
235                  DRATE(MYR,J,13) = DRATE(MYR,J,13) + DPROD(K)
236              END IF
237          610      CONTINUE
238              TPROD(MYR,J,13) = TPROD(MYR,J,13) + FPROD(MYR,J,13)
239          ***      WRITE(4,6010) MYR,J,PEAK(MYR,J), (DPROD(K),K=1,12)
240          6010      FORMAT('0',5X,'MYR=',I2,5X,'J=',I2,5X,'PEAK=',7F10.0/
241              +      41X,6F10.0)
242      ***      ..IDENTIFY THE PEAK RATE: (USING BUILT-IN FUNCTION "MAX")
243          HPEAK = MAX(DPROD(1),DPROD(2),DPROD(3),DPROD(4),
244              +      DPROD(5),DPROD(6),DPROD(7),DPROD(8),
245              +      DPROD(9),DPROD(10),DPROD(11),DPROD(12) )
246          FPEAK(MYR,J) = FPEAK(MYR,J) + HPEAK
247          PEAK(MYR,J) = PEAK(MYR,J) + HPEAK
248          IF (MYR.EQ.69.AND.HPEAK.GT.0)
249              +      WRITE(4,6012) MYR,J,HPEAK,FPEAK(MYR,J),PEAK(MYR,J)
250          6012      FORMAT('0',5X,'MYR=',I2,5X,'J=',I2,5X,'HPEAK=',F12.1,
251              +      'FPEAK=',F12.1,'PEAK=',F12.1)
252      ***      ..LOCATE THE PEAK RATE (MONTH) AND CORRESPONDING CUM
253      ***      AND SUM THE MIDMONTH CUMS FOR FIELD AND TOTAL BY VINTAGE
254          IF (HPEAK.GT.0) THEN
255              DO 615 K=1,12
256                  IF (DPROD(K).GE.HPEAK) THEN
257                      PKMO=K
258                  END IF
259          615      CONTINUE
260                  PKCUM(MYR,J)=WCUM(MYR,J,PKMO) - (FPROD(MYR,J,PKMO)*0.5)
261                  PEAKCM(MYR,J)=PEAKCM(MYR,J)+PKCUM(MYR,J)
262              END IF
263              IF (HPEAK.LE.0)
264                  +      PEAKCM(MYR,J) = PEAKCM(MYR,J) + WCUM(MYR,J,12)
265          620      CONTINUE
266          630      CONTINUE
267      ***      IF IPRSW = 1 THEN PROCESS FIELD DATA AND PRINT IT
268          IF (IPRSW.EQ.0) GOTO 680
269      ***      FIELD DATA PROCESSING
270          DO 660 MYR=69,91
271              WRITE(4,6100) HFLD,MYR
272          6100      FORMAT('1 FIELD-LEVEL TOTALS FOR FIELD-ID = ',I9,' FOR 19',
273              +      I2,' VINTAGE WELLS')
274              DO 650 IYR=69,91
275                  IF (MYR.EQ.69) THEN
276                      WRITE(4,6101) IYR, (FPROD(MYR,IYR,K),K=1,13)
277          6101      FORMAT('0',I2,13F10.0)
278                      WRITE(4,6102) (FDRATE(MYR,IYR,K),K=1,12),FPEAK(MYR,IYR)
279          6102      FORMAT(2X,12F10.1,F11.0)
280                      WRITE(4,6103) (WCUM(MYR,IYR,K),K=1,12)
281          6103      FORMAT(3X,12F10.0)
282                      WRITE(4,6109) (FPRODC(MYR,IYR,K),K=1,12)
283          6109      FORMAT(2X,12I10)
284                  END IF
285                  FPEAK(MYR,IYR) = 0.0
286              CONTINUE
287          660      CONTINUE
288      ***      REINITIATE VARIABLES FOR NEXT WELL ID
289          680      DO 690 MYR=69,91

```


Table B18. FORTRAN Program Listing for VINTPEAK (Continued)

```

290      FPCUM(MYR) = 0.0
291      DO 689 IYR=69,91
292          FPEAK(MYR,IYR) = 0.0
293          DO 686 K=1,12
294              FPROD(MYR,IYR,K) = 0.0
295              FDRATE(MYR,IYR,K) = 0.0
296              WCUM(MYR,IYR,K) = 0.0
297              FPRODC(MYR,IYR,K) = 0
298      686      CONTINUE
299          FPROD(MYR,IYR,13) = 0.0
300      689      CONTINUE
301      690      CONTINUE
302          IF (ISW.EQ.1) GOTO 999
303          HFLD=IFLD
304      C      PRINT *, IYR, IYR, IYR, (PROD(IYR,K), K=1,12)
305          GOTO 300
306
307      *****
308      ***FINAL STAGE - GRAND TOTALS *
309      *****
310      999 CONTINUE
311
312      DO 908 I = 69,91
313          DO 906 J = 69,91
314              DO 904 K = 1,12
315                  VMCUM(I,J,K) = VCUM(I,J,K) - (TPROD(I,J,K)*0.50)
316      904      CONTINUE
317      906      CONTINUE
318      908 CONTINUE
319
320      *****
321      ***PRINTOUT SUMMATION TABLE: *
322      *****
323      *** WRITE(4,910)
324      910 FORMAT ('1',/, '0 TOTALS FOR ALL PRE-1970 WELLS')
325      DO 920 IYR=69,91
326          MYR=69
327          PEAKCT(IYR) = PEAKCT(IYR) + TGCUM
328      ***      WRITE(4,9100) IYR, (TPROD(69,IYR,K), K=1,13)
329      ***      WRITE(4,9101) (DRATE(69,IYR,K), K=1,12), PEAK(69,IYR)
330      ***      WRITE(4,9050) (VMCUM(69,IYR,K), K=1,12)
331      ***      WRITE(4,9050) (VCUM(69,IYR,K), K=1,12)
332      9050      FORMAT (3X,12F10.0)
333      ***      WRITE(4,9102) (TPRODC(69,IYR,K), K=1,12)
334          WRITE(5,9501) ST,MYR,IYR, (TPROD(MYR,IYR,K), K=1,13)
335          WRITE(5,9502) ST,MYR,IYR, (DRATE(MYR,IYR,K), K=1,12),
336      +          PEAK(MYR,IYR)
337          WRITE(5,9503) ST,MYR,IYR, (VMCUM(MYR,IYR,K), K=1,12),
338      +          PEAKCM(MYR,IYR)
339          WRITE(5,9504) ST,MYR,IYR, (VCUM(MYR,IYR,K), K=1,12)
340          WRITE(5,9505) ST,MYR,IYR, (TPRODC(MYR,IYR,K), K=1,12)
341          PEAKT(IYR) = PEAKT(IYR) + PEAK(69,IYR)
342          PEAKCT(IYR) = PEAKCT(IYR) + PEAKCM(69,IYR)
343      DO 915 K=1,12
344          SUM(IYR,K)=SUM(IYR,K)+TPROD(69,IYR,K)
345          SUMC(IYR,K)=SUMC(IYR,K)+TPRODC(69,IYR,K)
346      915      CONTINUE
347      920 CONTINUE
348      DO 970 MYR=70,91
349      ***      WRITE(4,930) MYR
350      930      FORMAT ('1 TOTALS FOR ALL 19',I2,', WELLS')
351      DO 960 IYR=70,91
352      ***      WRITE(4,9100) IYR, (TPROD(MYR,IYR,K), K=1,13)
353      9100      FORMAT ('0',I2,12F10.0,F11.0)
354      ***      WRITE(4,9101) (DRATE(MYR,IYR,K), K=1,12), PEAK(MYR,IYR)
355      9101      FORMAT (2X,13F10.1)
356      ***      WRITE(4,9050) (VMCUM(MYR,IYR,K), K=1,12)
357      ***      WRITE(4,9050) (VCUM(MYR,IYR,K), K=1,12)
358      ***      WRITE(4,9102) (TPRODC(MYR,IYR,K), K=1,12)
359      9102      FORMAT (2X,12I10)
360          WRITE(5,9501) ST,MYR,IYR, (TPROD(MYR,IYR,K), K=1,13)
361      9501      FORMAT (I2,I2,' 1 ',I2,1X,13F15.0)
362          WRITE(5,9502) ST,MYR,IYR, (DRATE(MYR,IYR,K), K=1,12),
363      +          PEAK(MYR,IYR)
364      9502      FORMAT (I2,I2,' 2 ',I2,1X,13F15.1)
365          WRITE(5,9503) ST,MYR,IYR, (VMCUM(MYR,IYR,K), K=1,12),
366      +          PEAKCM(MYR,IYR)

```

Table B18. FORTRAN Program Listing for VINTPEAK (Continued)

```

367 9503 FORMAT (I2,I2,' 3 ',I2,1X,13F15.0)
368 WRITE(5,9504) ST,MYR,IYR,(VCUM(MYR,IYR,K),K=1,12)
369 9504 FORMAT (I2,I2,' 4 ',I2,1X,12F15.0,15X)
370 WRITE(5,9505) ST,MYR,IYR,(TPRODC(MYR,IYR,K),K=1,12)
371 9505 FORMAT (I2,I2,' 5 ',I2,1X,12I15,15X)
372 PEAKT(IYR) = PEAKT(IYR) + PEAK(MYR,IYR)
373 PEAKCT(IYR) = PEAKCT(IYR) + PEAKCM(MYR,IYR)
374 DO 955 K=1,12
375 SUM(IYR,K)=SUM(IYR,K)+TPRODC(MYR,IYR,K)
376 SUMC(IYR,K)=SUMC(IYR,K)+TPRODC(MYR,IYR,K)
377 955 CONTINUE
378 960 CONTINUE
379 970 CONTINUE
380 *** WRITE(4,9905)
381 9905 FORMAT ('1 SUMMATION:',/, 'OYR',7X,'ANNUAL PROD',6X,
382 + 'PEAK RATE',3X,'CUM AT PEAK',5X,'DAILY RATE',3X,'DAILY/PEAK',
383 + 3X,'PEAK/DAILY')
384 DO 996 IYR=69,91
385 LEAPYR = (IYR/4) * 4
386 DO 995 K=1,12
387 APROD(IYR)=APROD(IYR)+SUM(IYR,K)
388 995 CONTINUE
389 *** IF (LEAPYR.EQ.IYR) THEN
390 *** APRAT=APROD(IYR)/366.
391 *** PERCNT=APRAT/PEAKT(IYR)
392 *** PERCN2=PEAKT(IYR)/APRAT
393 *** WRITE(4,9909) IYR,APROD(IYR),PEAKT(IYR),PEAKCT(IYR),
394 + APRAT,PERCNT,PERCN2
395 9909 FORMAT('0',I2,'*',4X,F13.0,F15.1,5X,F13.0,5X,F10.1,
396 + 5X,F5.3,5X,F5.3)
397 *** ELSE
398 *** APRAT=APROD(IYR)/365.
399 *** PERCNT=APRAT/PEAKT(IYR)
400 *** PERCN2=PEAKT(IYR)/APRAT
401 *** WRITE(4,9910) IYR,APROD(IYR),PEAKT(IYR),PEAKCT(IYR),
402 + APRAT,PERCNT,PERCN2
403 9910 FORMAT('0',I2,5X,F13.0,F15.1,5X,F13.0,5X,F10.1,
404 + 5X,F5.3,5X,F5.3)
405 *** ENDDIF
406 *** WRITE(12,9919)
407 9919 FORMAT('1')
408 *** WRITE(12,9920) PRECUM(IYR)
409 9920 FORMAT(3X,'PRIOR CUM',168X,F14.0)
410 *** WRITE(12,9930) (J,(VMCUM(IYR,J,K),K=1,12),VCUM(IYR,J,12),
411 + J=69,91)
412 9930 FORMAT(9X,'19',I2,1X,12F17.0,3X,F17.0)
413 WRITE(15,9950) IYR
414 9950 FORMAT ('1 SUMMARY FOR 19',I2,' VINTAGE WELLS:',/, 'OYR',
415 + 7X,'ANNUAL PROD',6X,'PEAK RATE',3X,'CUM AT PEAK')
416 WRITE(15,9952) PRECUM(IYR)
417 9952 FORMAT(1X,'PRIOR CUM',29X,F15.0)
418 WRITE(15,9954) (MYR,TPROD(IYR,MYR,13),PEAK(IYR,MYR),
419 + PEAKCM(IYR,MYR),MYR=69,91)
420 9954 FORMAT('0',I2,5X,F13.0,F15.1,5X,F13.0)
421 996 CONTINUE
422 END

```

Appendix C

Gas-Well Completions by State

Calculating the forecast gas-well completions requires the combination of several data inputs. These are: 1) the forecast of lower 48 States total rigs for 2 years by month and case, 2) the percentage of total lower 48 States rigs which are drilling on gas prospects for 2 years by month and case, 3) the distribution of total lower-48 gas rigs into the 10 State/areas evaluated in the GASCAP model, and 4) the number of gas-well completions which result from the forecast gas rig activity. The product of these inputs is the monthly forecast of gas-well completions for each State/area for three cases. Figure C1 is a flow diagram of the process.

Drilling Rigs and Percent Gas Rigs Models

Data Preparation

Historical price and production data for both oil and gas were taken from the *Monthly Energy Review* (MER). Historical active drilling rigs and the percentage of drilling rigs drilling for gas came from Baker Hughes, Inc. All historical data were placed directly into the two main spreadsheets, **RIGS** and **GASRIGS**.

Price and production forecasts for oil and gas were taken from the *Short-Term Energy Outlook* (STEO). Monthly forecast data for the three cases, low, base, and high, were placed in the **RIGINPUT** spreadsheet. Because the gas prices are quarterly in the STEO, they are converted to monthly prices in the **FUTGASPR** spreadsheet before they are placed in the **RIGINPUT** spreadsheet. **FUTGASPR** uses the average monthly seasonality from the three previous years in the conversion from quarterly to monthly prices. Quarterly and annual weighted prices are the same as those in the original STEO quarterly price forecast.

Drilling Rig Model

The drilling rig model is contained in the spreadsheet named **RIGS**. The number of active drilling rigs is described as a function of income. Monthly income is defined as the products of oil price and oil production, and gas price and gas production. The oil price used is the U.S. refiners acquisition cost of foreign crude. Oil production is lower-48 crude oil and condensate production. The U.S. average gas price and lower-48 marketed wet wellhead gas production yield gas income.

The Solver routines in *Excel* were used to determine the coefficients of the drilling rig function which yield the best estimate of the actual drilling rigs. History from January 1984 was used to fit or calibrate the model. Solver is required to minimize the sum of the squares of the differences between the actual and estimated rigs.

After history is matched, the model is bench marked to the last 12 months of history. All coefficients are fixed except the multiplier b. Then the Solver routines are used to fit the model to only the last 12 months of history adjusting only the b coefficient.

Drilling rigs are forecast by copying the appropriate price and production data from the **RIGINPUT** spreadsheet to the **RIGS** spreadsheet. Each of the three cases, low, base, and high, are generated in turn by the **RIGS** spreadsheet and then copied to the **RIGSOUT** spreadsheet. A comparison of the forecast rigs and historical rigs is shown in the chart named **RIGS**.

Figure C1. New Gas-Well Completion

Percent Gas Rigs Model

The percent gas rig model is contained in the spreadsheet named **GASRIGS**. The percentage of active drilling rigs drilling for gas is described as a function of income. Monthly income is defined as the products of oil price and oil production, and gas price and gas production. The oil price used is the U.S. refiners acquisition cost of foreign crude. Oil production is lower-48 crude oil and condensate production. The U.S. average gas price and lower-48 marketed wet wellhead gas production yield gas income.

The Solver routines in *Excel* were used to determine the coefficients of the percent gas rigs function which yield the best estimate of the actual percentage of rigs drilling for gas. History from January 1984 was used to fit or calibrate the model. Solver is required to minimize the sum of the squares of the differences between the actual and estimated percent gas rigs.

After history is matched, the model is bench marked to history by splicing. The splicing ratio is the last actual value divided by the base case forecast value for the same month. The forecast values for all three cases, low, base, and high, are multiplied by this splicing ratio.

Percent gas rigs are forecast by copying the appropriate price and production data from the **RIGINPUT** spreadsheet to the **GASRIGS** spreadsheet. Each of the three cases, low, base, and high, are generated in turn by the **GASRIGS** spreadsheet and then copied to the **RIGSOUT** spreadsheet. A comparison of the forecast percent gas rigs and historical percent gas rigs is shown in the chart named **GASRIGS**.

Projected Gas-Well Completions

The results of the Drilling Rig Model and Percent Gas Rigs Model are manually extracted to data files which are manually incorporated into the **GASCMPL** spreadsheet. The product of the Drilling Rig Model and Percent Gas Rigs Models is the lower 48 States gas rig forecast. The lower 48 States gas rig forecast is not explicitly calculated in the spreadsheet but is part of a compound calculation. The **GASCMPL** spreadsheet distributes the lower-48 gas rig forecast into State/area monthly forecasts using the proportion of gas rigs the State/area contributed to the national total over the past 3 calendar years. The calculation of distribution proportions is an off-line manual procedure based on actual historical distributions as reported by Baker-Hughes. Gas rigs are converted to gas-well completions using the historical completions per rig over the most recent three calendar years. Completions are counted as determined from the **ATMPLZZ** SAS program of the GASCAP model. The State/area December well counts of Dwight's data for the three most recent complete calendar years were divided by the State/area annual total gas rigs for the same calendar years.

Three years of gas-well completion data are calculated by month and passed to other spreadsheets, using named-range combine features, which compile the initial gas demand and completions schedule used in the mainframe projection routines. The first year serves as a place-holder which is not evaluated in the projection routines. The two other years are used as the basis for the projections.

Table C3. Spreadsheet Structure Table for GASCMPL.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
Distribution factor	B45..K45	Annual proportion of lower-48 gas rigs active in each State/area based on last three historical calendar years of Baker-Hughes data
Completions per rig	B24..K24	Average number of gas-well completions per annual active gas rig in each State/area based on last three historical GASCAP active December gas well counts & annualized Baker-Hughes data for the same years
Table of forecast total rigs	Q7..V18	Results of Drilling Rigs Model
Place holder table of gas-well completions	B30..K41	Place holder for gas-well completions in the first of three years, these data do not actively influence the GASCAP model but are used to maintain the proper data structure
Table of calculated low case gas-well completions	B50..K73	Monthly forecast of low case gas-well completions by State/area for 2 years
Table of calculated base case gas-well completions	B84..K107	Monthly forecast of base case gas-well completions by State/area for 2 years
Table of calculated high case gas-well completions	B118..K141	Monthly forecast of high case gas-well completions by State/area for 2 years

Table C4. Spreadsheet Structure Table for GASRIGS.XLS

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
GDP	Col B	Gross Domestic Product deflator
Oil production	Col C - D	Average daily lower-48 crude oil and condensate production
Gas production	Col E	Average daily lower-48 gas production
Gas income	Col F	Gas income, constant \$
SGI	Col G	Smoothed gas income, constant \$
G13	Col H	3 month running average of gas income, constant \$

Table C4. Spreadsheet Structure Table for GASRIGS.XLS (Continued)

Coefficients, Variables, etc	Location	Description
Oil price	Col I - J	U.S. refiners acquisition cost of foreign crude oil, constant \$
Oil income	Col L	Lower-48 oil income, constant \$
SOI	Col M	Smoothed oil income, constant \$
Gas price	Col O - P	U.S. average gas price, constant \$
Gas rig ratio	Col T - V	Historical percent of gas rigs to total gas
Tax credit adjustment	Col Z	Adjustment factor for section 29 tax credit effects on gas drilling
GRR	Col AA	Predicted percentage of total active drilling rigs drilling for gas
Difference squared	Col AB	Difference between actual percent gas rigs and predicted gas rigs, squared.
Absolute difference	Col AC	Absolute value of the difference between actual drilling rigs and predicted drilling rigs
Results	AD232:AG258	Holding area for low, base, and high case projections
Temporary results	AI234:AI258	Area used to calculate temporary low, base, and high cases before being copied into the results holding area AD232:AG258
Splicing ratio	AI232	Splicing ratio used to bench mark predicted percent gas rigs to actual percent gas rigs
Σ Differences squared	AB3	Sum of the differences squared, column AB
Maximum difference	AB4	Maximum absolute difference, column AC
Minimum difference	AB5	Minimum absolute difference, column AC
a	AD1	Coefficient
b	AD2	Coefficient
α_{SOI}	AD3	Coefficient
d	AD4	Coefficient
e	AD5	Coefficient
f	AE1	Coefficient
α_{SOI}	AE3	Coefficient

Table C5. Spreadsheet Structure Table for RIGINPUT.XLS

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
Gas price	Col B - G	Low, base, and high quarterly and monthly gas price forecast
Oil prices	Col H - J	Low, base, and high oil price forecast
Gas production	Col K - M	Low, base, and high average daily gas production forecast
Oil production	Col N - P	Low, base, and high average daily oil production forecast

Table C6. Spreadsheet Structure Table for RIGS.XLS

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
GDP	Col B	Gross Domestic Product deflator
Oil production	Col C	Average daily lower-48 crude oil and condensate production
Gas production	Col D - F	Average daily lower-48 gas production
Oil price	Col G - H	U.S. refiners acquisition cost of foreign crude oil, constant \$
Gas price	Col J - K	U.S. average gas price, constant \$
Oil income	Col M	Lower-48 oil income, constant \$
α_{SOI}	Col N	Variable exponential smoothing coefficient for oil income
SOI	Col O	Smoothed oil income, constant \$
SOI6	Col P	Smoothed oil income with an exponential smoothing coefficient equivalent to a 6 month smoothing, constant \$
Switch	Col Q	Switching function used in α_{SOI}
GI	Col R	Lower-48 gas income, constant \$
SGI	Col U	Smoothed gas income, constant \$
Rigs	Col W	Actual historical active drilling rigs
Sn	Col X	Rig seasonality adjustment factor

Table C6. Spreadsheet Structure Table for RIGS.XLS (Continued)

Coefficients, Variables, etc	Location	Description
Rigs	Col Z	Predicted active drilling rigs from model function
Difference squared	Col AA	Difference between actual drilling rigs and predicted drilling rigs, squared
Absolute difference	Col AB	Absolute value of the difference between actual drilling rigs and predicted drilling rigs
Sn	AC19:AD30	Calculation for rig seasonality factor
Results	AC228:AF253	Holding area for low, base, and high case projections
Temporary results	AH230:AH253	Area used to calculate temporary low, base, and high cases before being copied into the results holding area AC228:AF253
Percent gas rigs	Col AJ - AK	Predicted percentage of total rigs drilling for gas
Maximum percent gas	Z1	Predicted maximum percentage of total rigs drilling for gas
Minimum percent gas	Z2	Predicted minimum percentage of total rigs drilling for gas, lower limit of 0.25
Average seasonality	AA1	Average of the 12 monthly seasonality factors calculated in AC19:AD30
Σ Differences squared	AA3	Sum of the differences squared, column AA
Maximum difference	AA4	Maximum absolute difference, column AB
Minimum difference	AA5	Minimum absolute difference, column AB
a	AC1	Coefficient
b	AC2	Coefficient
c	AC3	Coefficient
d	AC4	Coefficient
α_{SGI}	AD2	Coefficient
h	AD3	Coefficient
f	AD4	Coefficient
j	AD5	Coefficient
l	AD6	Coefficient

Table C7. Spreadsheet Structure Table for RIGSOUT.XLS

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
Rigs output	Col B - D	Low, base, and high case results from the total drilling rig model, RIGS.XLS
Percent gas rigs output	Col F - H	Low, base, and high case results from the percent gas rigs model, GASRIGS.XLS

Appendix D

Estimated Gas Demand and Conversions

Estimated Gas Demand

The U.S. quarterly forecast of dry gas production is obtained from the *Short-Term Energy Outlook* (STEO). Alaska's production is subtracted from the U.S. production forecast to get the lower 48 States' forecast (Figure D1). This dry gas production forecast is converted to gross gas and then distributed into 10 States/areas. This is done on the basis of marketed production for the most recent complete data year. All of this processing is done in the QGWG-S92 spreadsheet.

The quarterly gross gas demand for each State/area is distributed on a monthly basis for both projection years in the spreadsheets DELZZF92 (ZZ = State/area).

The Dwight's gas data are gross gas and it must be converted to dry gas. The programs which provide the ratio of dry gas to gross gas for the historical years are ZZBASG92 (ZZ = State/area) for all areas except the Gulf of Mexico which uses the program GMBASG92.

The EIA basis total gross gas forecast assembled by the spreadsheet, DELTTF92, is passed to the initial projection schedule spreadsheets for further processing.

Conversion into the Initial Projection Schedule

The EIA basis total gross gas forecast in the DELTTF92 spreadsheet is retained on diskette awaiting other preparatory processing prior to final assembly of the projection schedule. Preparatory processing includes: 1) converting the oil forecast into an oil-well gas forecast, 2) converting the total gas forecast into a gas-well gas only forecast, 3) converting the gas-well gas forecast from an EIA basis to a Dwight's basis, 4) combining the gas-well gas forecast with the new gas-well completion forecast, and 5) preparing a formatted ASCII file which will act as the forecast basis for the mainframe projection routines.

Assembly of the projection schedule begins with the macro-driven spreadsheet START, which assigns a run series identifier to the specified spreadsheet file ID. The run identifier is attached by various spreadsheets to output data files to enable positive recognition of the input files.

Formulation of the oil-well gas forecast requires the conversion of oil forecast data into a complementary gas file. This is accomplished through the serial processing of several spreadsheets. The oil forecast data are prepared, outside the GASCAP model, as daily rates and transferred within the spreadsheets LOWOIL, BASEOIL, and HIGHOIL. These spreadsheets are sequentially processed through the macro-driven spreadsheet CONVERT, which develops data files of monthly oil volumes from daily rates. The oil volume data files are processed into oil-well gas volumes by the macro-driven spreadsheet MONTHLY. MONTHLY contains historical monthly oil volumes and annual gas-oil-ratios for each of the States/areas. The spreadsheet also calls in forecast oil volumes to calculate historical and forecast oil-well gas volumes. The gas-oil-ratio for the last historical year is used as the forecast gas-oil-ratio. Since EIA does not report the Gulf of Mexico OCS as a separate gas-reporting entity, as required by the GASCAP system, actual oil-well gas data which are supplied through the Minerals Management Service (MMS) of the U.S. Department of Interior are used for this area. The Gulf of Mexico OCS planning area data are subtracted from the Louisiana (including Gulf of Mexico OCS) and Texas (including Gulf of Mexico OCS) data reported in EIA publications. The forecast data series for the Gulf of Mexico OCS are

Figure D1. Natural Gas Demand and Well Completion Schedule

calculated using the gas-oil-ratio as determined from MMS annual oil-well gas data. The run identification file, **ID**, is utilized to output oil-well gas files which are named to associate them with a specific run series.

Since the mainframe projection routines evaluate production and capacity of gas-well gas on a Dwight's basis, the EIA total gas forecast must be reduced to gas-well gas only and converted to a Dwight's basis. The data transformations are accomplished in the macro-driven spreadsheet **FORINIT**. Oil-well gas forecast volumes (**MONLOA**, **MONBAA**, and **MONHIA**) are subtracted from the total gas forecast (**DELTTF92**), except for the State of Kansas which is run through the projection routines on a total gas basis, to make the projection schedule on a gas-well gas basis. The gas-well gas forecast is also converted from a gross EIA basis to a gross Dwight's basis within the **FORINIT** spreadsheet. The conversions are called from the spreadsheet **EIAFACT** into the **FORINIT** spreadsheet by macros. The gross Dwight's-basis gas-well gas forecast by State/area and case are output for further processing.

The gross Dwight's-basis gas-well gas forecast by State/area and case are combined with the forecast of new gas-well completions (**GASCMPL**) in the macro-driven spreadsheet **INITIAL**. An ASCII file of the initial demand schedule is created (**INITA**) and sent to the mainframe to serve as a starting point in the mainframe projection processing.

Table D1. Reference Table of PC File Names, Software, and Functions

File Name	Software	Function
BASEOIL	LOTUS 123	Provide individual base case monthly oil data by area as basis for deriving projected oil-well gas production
CONVERT	LOTUS 123	Convert STEO monthly oil forecast rates into monthly oil volumes
DELTTF92	LOTUS 123	Produce table of monthly gross gas demand for 10 States/areas and is used as a starting point in building the initial demand schedule for the mainframe projection routine
DELZZF92 ^a	LOTUS 123	Distribute quarterly demand on monthly basis
EIAFACT	LOTUS 123	Calculate EIA/Dwight conversion factors for use in subsequent processing
FORINIT	LOTUS 123	1) Combine scheduled gas demand with oil-well gas to derive scheduled gas-well gas (total gas - oil-well gas = gas-well gas). 2) Normalize EIA-based gas-well gas demand to Dwight's basis
GASCMPL	LOTUS 123	Calculate the forecast gas well completions coming on stream for each month and case to be used as part of the mainframe projection routine
GMBASG92	LOTUS 123	Calculate the DRY/GROSS total gas conversion factors for the Gulf of Mexico
HIGHOIL	LOTUS 123	Provide individual high case monthly oil data by area as basis for deriving projected oil-well gas production
INITIAL	LOTUS 123	1) Combine derived scheduled gas well-gas with forecast gas well completions 2) Create the ASCII file which serves as the initial schedule for the mainframe projection routines.

Table D1. Reference Table of PC File Names, Software, and Functions (Continued)

File Name	Software	Function
LOWOIL	LOTUS 123	Provide individual low case monthly oil data by area as basis for deriving projected oil-well gas production
MONTHLY	LOTUS 123	Convert historical oil volumes and forecast monthly STEO area-specific oil volumes into gas-well gas volumes using appropriate annual GAS/OIL ratios
QGWG-S92	LOTUS 123	Distribute gas production demand into 10 States/areas on a quarterly basis
START	LOTUS 123	Assign an ID to the specific data in the new "schedule" series which is carried as an identifier throughout the spreadsheet portion of GASCAP
ZZBASG92 ^b	LOTUS 123	Calculate the DRY/GROSS total gas conversion factors

^aZZ = State/area as defined below:

CA = California (including Pacific OCS)
 GM = Gulf of Mexico OCS
 KS = Kansas
 LA = Louisiana (excluding Gulf of Mexico OCS)
 NM = New Mexico
 OK = Oklahoma
 RM = Rocky Mountain States group
 SE = Southeastern States group
 SS = Eighteen States Area
 TX = Texas (excluding Gulf of Mexico OCS).

^bZZ = State/area as defined below:

CA = California (including Pacific OCS)
 KS = Kansas
 LA = Louisiana (excluding Gulf of Mexico OCS)
 NM = New Mexico
 OK = Oklahoma
 RM = Rocky Mountain States group
 SE = Southeastern States group
 SS = Eighteen States Area
 TX = Texas (excluding Gulf of Mexico OCS).

Table D2. Spreadsheet Structure Table for BASEOIL.WK1

Coefficients, Variables, etc	Location	Description
TX	B5..Y5	Texas monthly base case crude oil forecast daily rates (mb/d)
LA	B7..Y7	Louisiana (excluding Gulf of Mexico OCS) monthly base case crude oil forecast daily rates (mb/d)
GC	B11..Y11	Gulf of Mexico OCS monthly base case crude oil forecast daily rates (mb/d)
CA	B13..Y13	California (including Pacific OCS) monthly base case crude oil forecast daily rates (mb/d)
KS	B15..Y15	Kansas monthly base case crude oil forecast daily rates (mb/d)
NM	B17..Y17	New Mexico monthly base case crude oil forecast daily rates (mb/d)
OK	B19..Y19	Oklahoma monthly base case crude oil forecast daily rates (mb/d)
SE	B29..Y29	Southeastern States monthly base case crude oil forecast daily rates (mb/d)
RM	B43..Y43	Rocky Mountain States monthly base case crude oil forecast daily rates (mb/d)
18	B45..Y45	Eighteen States monthly base case crude oil forecast daily rates (mb/d)

Table D3. Spreadsheet Structure Table for CONVERT.WK1

Coefficients, Variables, etc	Location	Description
Time	A5..A28	Date value of last day in the month, month and year
Incoming oil forecast daily rates	A50..Z100	Area which holds the entire monthly STEO oil average daily rate forecast files (mb/d), each of the three cases sequentially occupy this space during processing
TX oil volume	B5..B28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
LA oil volume	C5..C28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
FO oil volume	D5..D28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)

Table D3. Spreadsheet Structure Table for CONVERT.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
CA oil volume	E5..E28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
KS oil volume	F5..F28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
NM oil volume	G5..G28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
OK oil volume	H5..H28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
SE oil volume	I5..I28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
RM oil volume	J5..J28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)
Eighteen States oil volume	K5..K28	Product of average daily rate for the month and days in the month which yields the monthly volume of crude oil (mb)

Table D4. Macros Listing for CONVERT.WK1

Macro Name: \O

```
/fdC:\123\JAMES~{onerror NO_ID}
{goto}ID~/fcelID~
{goto}A29~{blank COUNT}~
```

Macro Name: \G (LOOP)

```
{goto}A50~{let CHK,0}~{beep}
{indicate LOW}{let A54,Please select LOW case oil forecast file}~
{let A56,from the listed files in drive A}~
{onerror NO_A}
/fcce{esc 2}A:~{?}~
{if A54=""}{let M6,TX}~{let CHK,1}~
{if @upper(@left(@trim(A54),3))<>"TEX"}{goto}M6~TX~{let CHK,1}~
{if A56=""}{let M7,LA}~{let CHK,1}~
{if @upper(@left(@trim(A56),3))<>"LOU"}{goto}M7~LA~{let CHK,1}~
{if A60=""}{let M8,GC}~{let CHK,1}~
{if @upper(@left(@trim(A60),3))<>"GUL"}{goto}M8~GC~{let CHK,1}~
{if A62=""}{let M9,CA}~{let CHK,1}~
{if @upper(@left(@trim(A62),3))<>"CAL"}{goto}M9~CA~{let CHK,1}~
{if A64=""}{let M10,KS}~{let CHK,1}~
{if @upper(@left(@trim(A64),3))<>"KAN"}{goto}M10~KS~{let CHK,1}~
{if A66=""}{let M11,NM}~{let CHK,1}~
```

Table D4. Macros Listing for CONVERT.WK1 (Continued)

```
{if @upper(@left(@trim(A66),3))<>"NEW"}{goto}M11~NM~{let CHK,1}~
{if A68=""}{let M12,OK}~{let CHK,1}~
{if @upper(@left(@trim(A68),3))<>"OKL"}{goto}M12~OK~{let CHK,1}~
{if A78=""}{let M13,SE}~{let CHK,1}~
{if @upper(@left(@trim(A78),3))<>"SUB"}{goto}M13~SE~{let CHK,1}~
{if A92=""}{let M14,RM}~{let CHK,1}~
{if @upper(@left(@trim(A92),3))<>"SUB"}{goto}M14~RM~{let CHK,1}~
{if A94=""}{let M15,'17}~{let CHK,1}~
{branch MORE} (CONTINUE)
```

Subroutine Name: LOOP

see Macro \G

Subroutine Name: CONTINUE

{branch MORE}

Subroutine Name: NO_A

```
{goto}A50~{let A54,"Diskette must be in drive A: which containsstep thru
{let A56,"Retrieve CONVERT.wk1 AFTER you have made sure the"}~
{let A57,"oil forecast files are on the diskette !!"}~
{let A60,"Strike any key and you will exit LOTUS"}~
{get CHK}
/qy
```

Subroutine Name: MORE

```
{if @upper(@left(@trim(A94),3))<>"EIG"}{goto}M15~'18~{let CHK,1}~
{if A96=""}{let M16,L48}~{let CHK,1}~
{if CHK=1}{goto}M1~{beep}{branch AMISS}
{let COUNT,COUNT+1}~
{if COUNT=1}{branch LOW}
{if COUNT=2}{branch BASE}
{calc}{branch HIGH}
```

Subroutine Name: LOW

```
{calc}/fxvOLOW
+$ID
~EXTRACT~r{esc}{indicate BASE}{let CASE,"{let A54,Please select BASE case oil forecast
file}~"}~
{blank A52..Z100}{blank A50..B51}
{branch LOOP}
```

Subroutine Name: BASE

```
{calc}/fxvOBASE
+$ID
~EXTRACT~r{esc}{goto}A50~{indicate HIGH}{let CASE,"{let A54,Please select AF25:c HIGH
case oil forecast file}~"}~
{blank A52..Z100}{blank A50..B51}
{branch LOOP}
```

Table D4. Macros Listing for CONVERT.WK1 (Continued)

Subroutine Name: HIGH

```
{calc}/fxvOHIGH
+$ID
~EXTRACT~r{esc}{indicate DONE}{blank A52..Z100}{blank A50..B51}
{let A55,You are done with this file. Press any key to load MONTHLY.wk1}~
{let A57,"If you misran this spreadsheet, reload CONVERT and try again."}~
{get ID}~/frMONTHLY~
```

Subroutine Name: AMISS

```
{get CHK}
/wey
```

Subroutine Name: NO_ID

```
{goto}A50~
{let A53,There is no valid run identifier in the system !!}~
{let A55,Press any key to load the "START" program to set an ID}~
{get A50}
/frSTART~
```

Table D5. Spreadsheet Structure Table for DELTTF92.WK1

Coefficients, Variables, etc	Location	Description
State/area	Col A	State/area abbreviation
Year	Col B	year identifier
Month	Col C	numeric month designator (1-12)
FO total gas demand	D8..D43	Gulf of Mexico OCS monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
TX total gas demand	D44..D79	Texas (excluding OCS) monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
LA total gas demand	D80..D115	Louisiana (excluding OCS) monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
CA total gas demand	D116..D151	California (including Pacific OCS) monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
KS total gas demand	D152..D187	Kansas monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)

Table D5. Spreadsheet Structure Table for DELTTF92.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
NM total gas demand	D188..D223	New Mexico monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
OK total gas demand	D224..D259	Oklahoma monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
SE total gas demand	D260..D295	Southeastern States monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
RM total gas demand	D296..D331	Rocky Mountain States monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)
Eighteen States total gas demand	D332..D367	Eighteen States monthly total gas demand forecast for one historical year and two forecast years on a gross basis (Bcf)

Table D6. Macros Listing for DELTTF92.WK1

Macro Name: \A

{GOTO}D8~
 /fccnC64.C99~DELGMF92~
 {GOTO}D44~
 /fccnC64.C99~DELTXF92~
 {GOTO}D80~
 /fccnC64.C99~DELLAF92~
 {GOTO}D116~
 /fccnC64.C99~DELCAF92~
 {GOTO}D152~
 /fccnC64.C99~DELKSF92~
 {GOTO}D188~
 /fccnC64.C99~DELNMF92~
 {GOTO}D224~
 /fccnC64.C99~DELOKF92~
 {GOTO}D260~
 /fccnC64.C99~DELSEF92~
 {GOTO}D296~
 /fccnC64.C99~DELRMF92~
 {GOTO}D332~
 /fccnC64.C99~DELSSF92~
 {CALC}{HOME}

Table D7. Spreadsheet Structure Table for DELZZF92.WK1^a

Coefficients, Variables, etc	Location	Description
Monthly marketed gas production, last historical year	Col C	Sum of gas-well gas and oil-well gas
Quarterly marketed gas production, last historical year	Col E	For each quarter, the corresponding 3 months production is added to get quarterly marketed production
Fraction	Col F	Each month's historical marketed production is divided by the corresponding quarter's marketed production
Quarterly gross gas demand, 1st projection year	Col O	Quarterly gross gas demand for 1st projection year is obtained from file QGWG-S92.WK1
Monthly gross gas demand, 1st projection year	Col M	Each month's gross gas demand is obtained by multiplying monthly fraction (Col F) by the corresponding quarter's demand (Col O)
Quarterly gross gas demand, 2nd projection year	Col S	Quarterly gross gas demand for 2nd projection year is obtained from file QGWG-S92.WK1
Monthly gross gas demand, 2nd projection year	Col Q	Each month's gross gas demand is obtained by multiplying monthly fraction (Col F) by the corresponding quarter's demand (Col S)

^aZZ = State/area (see Table D1 note).

Table D8. Macros Listing for DELZZF92.WK1^a

Macro Name: VA

{CALC}
/rvE64.E99~C64~
/rff0~C64.C99~

^aZZ = State/area (see Table D1 note).

Table D9. Spreadsheet Structure Table for EIAFACT.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Year
FO Dwight's gross annual total	B6..B25	Gulf of Mexico OCS annual gas-well gas production on a gross Dwight's basis (mmcf)
TX Dwight's gross annual total	B30..B49	Texas (excluding OCS) annual gas-well gas production on a gross Dwight's basis (mmcf)
LA Dwight's gross annual total	B54..B73	Louisiana (excluding OCS) annual gas-well gas production on a gross Dwight's basis (mmcf)
CA Dwight's gross annual total	B78..B97	California (including Pacific OCS) gas-well gas production on a gross Dwight's basis (mmcf)
KS Dwight's gross annual total	B102..B121	Kansas gas-well gas production combined with oil-well gas production on a gross annual basis (mmcf)
NM Dwight's gross annual total	B126..B145	New Mexico annual gas-well gas production on a gross Dwight's basis (mmcf)
OK Dwight's gross annual total	B150..B169	Oklahoma annual gas-well gas production on a gross Dwight's basis (mmcf)
SE Dwight's gross annual total	B174..B193	Southeastern States annual gas-well gas production on a gross Dwight's basis (mmcf)
RM Dwight's gross annual total	B198..B217	Rocky Mountain States annual gas-well gas production on a gross Dwight's basis (mmcf)
FO EIA gross annual total	C6..C25	Gulf of Mexico OCS annual gas-well gas production on a gross EIA basis (mmcf)
TX EIA gross annual total	C30..C49	Texas (excluding OCS) annual gas-well gas production on a gross EIA basis (mmcf)
LA EIA gross annual total	C54..C73	Louisiana (excluding OCS) annual gas-well gas production on a gross EIA basis (mmcf)
CA EIA gross annual total	C78..C97	California (including Pacific OCS) annual gas-well gas production on a gross EIA basis (mmcf)

Table D9. Spreadsheet Structure Table for EIAFACT.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
KS EIA gross annual total	C102..C121	Kansas annual combined gas-well gas and oil-well gas production on a gross EIA basis (mmcf)
NM EIA gross annual total	C126..C145	New Mexico annual gas-well gas production on a gross EIA basis (mmcf)
OK EIA gross annual total	C150..C169	Oklahoma annual gas-well gas production on a gross EIA basis (mmcf)
SE EIA gross annual total	C174..C193	Southeastern States annual gas-well gas production on a gross EIA basis (mmcf)
RM EIA gross annual total	C198..C217	Rocky Mountain States annual gas-well gas production on a gross EIA basis (mmcf)
FO conversion	F6..F25	Gulf of Mexico OCS MMS(EIA)/Dwight gross conversion, or manual override of actual data
TX conversion	F30..F49	Texas (excluding OCS) EIA/Dwight gross conversion, or manual override of actual data
LA conversion	F54..F73	Louisiana (excluding OCS) EIA/Dwight gross conversion, or manual override of actual data
CA conversion	F78..F97	California (including Pacific OCS) EIA/Dwight gross conversion, or manual override of actual data
KS conversion	F102..F121	Kansas EIA/Dwight gross conversion, or manual override of actual data
NM conversion	F126..F145	New Mexico EIA/Dwight gross conversion, or manual override of actual data
OK conversion	F150..F169	Oklahoma EIA/Dwight gross conversion, or manual override of actual data
SE conversion	F174..F193	Southeastern States EIA/Dwight gross conversion, or manual override of actual data
RM conversion	F198..F217	Rocky Mountain States EIA/Dwight gross conversion, or manual override of actual data

Table D10. Spreadsheet Structure Table for FORINIT.WK1

Coefficients, Variables, etc	Location	Description
ID	P2	Run series identifier, assigned in START.wk1
Demand	I8..I367	EIA total gross demand (Bcf)
Oil-well gas	K8..K367	Calculated gross EIA oil-well gas for single case (mmcf)
Extract	A1..J367	Portion of the spreadsheet extracted as values for use in other programs, single case only
Case	B8..B367	Case indicator to distinguish output and assign file names
Factors	L117..V137	Table of EIA/Dwight's gross gas-well gas conversions
Time	C8..D367	Year and month designators
Abbreviation	A8..A367	Two-digit State/area abbreviation

Table D11. Macros Listing for FORINIT.WK1

Macro Name: \0

{goto}INTRO~{windowsoff}

Macro Name: \1

```
{goto}ID~/fccelD~{calc}/wgrm{home}
{GET_CONVERSIONS}
{goto}I8~/fccnD8..D367~{esc 2}a:*.wk1~{?}~
{let A1,"INFERRED BASE CASE GWG"}~/reA2~
{indicate BASE}{goto}B8~BASE~/cB8~B8..B367~
{goto}K8~/fccnE136..E171~
MONBA
+ $ID
~
{goto}K44~/fccnC136..C171~
MONBA&+$ID~
{goto}K80~/fccnD136..D171~
MONBA&+$ID~
{goto}K116~/fccnF136..F171~
MONBA&+$ID~
{goto}K152~/fccnG136..G171~
MONBA&+$ID~
{goto}K188~/fccnH136..H171~
MONBA&+$ID~
{goto}K224~/fccnI136..I171~
MONBA&+$ID~
{goto}K260~/fccnJ136..J171~
MONBA&+$ID~
```


Table D11. Macros Listing for FORINIT.WK1 (Continued)

```
{goto}K296~/fccnK136..K171~
MONBA&+$ID~
{goto}K332~/fccnL136..L171~
MONBA&+$ID~
{calc}
/fxvGWGB
+$ID
~EXTRACT~r{esc}/reK8..K367~
{let A1,"INFERRED HIGH CASE GWG, DWIGHTS-BASIS"}~/reA2~
{goto}B8~HIGH~/cB8~B8..B367~
{indicate HIGH}{goto}K8~/fccnE136..E171~
MONHI
+$ID
~
{goto}K44~/fccnC136..C171~
MONHI&+$ID~
{goto}K80~/fccnD136..D171~
MONHI&+$ID~
{goto}K116~/fccnF136..F171~
MONHI&+$ID~
{goto}K152~/fccnG136..G171~
MONHI&+$ID~
{goto}K188~/fccnH136..H171~
MONHI&+$ID~
{goto}K224~/fccnI136..I171~
MONHI&+$ID~
{goto}K260~/fccnJ136..J171~
MONHI&+$ID~
{goto}K296~/fccnK136..K171~
MONHI&+$ID~
{goto}K332~/fccnL136..L171~
MONHI&+$ID~
{calc}/rvK8..K367~K8~
/fxvGWGH
+$ID
~EXTRACT~r{esc}/reK8..K367~
{indicate LOW}{goto}B8~LOW~/cB8~B8..B367~
{goto}K8~/fccnE136..E171~
MONLO
+$ID
~
{goto}K44~/fccnC136..C171~
MONLO&+$ID~
{goto}K80~/fccnD136..D171~
MONLO&+$ID~
{goto}K116~/fccnF136..F171~
MONLO&+$ID~
{goto}K152~/fccnG136..G171~
MONLO&+$ID~
{goto}K188~/fccnH136..H171~
```

Table D11. Macros Listing for FORINIT.WK1 (Continued)

```

MONLO&+$ID~
{goto}K224~/fccnI136..I171~
MONLO&+$ID~
{goto}K260~/fccnJ136..J171~
MONLO&+$ID~
{goto}K296~/fccnK136..K171~
MONLO&+$ID~
{goto}K332~/fccnL136..L171~
MONLO&+$ID~
{let A1,"INFERRED LOW CASE GWG, DWIGHTS-BASIS"}~
{calc}
/fxvGWGL
+$ID
~EXTRACT~r{esc}{indicate NEXT}
/frINITIAL~

```

Subroutine Name: GET_CONVERSIONS

```

{windowsoff}{indicate READ}
{blank CA}{blank FO}{blank LA}{blank KS}{blank LA}{blank NM}{blank OK}{blank TX}
  {blank RM}{blank SE}
{goto}FO~/fccnFO~EIAFACT~
{goto}TX~/fccnTX~EIAFACT~
{goto}LA~/fccnLA~EIAFACT~
{goto}CA~/fccnCA~EIAFACT~
{goto}KS~/fccnKS~EIAFACT~
{goto}NM~/fccnNM~EIAFACT~
{goto}OK~/fccnOK~EIAFACT~
{goto}SE~/fccnSE~EIAFACT~
{goto}RM~/fccnRM~EIAFACT~
/rvFACT_TABLE~FACT_TABLE~
{indicate SCHED}
{windowson}{return}

```

Table D12. Macros Listing for INITIAL.WK1

Macro Name: \0

```

/FDC:\123\JAMES~{goto}ID~/fccelD~{calc}/wgrm/reE9..E1088~
{goto}E9~/fccnFO~GASCMPL~
{goto}E21~/fccnFOL~GASCMPL~
{goto}E45~/fccnTX~GASCMPL~
{goto}E57~/fccnTXL~GASCMPL~
{goto}E81~/fccnLA~GASCMPL~
{goto}E93~/fccnLAL~GASCMPL~
{goto}E117~/fccnCA~GASCMPL~
{goto}E129~/fccnCAL~GASCMPL~
{goto}E153~/fccnKS~GASCMPL~
{goto}E165~/fccnKSL~GASCMPL~
{goto}E189~/fccnNM~GASCMPL~
{goto}E201~/fccnNML~GASCMPL~

```

Table D12. Macros Listing for INITIAL.WK1 (Continued)

```
{goto}E225~/fccnOK~GASCMPL~
{goto}E237~/fccnOKL~GASCMPL~
{goto}E261~/fccnSE~GASCMPL~
{goto}E273~/fccnSEL~GASCMPL~
{goto}E297~/fccnRM~GASCMPL~
{goto}E309~/fccnRML~GASCMPL~
{goto}E333~/fccnSS~GASCMPL~
{goto}E345~/fccnSSL~GASCMPL~
{goto}E369~/fccnFO~GASCMPL~
{goto}E381~/fccnFOB~GASCMPL~
{goto}E405~/fccnTX~GASCMPL~
{goto}E417~/fccnTXB~GASCMPL~
{goto}E441~/fccnLA~GASCMPL~
{goto}E453~/fccnLAB~GASCMPL~
{goto}E477~/fccnCA~GASCMPL~
{goto}E489~/fccnCAB~GASCMPL~
{goto}E513~/fccnKS~GASCMPL~
{goto}E525~/fccnKSB~GASCMPL~
{goto}E549~/fccnNM~GASCMPL~
{goto}E561~/fccnNMB~GASCMPL~
{goto}E585~/fccnOK~GASCMPL~
{goto}E597~/fccnOKB~GASCMPL~
{goto}E621~/fccnSE~GASCMPL~
{goto}E633~/fccnSEB~GASCMPL~
{goto}E657~/fccnRM~GASCMPL~
{goto}E669~/fccnRMB~GASCMPL~
{goto}E693~/fccnSS~GASCMPL~
{goto}E705~/fccnSSB~GASCMPL~
{goto}E729~/fccnFO~GASCMPL~
{goto}E741~/fccnFOH~GASCMPL~
{goto}E765~/fccnTX~GASCMPL~
{goto}E777~/fccnTXH~GASCMPL~
{goto}E801~/fccnLA~GASCMPL~
{goto}E813~/fccnLAH~GASCMPL~
{goto}E837~/fccnCA~GASCMPL~
{goto}E849~/fccnCAH~GASCMPL~
{goto}E873~/fccnKS~GASCMPL~
{goto}E885~/fccnKSH~GASCMPL~
{goto}E909~/fccnNM~GASCMPL~
{goto}E921~/fccnNMH~GASCMPL~
{goto}E945~/fccnOK~GASCMPL~
{goto}E957~/fccnOKH~GASCMPL~
{goto}E981~/fccnSE~GASCMPL~
{goto}E993~/fccnSEH~GASCMPL~
{goto}E1017~/fccnRM~GASCMPL~
{goto}E1029~/fccnRMH~GASCMPL~
{goto}E1053~/fccnSS~GASCMPL~
{goto}E1065~/fccnSSH~GASCMPL~
/rvE9..E1088~E9~
{GOTO}G9~/fccnG8..G368~GWGL
```

Table D12. Macros Listing for INITIAL.WK1 (Continued)

```

+$ID
~{GOTO}G369~/fccnG8..G368~GWGB
+$ID
~{GOTO}G729~/fccnG8..G368~GWGH
+$ID
~/rff3~G9..G1088~/rvG9..G1088~G9~{HOME}{calc}
/fs~r{esc}
{onerror CONTINUE}
/feplINIT
+$ID
~y
/pfINIT (CONTINUE)
+$ID
~rA1..G1088~oouml6~mr135~qagq
/fxvINIT
+$ID
~A9..G1088~r{esc}{goto}N4~{beep}{get l80}
~/wey

```

Subroutine Name: CONTINUE

```

/pfINIT
+$ID
~rA1..G1088~oouml6~mr135~qagq
/fxvINIT
+$ID
~A9..G1088~r{esc}{goto}N4~{beep}{get l80}
~/wey

```

Table D13. Spreadsheet Structure Table for GASCMPL.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
Distribution factor	B45..K45	Annual proportion of lower-48 gas rigs active in each State/area based on last 3 historical calendar years of Baker-Hughes data
Completions per rig	B24..K24	Average number of gas-well completions per annual active gas rig in each State/area based on last 3 historical GASCAP active December gas well counts and annualized Baker-Hughes data for the same years
Table of forecast total rigs	Q7..V18	Results of Drilling Rigs Model

Table D13. Spreadsheet Structure Table for GASCMPL.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Place holder table of gas-well completions	B30..K41	Place holder for gas-well completions in the first of three years, these data do not actively influence the GASCAP model but are used to maintain the proper data structure
Table of calculated low case gas-well completions	B50..K73	Monthly forecast of low case gas-well completions by State/area for 2 years
Table of calculated base case gas-well completions	B84..K107	Monthly forecast of base case gas-well completions by State/area for 2 years
Table of calculated high case gas-well completions	B118..K141	Monthly forecast of high case gas-well completions by State/area for 2 years

Table D14. Spreadsheet Structure Table for GMBASG92.WK1 (Gulf of Mexico)

Coefficients, Variables, etc	Location	Description
Gross gas	B47..B56	Gross gas production is sum of gas-well and oil-well gas
Dry gas	C47..C56	Dry gas production is sum of gas-well gas and oil-well gas
Conversion factor	D47..D56	Dry gas divided by the gross gas gives the conversion factor

Table D15. Spreadsheet Structure Table for HIGHOIL.WK1

Coefficients, Variables, etc	Location	Description
TX	B5..Y5	Texas monthly high case crude oil forecast daily rates (mb/d)
LA	B7..Y7	Louisiana (excluding Gulf of Mexico OCS) monthly high case crude oil forecast daily rates (mb/d)
GC	B11..Y11	Gulf of Mexico OCS monthly high case crude oil forecast daily rates (mb/d)

Table D15. Spreadsheet Structure Table for HIGHOIL.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
CA	B13..Y13	California (including Pacific OCS) monthly high case crude oil forecast daily rates (mb/d)
KS	B15..Y15	Kansas monthly high case crude oil forecast daily rates (mb/d)
NM	B17..Y17	New Mexico monthly high case crude oil forecast daily rates (mb/d)
OK	B19..Y19	Oklahoma monthly high case crude oil forecast daily rates (mb/d)
SE	B29..Y29	Southeastern States monthly high case crude oil forecast daily rates (mb/d)
RM	B43..Y43	Rocky Mountain States monthly high case crude oil forecast daily rates (mb/d)
18	B45..Y45	Eighteen States monthly high case crude oil forecast daily rates (mb/d)

Table D16. Spreadsheet Structure Table for INITIAL.WK1

Coefficients, Variables, etc	Location	Description
ID	J1	Run series identifier assigned in START.WK1
Abbreviation	Col A	Two-digit State/area abbreviation
Case	Col B	Case designator, Low case in rows 9-368, Base case in rows 369-728, and High case in rows 729-1088
Year	Col C	Year
Month	Col D	Month
New completions	Col E	Monthly new gas-well completions
Yearly completions	Col F	Annual summation of monthly new gas-well completions
Demand	Col G	Monthly scheduled Dwight's-basis gas-well gas demand
Upload schedule	A1..G1088	Range output as initial demand schedule ASCII file which is sent to the mainframe as basis for projection routines

Table D17. Spreadsheet Structure Table for LOWOIL.WK1

Coefficients, Variables, etc	Location	Description
TX	B5..Y5	Texas monthly low case crude oil forecast daily rates (mb/d)
LA	B7..Y7	Louisiana (excluding Gulf of Mexico OCS) monthly low case crude oil forecast daily rates (mb/d)
GC	B11..Y11	Gulf of Mexico OCS monthly low case crude oil forecast daily rates (mb/d)
CA	B13..Y13	California (including Pacific OCS) monthly low case crude oil forecast daily rates (mb/d)
KS	B15..Y15	Kansas monthly low case crude oil forecast daily rates (mb/d)
NM	B17..Y17	New Mexico monthly low case crude oil forecast daily rates (mb/d)
OK	B19..Y19	Oklahoma monthly low case crude oil forecast daily rates (mb/d)
SE	B29..Y29	Southeastern States monthly low case crude oil forecast daily rates (mb/d)
RM	B43..Y43	Rocky Mountain States monthly low case crude oil forecast daily rates (mb/d)
18	B45..Y45	Eighteen States monthly low case crude oil forecast daily rates (mb/d)

Table D18. Spreadsheet Structure Table for MONTHLY.WK1

Coefficients, Variables, etc	Location	Description
Oil	Q33..Z212	Monthly State/area oil production from the PSA for historical data and the GASCAP/ STEO oil forecast for projections
GOR	A251..L270	Annual gas/oil ratios (GOR) for each State/area for historical and forecast years
Time	Col A	Day, month, and year
Oil-well gas	A4..L183	Historical and forecast monthly oil-well gas as calculated from oil production and GOR* (mmcf)

Note: Oil-well gas for Gulf of Mexico OCS is not calculated using the GOR method for the years 1980 through 1988. These data are taken from MMS-reported casinghead gas volumes sent to EIA.

Table D19. Macros Listing for MONTHLY.WK1

Macro Name: \O

```
{goto}ID~/fccelD~{home}{goto}V1~
```

Macro Name: \U

```
{indicate BASE}{home}
{goto}EXTRACT~MONBA
+$ID
~{r}@now~{r}@now~
~{windowsoff}/reFORECAST~{goto}FORECAST~
/fccnMONTHLY~
OBASE&+$ID~
/fxvMONBA
+$ID
~EXTRACT~r{esc}{windowson}
{indicate HIGH}{home}
{goto}EXTRACT~MONHI
+$ID
~{windowsoff}/reFORECAST~{goto}FORECAST~
/fccnMONTHLY~
OHIGH&+$ID~
/fxvMONHI
+$ID
~EXTRACT~r{esc}{windowson}
{indicate LOW}{home}
{goto}EXTRACT~MONLO
+$ID
~{windowsoff}/reFORECAST~{goto}FORECAST~
/fccnMONTHLY~
OLOW&+$ID~
/fxvMONLO
+$ID
~EXTRACT~r{esc}{indicate DONE}/reFORECAST~/r{t}V1..V7~/rfgV10~{windowson}
{goto}V1~{beep}{get FORECAST}/rFORINIT~
```

Table D20. Spreadsheet Structure Table for QGWG-S92.WK1

Coefficients, Variables, etc	Location	Description
U.S. quarterly dry gas demand for 1st projection year	W46..Z46	Obtain from STEO
Alaska's quarterly dry gas demand for 1st projection year	W47..Z47	Alaska's quarterly dry gas demand

Table D20. Spreadsheet Structure Table for QGWG-S92.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Lower 48 States quarterly dry gas demand for 1st projection year	W48..Z48	Alaska's quarterly demand is subtracted from U.S. demand to get lower 48 States demand
Texas gross gas demand for 1st projection year	W9..Z9	Lower 48 States quarterly dry gas demand is multiplied by the Texas quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Texas
Louisiana gross gas demand for 1st projection year	W10..Z10	Lower 48 States quarterly dry gas demand is multiplied by the Louisiana quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Louisiana
Gulf of Mexico gross gas demand for 1st projection year	W14..Z14	Lower 48 States quarterly dry gas demand is multiplied by the Gulf of Mexico quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Gulf of Mexico
California gross gas demand for 1st projection year	W16..Z16	Lower 48 States quarterly dry gas demand is multiplied by the California quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for California
Kansas gross gas demand for 1st projection year	W17..Z17	Lower 48 States quarterly dry gas demand is multiplied by the Kansas quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Kansas
New Mexico gross gas demand for 1st projection year	W18..Z18	Lower 48 States quarterly dry gas demand is multiplied by the New Mexico quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for New Mexico
Oklahoma gross gas demand for 1st projection year	W19..Z19	Lower 48 States quarterly dry gas demand is multiplied by the Oklahoma quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Oklahoma
Southeast gross gas demand for 1st projection year	W28..Z28	Lower 48 States quarterly dry gas demand is multiplied by the Southeast quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Southeast
Rocky Mountain gross gas demand for 1st projection year	W38..Z38	Lower 48 States quarterly dry gas demand is multiplied by the Rocky Mountain quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Rocky Mountains

Table D20. Spreadsheet Structure Table for QGWG-S92.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Eighteen States gross gas demand for 1st projection year	W40..Z40	Lower 48 States quarterly dry gas demand is multiplied by the 18 States quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for the 18 States
U.S. quarterly dry gas demand for 2nd projection year	AC46..AF46	Obtain from STEO
Alaska's quarterly dry gas demand for 2nd projection year	AC47..AF47	Alaska's quarterly dry gas demand
Lower 48 States quarterly dry gas demand for 2nd projection year	AC48..AF48	Alaska's quarterly demand is subtracted from U.S. demand to get lower 48 States demand
Texas gross gas demand for 2nd projection year	AC9..AF9	Lower 48 States quarterly dry gas demand is multiplied by the Texas quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Texas
Louisiana gross gas demand for 2nd projection year	AC10..AF10	Lower 48 States quarterly dry gas demand is multiplied by the Louisiana quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Louisiana
Gulf of Mexico gross gas demand for 2nd projection year	AC14..AF14	Lower 48 States quarterly dry gas demand is multiplied by the Gulf of Mexico quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Gulf of Mexico
California gross gas demand for 2nd projection year	AC16..AF16	Lower 48 States quarterly dry gas demand is multiplied by the California quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for California
Kansas gross gas demand for 2nd projection year	AC17..AF17	Lower 48 States quarterly dry gas demand is multiplied by the Kansas quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Kansas
New Mexico gross gas demand for 2nd projection year	AC18..AF18	Lower 48 States quarterly dry gas demand is multiplied by the New Mexico quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for New Mexico

Table D20. Spreadsheet Structure Table for QGWG-S92.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Oklahoma gross gas demand for 2nd projection year	AC19..AF19	Lower 48 States quarterly dry gas demand is multiplied by the Oklahoma quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Oklahoma
Southeast gross gas demand for 2nd projection year	AC28..AF28	Lower 48 States quarterly dry gas demand is multiplied by the Southeast quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Southeast
Rocky Mountain gross gas demand for 2nd projection year	AC38..AF38	Lower 48 States quarterly dry gas demand is multiplied by the Rocky Mountain quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for Rocky Mountains
Eighteen States gross gas demand for 2nd projection year	AC40..AF40	Lower 48 States quarterly dry gas demand is multiplied by the 18 States quarterly fraction and multiplied by the conversion factor to obtain quarterly gross gas demand for the 18 States

Table D21. Spreadsheet Structure Table for START.WK1

Coefficients, Variables, etc	Location	Description
ID	O2	Alpha run identifier passed as a spreadsheet file for integration in other PC programs
Old ID	N2	Alpha run identifier saved from the last execution of the program
New ID	P2	Proposed new run identifier which increments the old ID

Table D22. Macros Listing for START.WK1

Macro Name: \0

```

/fdC:\123\JAMES~{onerror NO_ID}
{goto}ID~/fcelD~
{home}{onerror}
{menubrand MENU}

```

Menu Name: MENU

Increment

Automatically Increment the ID by 1 letter, then autoloading the next program

```

/fxvID~NEW_ID~r{esc}{let ID,NEW_ID}~{ENDING}

```

Table D22. Macros Listing for START.WK1 (Continued)

Reuse

Reuse the ID that is currently in the system, then autoloading next program

{ENDING}

Manual

Manually assign an alphabetic ID, then autoloading next program

{MAN_ID}

Quit

Stop right here and leave me with a blank worksheet

/wey

Subroutine Name: MAN_ID

```
{beep}/xlEnter alpha run series ID (2 dig. max) :~ID~
{if @length(ID)<1#or#@length(ID)>2}/bbbbbb{branch MAN_ID}
{if @value(@right(ID,1))>=1}/bbbbbb{branch MAN_ID}
{if @value(@left(ID,1))>=1}/bbbbbb{branch MAN_ID}
{let ID,@upper(ID)}~
/fxvID~ID~r{esc}{ENDING}
```

Subroutine Name: NO_ID

```
{let OLD_ID,MISSING}~{let ID,@}~
{home}{menubbranch NOID_MENU}
```

Menu Name: NOID_MENU

Increment

Automatically Assign run "A" to ID

/fxvID~NEW_ID~r{esc}{ENDING}

Manual

Manually assign an alphabetic 2-digit ID

{MAN_ID}

Quit

Stop right here and leave me with a blank worksheet

/wey

Subroutine Name: ENDING

```
{let OLD_ID,ID}~/fs~r{esc}{goto}NULL~{get NULL}
/frCONVERT~
```

Table D23. Spreadsheet Structure Table for ZZBASG92.WK1^a (Excluding Gulf of Mexico)

Coefficients, Variables, etc	Location	Description
Gross gas	Col D	Sum of gas-well and oil-well gas
Dry gas	Col E	Sum of gas-well gas and oil-well gas
Conversion factor	Col F	Dry gas divided by the gross gas gives the conversion factor

^aZZ = State/area (see Table D1 note).

Appendix E

Projection Routine

The projection part of **GASCAP** consists of two projection routines and a reallocation module. Figure E1 is a flow diagram of the projection routine. An initial demand schedule is tested against the capacity projected for each State/area by month. If capacity is not greater than demand for each month for each State/area, the excess demand is reallocated to other State/areas, and the process is repeated until demand is met or all State/areas are producing at capacity.

EPROJZZ is a SAS program that projects productive capacity for nine of the ten State/areas. **EPROJZZ** reads in the equation parameters generated in **CHYP9TMP** and the historical production and estimated historical capacity data generated from Dwight's. It outputs three files: 1) history, 2) projection, and 3) December production by vintage and year of production for use in the table and figure generating routines.

PROJ17ST is a SAS program that uses data from the other 18 States to make projections. Initially the annual production from the *Natural Gas Annual* and monthly well completions from API are used to generate an equation for annual data. Then the equation is transformed to a monthly equation where monthly estimates and projections are made for productive capacity. It only outputs two files: 1) history and 2) projection. There is no vintage data, only time series data.

Detailed instructions for running the projection programs are included in their JCLs.

Table E1. Reference Table of JCLs, Programs, and Functions

JCL Name	Language	Function
EPROJZZ	SAS	Projects the capacity for each State/area that uses Dwight's data
PROJ17ST	SAS	Projects the capacity for the 18 States/areas

Figure E1. Production and Capacity Projection Process

Table E2. SAS Program Listing for EPROJZZ

```

1  //uidUPRZZ JOB (acct,DAL,,999),NAME,REGION=1500K,TIME=(00,59),
2  //      MSGCLASS=A
3  //*****
4  /**      EPROJZZ BY VELTON FUNK      UNITS ARE MCF/D AND MCF
5  /**      MODIFIED BY LESTER J. WALTERS JR. 3/31/92
6  /**
7  /**      SAS JCL FOR GAS PRODUCTION PROJECTION
8  /**
9  /**      EDIT CHANGES TO STATE SPECIFIC PROGRAMS
10 /**      1. CH 'JJ'      TO JOB CARD CODE EG. 0U FOR 1990 UNEDITED
11 /**      2E FOR 1991 EDITED, ETC
12 /**      2. CH 'XXX'      TO STATE ID DATE CODE, EG. TX0692E
13 /**      3. CH 'VY1'      TO 1ST VINTAGE YEAR EG. 69, 70, ...
14 /**      4. CH 'PY1'      TO 1ST PROJECTION YEAR EG. 92
15 /**      5. CH 'PY2'      TO 2ND PROJECTION YEAR EG. 93
16 /**      6. CH 'PY3'      TO 3RD PROJECTION YEAR EG. 94
17 /**      7. CH 'YYY'      TO YEAR CODE FOR DATA SETS EG.
18 /**      U1990 FOR 1990 UNEDITED DATA
19 /**      E1992 FOR 1992 EDITED DATA, ETC
20 /**      8. CH 'LOW'      TO CASE: LOW BASE OR HIGH
21 /**      9. CH 'ZZ'      TO STATE POSTAL CODE, IE CA, ... , ZZ
22 /**      10. CH 'uid'      TO USER ID CODE EG PKF
23 /**      11. CH 'NAME'      IN JOB CARD TO YOUR LAST NAME
24 /**      12. FIND '##'      FOR FURTHER CHANGES
25 /*******
26 /**
27 /** STEP1      EXEC SAS,TAGDSN='CNacct.PRJ.BLOW.YYY.ZETAPLOT',
28 /**STEP1      EXEC SAS,
29 /**      TIME=(00,59),TAGDISP='MOD',REGION=1500K,
30 /**      OPTIONS='ERRORS=01'
31 /**
32 /**IN1      DD DSN=CNacct.PRJ.CHYP9.YYY.EQUAT,DISP=SHR
33 /**IN2      DD DSN=CNacct.PRJ.DRD4.PROD.XXX,DISP=SHR
34 /**IN3      DD DSN=CNacct.PRJ.DRD4.EARLY.XXX,DISP=SHR
35 /**IN4      DD DSN=CNacct.PRJ.SCHED,DISP=SHR
36 /**IN5      DD DSN=CNacct.PRJ.BSASDS.MONTH9JJ,DISP=SHR
37 /**IN6      DD DSN=CNacct.PRJ.LOADFACT,DISP=SHR
38 /**
39 /**OUT1      DD DSN=CNacct.PRJ.PROD.ZZLOW,DISP=OLD
40 /**      DCB=(RECFM=FB,LRECL=100,BLKSIZE=1000),
41 /**      UNIT=DASD,DISP=(NEW,CATLG,DELETE),SPACE=(TRK,(75,5),RLSE)
42 /**OUT2      DD DSN=CNacct.PRJ.PROD.SCHED.ZZLOW,DISP=OLD
43 /**      DCB=(RECFM=FB,LRECL=100,BLKSIZE=1000),
44 /**      UNIT=DASD,DISP=(NEW,CATLG,DELETE),SPACE=(TRK,(75,5),RLSE)
45 /**OUT3      DD DSN=CNacct.PRJ.PROD.ZZAVLOW,DISP=OLD
46 /**      DCB=(RECFM=FB,LRECL=100,BLKSIZE=1000),
47 /**      UNIT=DASD,DISP=(NEW,CATLG,DELETE),SPACE=(TRK,(75,5),RLSE)
48 /**
49 /**
50 /**FT20F001 DD SYSOUT=A
51 /**
52 /**SYSIN DD *
53
54 *** EPROJZZ XXX *****;
55
56 /*****
57 * THIS PROGRAM CALCULATES PROJECTIONS FOR HIGH, LOW, AND BASE      *
58 * CASES FOR EACH STATE/AREA BASED ON THE SCHEDULING PROVIDED      *
59 * BY THE PC PROGRAM AND OTHER PRODUCTION INPUTS FROM SAS          *
60 * PROGRAMS: CHYP9TMP, DRD4TMPL, AND BSASTMPL.                      *
61 *                                                                    *
62 *                                                                    *
63 * INPUT DATA FILES                                                *
64 *                                                                    *
65 *      &.CHYP9.YYY.EQUAT - ESTIMATED PEAK RATE PARAMETERS          *
66 *                                                                    *
67 *      &.DRD4.PROD.XXX - FIRST YEAR ESTIMATED PRODUCTION DATA     *
68 *                                                                    *
69 *      &.DRD4.EARLY.XXX - FIRST YEAR AVERAGE PRODUCTION RATES PER *
70 *                          WELL FOR EACH MONTH                     *
71 *                                                                    *
72 *      &.SCHED - DEMAND SCHEDULE                                    *
73 *                                                                    *
74 *      &.BSASDS.MONTH9JJ - DAILY GAS PRODUCTION RATES AND NUMBER OF *
75 *                          PRODUCING GAS WELLS FOR ALL STATES      *
76 *                                                                    *

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

77 *      &.LOADFACT      - LOAD FACTOR: NUMBER OF WELLS PRODUCING *
78 *                      IN DECEMBER DIVIDED BY NUMBER OF WELLS *
79 *                      PRODUCING AT ANYTIME DURING THE YEAR *
80 *
81 * OUTPUT DATA SETS *
82 *
83 *      OUT1      - HISTORICAL PRODUCTION *
84 *      VARIABLES - AREA, CASE, YR, MONTH, WLS, MAXWEL, SPROD *
85 *                      SRATE, ORATE, PRATE *
86 *
87 *      OUT2      - REALLOCATION SCHEDULE *
88 *      VARIABLES - AREA, CASE, YR, MONTH, WLS, MAXWEL, SPROD, *
89 *
90 *
91 *
92 *      OUT3      - DECEMBER VINTAGE PRODUCTION PERCENTS *
93 *      VARIABLES (WELL-AGE REPORT) *
94 *                      - AREA, CASE, VINTAGE, YR, MONTH, ORATE, PRATE *
95 *
96 *
97 * VARIABLES USED IN THIS PROGRAM *
98 *
99 *      VARIABLE USAGE CODES: *
100 *          I - INPUT VARIABLES *
101 *          O - OUTPUT VARIABLES *
102 *          I/O - INPUT & OUTPUT VARIABLES *
103 *          C - CALCULATION VARIABLES *
104 *
105 *      B1      (I)  - PEAK RATE AVERAGE BY VINTAGE, MCF/DAY *
106 *
107 *      B2      (I)  - ULTIMATE RECOVERY BY VINTAGE, MCF *
108 *
109 *      B3      (I)  - FIXED EXPONENT OF PEAK RATE MODEL STATEMENT *
110 *
111 *      MAXID   (I)  - LAST VINTAGE YEAR *
112 *
113 *      MINID   (I)  - FIRST VINTAGE YEAR *
114 *
115 *      VINTAGE (I)  - FIRST YEAR OF PRODUCTION *
116 *
117 *      GWELLS  (I)  - NUMBER OF GAS WELLS *
118 *
119 *      ARATE   (I)  - AVERAGE PRODUCTION RATE PER WELL, MCF/DAY *
120 *
121 *      GP1     (I)  - CUM AT END OF VINTAGE YEAR, MCF *
122 *
123 *      GP2     (I)  - (CUM AT END OF PREVIOUS MONTH) - (GP1), MCF *
124 *
125 *      ST      (I)  - STATE/AREA *
126 *
127 *      PKFACTOR (I) - B1 PARAMETER MULTIPLIER; LOAD FACTOR *
128 *
129 *      PRATE   (I/O) - ESTIMATED CAPACITY OR RATE BY MONTH, MCF/DAY *
130 *
131 *      ORATE   (I/O) - DAILY PRODUCTION RATE EACH MONTH, MCF/DAY *
132 *
133 *      AREA    (I/O) - STATE/AREA *
134 *
135 *      CASE    (I/O) - SHORT TERM ENERGY OUTPUT (STEO) *
136 *                      (GAS DEMAND/# WELLS SCHEDULED): *
137 *                      'HIGH' - HIGH WELL COUNT *
138 *                      'BASE' - NORMAL WELL COUNT *
139 *                      'LOW' - LOW WELL COUNT *
140 *
141 *      SPROD   (I/O) - SCHEDULED PRODUCTION ( IN BCF/MONTH UNITS *
142 *                      WHEN READ IN; LATER CHANGED TO MCF UNITS) *
143 *
144 *      WLS     (I/O) - NUMBER OF PRODUCING WELLS *
145 *
146 *      MAXWEL  (I/O) - MAXIMUM NEW WELLS COMPLETED DURING NEW *
147 *                      VINTAGE YEAR *
148 *
149 *      YECUM   (I/C) - YEAR-END CUM OF NEW PROJECTED PRODUCTIONS, *
150 *                      MCF *
151 *
152 *      QE      (I/C) - PRODUCTION CAPACITY AT END OF PREVIOUS *
153 *                      MONTH AND BEGINNING OF CURRENT MONTH, MCF/DAY*

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

154 *
155 * PWB2 (I/C) - PER WELL ULTIMATE RECOVERY, MCF *
156 *
157 * PWB1 (C) - PER WELL PEAK RATE AVERAGE, MCF/DAY *
158 *
159 * PWB3 (C) - FIXED EXPONENT OF PEAK RATE MODEL STATEMENT *
160 *
161 * GP3 (C) - WELL PRODUCTION DIFFERENCE, MCF *
162 * (NEW WELL NORMAL PRODUCTION) - *
163 * (ESTIMATED PRODUCTION) *
164 *
165 * GPE (C) - (MID-MONTH CUM) - (GP1), MCF *
166 *
167 * TIME1 (C) - CUM PRODUCTION PSEUDO TIME AT BEGINNING *
168 * OF MONTH *
169 *
170 * TIME2 (C) - CUM PRODUCTION PSEUDO TIME AT END OF MONTH *
171 *
172 * QE2 (C) - PRODUCTION CAPACITY AT END OF PROJECTED *
173 * MONTH, MCF/DAY *
174 *
175 * GP2E (C) - CUM THROUGH END OF MONTH IF PRODUCTION IS *
176 * AT CAPACITY, MCF *
177 *
178 * NPRODM (C) - CUM PRODUCTION DIFFERENCE: CUM PRODUCTION AT *
179 * END OF MONTH PRODUCING AT CAPACITY MINUS *
180 * CUM PRODUCTION AT BEGINNING OF MONTH (I.E. *
181 * MAXIMUM AMOUNT OF PRODUCTION THAT CAN BE *
182 * PRODUCED FOR THE MONTH); MCF *
183 *
184 * NPRODMT (C) - SUM OF NPRODM OVER ALL VINTAGES, MCF *
185 *
186 * WELLS (C) - CUMULATIVE WELL COUNT *
187 *
188 * HPROD (C) - NORMAL PRODUCTION EXPECTED FOR THE 1ST MONTH, *
189 * MONTH, MCF *
190 *
191 * GPH (C) - RUNNING CUM NORMAL PRODUCTION, MCF *
192 * STARTS OFF AT 1ST MONTH EXPECTED NORMAL *
193 * PRODUCTION *
194 *
195 * VPROD (C) - PROJECTED PRODUCTION, MCF *
196 *
197 * NPR (C) - NEW PROJECTED PRODUCTION BY VINTAGE, MCF *
198 *
199 * NRATE (C) - AVERAGE DAILY NPR, MCF/DAY *
200 *
201 * MAXPROD (C) - MAX PRODUCTION, MCF *
202 *
203 * MAXRATE (C) - MAX PRODUCTION DAILY RATE, MCF/DAY *
204 *
205 * QP (C) - PRODUCTION CAPACITY AT BEGINNING OF MONTH *
206 * OR END OF PREVIOUS MONTH. MCF/DAY *
207 *
208 * PWELLS (C) - NUMBER OF WELLS FOR THE MONTH *
209 *
210 * QNEW (C) - SUM OF MAX PRODUCTION FOR NEXT MONTH OVER *
211 * ALL VINTAGES, MCF/DAY *
212 *
213 * TPR (C) - EQUALS VPROD AT END OF PROJECTED DATASETS, *
214 * MCF *
215 *
216 * DPR (C) - EQUAL SPROD1 AT END OF PROJECTED DATASETS, *
217 * MCF *
218 *
219 * CPROD (O) - PRODUCTIVE CAPACITY FOR MONTH, BCF *
220 *
221 * MPROD (O) - MONTHLY PRODUCTION, BCF *
222 *
223 * SRATE (O) - SCHEDULED DAILY RATE, MCF/DAY *
224 *
225 *****/
226
227 /*****
228 * READ LOAD FACTOR AND CREATE A LOAD FACTOR RECORD FOR EACH *
229 * VINTAGE FOR THE GIVEN STATE/AREA. *
230 *****/

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

231 DATA DATLFAC;INFILE IN6;
232 INPUT ST $1-7 PKFACTOR 9-17;
233 IF ST NE 'XXX' THEN DELETE;
234 VINTAGE = 69;OUTPUT DATLFAC;
235 VINTAGE = 70;OUTPUT DATLFAC;
236 VINTAGE = 71;OUTPUT DATLFAC;
237 VINTAGE = 72;OUTPUT DATLFAC;
238 VINTAGE = 73;OUTPUT DATLFAC;
239 VINTAGE = 74;OUTPUT DATLFAC;
240 VINTAGE = 75;OUTPUT DATLFAC;
241 VINTAGE = 76;OUTPUT DATLFAC;
242 VINTAGE = 77;OUTPUT DATLFAC;
243 VINTAGE = 78;OUTPUT DATLFAC;
244 VINTAGE = 79;OUTPUT DATLFAC;
245 VINTAGE = 80;OUTPUT DATLFAC;
246 VINTAGE = 81;OUTPUT DATLFAC;
247 VINTAGE = 82;OUTPUT DATLFAC;
248 VINTAGE = 83;OUTPUT DATLFAC;
249 VINTAGE = 84;OUTPUT DATLFAC;
250 VINTAGE = 85;OUTPUT DATLFAC;
251 VINTAGE = 86;OUTPUT DATLFAC;
252 VINTAGE = 87;OUTPUT DATLFAC;
253 VINTAGE = 88;OUTPUT DATLFAC;
254 VINTAGE = 89;OUTPUT DATLFAC;
255 VINTAGE = 90;OUTPUT DATLFAC;
256 VINTAGE = 91;OUTPUT DATLFAC;
257 VINTAGE = 92;OUTPUT DATLFAC;
258 VINTAGE = 93;OUTPUT DATLFAC;
259 VINTAGE = 94;OUTPUT DATLFAC;
260 VINTAGE = 95;OUTPUT DATLFAC;
261 VINTAGE = 96;OUTPUT DATLFAC;
262 VINTAGE = 97;OUTPUT DATLFAC;
263 VINTAGE = 98;OUTPUT DATLFAC;
264 VINTAGE = 99;OUTPUT DATLFAC;
265 DELETE;
266
267 proc print;
268 title 'datlfac';
269 /*****
270  * READ IN THE VINTAGE, YR, & PEAK RATE PARAMETERS.  KEEP THE      *
271  * INFORMATION FOR THE GIVEN STATE/AREA.                          *
272  *****/;
273 DATA DATOPARM;SET IN1.PARMS;
274 IF ST NE 'XXX' THEN DELETE;
275
276 /*****
277  * SORT THE LOAD FACTOR AND THE PARAMETER INFORMATION DATASETS    *
278  * BY VINTAGE.                                                    *
279  *****/;
280 PROC SORT DATA= DATOPARM; BY VINTAGE;
281 PROC SORT DATA= DATLFAC ; BY VINTAGE;
282
283 /*****
284  * MERGE THE LOAD FACTOR AND THE PARAMETER INFORMATION DATASETS  *
285  * BY VINTAGE.                                                    *
286  *****/;
287 DATA DATNPARM;MERGE DATOPARM DATLFAC; BY VINTAGE;
288
289
290 /*****
291  * SET UP THE NEW PER WELL PARAMETERS DATASET (DATN) AND THE      *
292  * ALREADY DEFINED VINTAGE PARAMETERS DATASET (DATV).              *
293  *****/;
294 DATA DATV DATN;
295 SET DATNPARM ;
296 IF B1 LT 0 THEN DELETE;
297
298 *** CALCULATE A NEW B1 PARAMETER USING THE LOAD FACTOR "PKFACTOR";
299 B1= B1*PKFACTOR;
300
301 *** NEW PER WELL VINTAGE PARAMETERS;
302 IF VINTAGE EQ 99 THEN DO;
303 VINTAGE= 999;
304 PWB1=B1;
305 PWB2=B2;
306 PWB3=B3;
307 OUTPUT DATN;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

308     DELETE;
309     END;
310
311 *** SET UP FOR FIRST MONTH OF NEXT YEAR'S PROJECTION USING ALREADY;
312 *** DEFINED PARAMETERS;
313     YR=YR + 1;
314     MONTH=1;
315     IF VINTAGE LT MINID THEN DELETE;
316     IF VINTAGE GE 999 THEN DELETE;
317     IF B1 LE 0 THEN DELETE;
318 *** GET GOOD NUMBERS FOR CUM PRIOR TO FIRST YEAR (GP1) AND FLOW;
319 *** RATE AT END OF YEAR (QE);
320     IF GP1 LE 0 AND YECUM GT 0 THEN GP1= YECUM;
321     IF QE LE 0 AND B1 GT 0 THEN QE= B1;
322     OUTPUT DATV;
323
324 /******
325  * SORT THE ALREADY DEFINED VINTAGE PARAMETER INFORMATION BY          *
326  * VINTAGE.                                                            *
327  *****/
328 PROC SORT DATA=DATV; BY DESCENDING VINTAGE;
329
330
331 /******
332  * FOR DEBUG/CHECKING PURPOSES.                                        *
333  *****/
334 /*
335 TITLE 'DATA SET DATN VINTAGE YR PARMS--IN1';
336 PROC PRINT DATA=DATN;
337
338 TITLE 'DATA SET DATV VINTAGE YR PARMS--IN1';
339 PROC PRINT DATA=DATV;
340 /*;
341
342 /******
343  * INPUT THE SCHEDULED PRODUCTION AND WELLS FROM IN4                  *
344  * AND CONVERT SCHEDULED PRODUCTION UNITS (BCF TO MCF).              *
345  *****/
346 DATA DATSCH;
347     RETAIN WELLS;
348     INFILE IN4;
349     INPUT AREA $13-14 CASE $20-23 @;
350     IF AREA NE 'ZZ' OR CASE NE 'LOW' THEN DO;INPUT;DELETE;END;
351     INPUT AREA $13-14 CASE $20-23 YR 29-32 MONTH 40-41 WLS 45-50
352           MAXWEL 54-59 @61 SPROD F8.3;
353
354 *** CALCULATE TOTAL NUMBER OF WELLS;
355     WELLS=WELLS + WLS;
356     IF MONTH EQ 1 THEN WELLS= WLS;
357
358 *** DETERMINE NUMBER OF DAYS IN ASSOCIATED MONTHS FOR MONTH TO DAY;
359 *** CONVERSION;
360     DAYS=30;
361     IF MONTH EQ 1 OR MONTH EQ 3 OR MONTH EQ 5 OR MONTH EQ 7 THEN DAYS=31;
362     IF MONTH EQ 8 OR MONTH EQ 10 OR MONTH EQ 12 THEN DAYS=31;
363 *** TAKE INTO ACCOUNT LEAP YEAR FOR FEBRUARY;
364     IF MONTH EQ 2 THEN DO;
365         DAYS=28;
366         IF (INT(YR/4) * 4) EQ YR THEN DAYS=29;
367     END;
368
369 *** CONVERT SCHEDULED PRODUCTION (SPROD) FROM BCF TO MCF UNITS;
370     SPROD= 1000000*SPROD;
371 *** CALCULATE SCHEDULED DAILY RATE;
372     SRATE= SPROD/DAYS;
373
374 /******
375  * FOR DEBUG/CHECKING PURPOSES.                                        *
376  *****/
377 /*
378 PROC PRINT;
379 TITLE 'PRODUCTION SCHED.';
380 /*;
381
382 /******
383  * SORT THE DATA BY PRODUCTION MONTH AND YEAR.                      *
384  *****/

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

385 PROC SORT DATA= DATSCH; BY MONTH YR;
386
387 /*****
388  * INPUT THE AVERAGE WELLS 1ST YR PRODUCTION SCHEDULE. APPEND TO *
389  * NEW VINTAGE PARAMETERS. MAKE SURE THERE ARE GOOD VALUES TO *
390  * WORK WITH.
391  *****/;
392 DATA DATP1;
393   SET DATN IN3.WELLS;
394
395   RETAIN RPWB1 RPWB2 RPWB3;
396   KEEP MONTH ARATE VINTAGE PWB1 PWB2 PWB3;
397
398   *** KEEP INFORMATION FOR THE GIVEN STATE/AREA;
399   IF ST NE 'XXX' THEN DELETE;
400
401   *** MAKE SURE THERE ARE VALUES FOR THE PER WELL PARAMETER VARIABLES;
402   IF PWB1 NE . THEN DO;
403     RPWB1=PWB1;
404     RPWB2=PWB2;
405     RPWB3=PWB3;
406   END;
407
408   PWB1=RPWB1;
409   PWB2=RPWB2;
410   PWB3=RPWB3;
411
412   *** VINTAGE=999 IS THE 1ST YEAR PRODUCTION PER WELL PARAMETER MARKER;
413   VINTAGE=999;
414   IF MONTH LE 0 OR MONTH GT 12 THEN DELETE;
415   IF ARATE LT 0 THEN DELETE;
416   OUTPUT;
417
418   /*****
419   * FOR DEBUG/CHECKING PURPOSES.
420   *****/;
421   /*
422   PROC PRINT; TITLE 'FIRST YRS PROD SCHED. PER WELL';
423   /*;
424
425   /*****
426   * SORT THE DATA BY PRODUCTION MONTH.
427   *****/;
428   PROC SORT DATA= DATP1; BY MONTH;
429
430   /*****
431   * COMBINE THE SCHEDULED PRODUCTION WITH THE AVERAGE WELLS 1ST *
432   * YEAR PRODUCTION SCHEDULE.
433   *****/;
434   DATA DATNEW;
435     MERGE DATSCH DATP1; BY MONTH;
436
437     VINTAGE=YR-1900;
438
439
440   /*****
441   * SORT THE DATA BY PRODUCTION YEAR AND MONTH.
442   *****/;
443   PROC SORT DATA= DATNEW; BY YR MONTH;
444
445   /*****
446   * FOR DEBUG/CHECKING PURPOSES.
447   *****/;
448   /*
449   PROC PRINT; TITLE 'DATNEW';
450   /*;
451
452   /*****
453   * SET UP DATASETS WITH THE SCHEDULED PRODUCTION AND AVERAGE WELLS *
454   * 1ST YEAR PRODUCTION SCHEDULE FOR EACH MONTH OF EACH PROJECTED *
455   * YEAR. YR1, YR2, YR3 WITHIN THE DATASET NAMES STAND FOR THE *
456   * 1ST, 2ND, AND 3RD PROJECTION YEARS, RESPECTIVELY.
457   *****/;
458   DATA DYR1M01 DYR1M02 DYR1M03 DYR1M04 DYR1M05 DYR1M06
459     DYR1M07 DYR1M08 DYR1M09 DYR1M10 DYR1M11 DYR1M12
460     DYR2M01 DYR2M02 DYR2M03 DYR2M04 DYR2M05 DYR2M06
461     DYR2M07 DYR2M08 DYR2M09 DYR2M10 DYR2M11 DYR2M12

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

462     Dyr3M01 Dyr3M02 Dyr3M03 Dyr3M04 Dyr3M05 Dyr3M06
463     Dyr3M07 Dyr3M08 Dyr3M09 Dyr3M10 Dyr3M11 Dyr3M12;
464     SET DATNEW;
465
466     RETAIN LWELL;
467
468     *** LAST MONTH'S WELL COUNT (LWELL) FOR THE 1ST MONTH OF THE 1ST;
469     *** PROJECTED YEAR IS ZERO;
470     IF MONTH EQ 1 THEN LWELL= 0;
471
472     *** REFER TO BEGINNING JCL COMMENTS FOR MEANING OF PY1, PY2, PY3;
473     *** WITHIN THE YR VARIABLE VALUE CHECKS;
474
475     *** 1ST PROJECTION YEAR'S DATASETS;
476     IF YR EQ 19PY1 AND MONTH EQ 1 THEN OUTPUT Dyr1M01;
477     IF YR EQ 19PY1 AND MONTH EQ 2 THEN OUTPUT Dyr1M02;
478     IF YR EQ 19PY1 AND MONTH EQ 3 THEN OUTPUT Dyr1M03;
479     IF YR EQ 19PY1 AND MONTH EQ 4 THEN OUTPUT Dyr1M04;
480     IF YR EQ 19PY1 AND MONTH EQ 5 THEN OUTPUT Dyr1M05;
481     IF YR EQ 19PY1 AND MONTH EQ 6 THEN OUTPUT Dyr1M06;
482     IF YR EQ 19PY1 AND MONTH EQ 7 THEN OUTPUT Dyr1M07;
483     IF YR EQ 19PY1 AND MONTH EQ 8 THEN OUTPUT Dyr1M08;
484     IF YR EQ 19PY1 AND MONTH EQ 9 THEN OUTPUT Dyr1M09;
485     IF YR EQ 19PY1 AND MONTH EQ 10 THEN OUTPUT Dyr1M10;
486     IF YR EQ 19PY1 AND MONTH EQ 11 THEN OUTPUT Dyr1M11;
487     IF YR EQ 19PY1 AND MONTH EQ 12 THEN OUTPUT Dyr1M12;
488
489     *** 2ND PROJECTION YEAR'S DATASETS;
490     IF YR EQ 19PY2 AND MONTH EQ 1 THEN OUTPUT Dyr2M01;
491     IF YR EQ 19PY2 AND MONTH EQ 2 THEN OUTPUT Dyr2M02;
492     IF YR EQ 19PY2 AND MONTH EQ 3 THEN OUTPUT Dyr2M03;
493     IF YR EQ 19PY2 AND MONTH EQ 4 THEN OUTPUT Dyr2M04;
494     IF YR EQ 19PY2 AND MONTH EQ 5 THEN OUTPUT Dyr2M05;
495     IF YR EQ 19PY2 AND MONTH EQ 6 THEN OUTPUT Dyr2M06;
496     IF YR EQ 19PY2 AND MONTH EQ 7 THEN OUTPUT Dyr2M07;
497     IF YR EQ 19PY2 AND MONTH EQ 8 THEN OUTPUT Dyr2M08;
498     IF YR EQ 19PY2 AND MONTH EQ 9 THEN OUTPUT Dyr2M09;
499     IF YR EQ 19PY2 AND MONTH EQ 10 THEN OUTPUT Dyr2M10;
500     IF YR EQ 19PY2 AND MONTH EQ 11 THEN OUTPUT Dyr2M11;
501     IF YR EQ 19PY2 AND MONTH EQ 12 THEN OUTPUT Dyr2M12;
502
503     *** 3RD PROJECTION YEAR'S DATASETS;
504     IF YR EQ 19PY3 AND MONTH EQ 1 THEN OUTPUT Dyr3M01;
505     IF YR EQ 19PY3 AND MONTH EQ 2 THEN OUTPUT Dyr3M02;
506     IF YR EQ 19PY3 AND MONTH EQ 3 THEN OUTPUT Dyr3M03;
507     IF YR EQ 19PY3 AND MONTH EQ 4 THEN OUTPUT Dyr3M04;
508     IF YR EQ 19PY3 AND MONTH EQ 5 THEN OUTPUT Dyr3M05;
509     IF YR EQ 19PY3 AND MONTH EQ 6 THEN OUTPUT Dyr3M06;
510     IF YR EQ 19PY3 AND MONTH EQ 7 THEN OUTPUT Dyr3M07;
511     IF YR EQ 19PY3 AND MONTH EQ 8 THEN OUTPUT Dyr3M08;
512     IF YR EQ 19PY3 AND MONTH EQ 9 THEN OUTPUT Dyr3M09;
513     IF YR EQ 19PY3 AND MONTH EQ 10 THEN OUTPUT Dyr3M10;
514     IF YR EQ 19PY3 AND MONTH EQ 11 THEN OUTPUT Dyr3M11;
515     IF YR EQ 19PY3 AND MONTH EQ 12 THEN OUTPUT Dyr3M12;
516
517     *** SET LAST MONTH'S WELL COUNT FOR NEXT MONTH;
518     LWELL=WELLS;
519
520     /*****
521     * GET THE VINTAGE YEAR PARAMETERS AND CALCULATE MAXIMUM AMOUNT *
522     * OF PRODUCTION FROM THE OLD VINTAGE DATA FOR NEXT MONTH'S *
523     * CALCULATIONS, WHICH IS THE FIRST PROJECTED MONTH. *
524     *****/
525     DATA DATV0;
526     SET DATV;
527
528     KEEP VINTAGE YR GP1 GP3 B1-B3 YECUM QE NPROD M ;
529
530     RETAIN NPROD M 0 ;
531
532     IF VINTAGE EQ 999 THEN DELETE;
533
534     *** CALC MAX PRODUCTION AMOUNT THAT CAN BE PRODUCED FROM *;
535     *** THE OLD VINTAGES - USED FOR NEXT MONTH'S PROJECTION *;
536
537     GP2=YECUM - GP1;
538     IF B2 GT GP2 THEN QE=B1*(1-GP2/B2)**B3;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

539 *** ZERO (QE) CAPACITY MEANS HAVE ALREADY REACHED *;
540 *** ULTIMATE RECOVERY (MAX AMOUNT) *;
541 IF B2 LE GP2 THEN QE=0;
542 GP3= 0;
543
544 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
545 ((B3 - 1)*D1*(1-GP3/B2)**B3);
546 TIME2=TIME1 + 31 ;
547 QE2= (B1*(1-(GP3/B2))**B3)*
548 (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
549 GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
550 NPROD= GP2E - (YECUM - GP1) ;
551 IF B2 LE 0 THEN NPROD= 0;
552
553 *** 1ST PROJECTION YEAR INITIALIZATION;
554 IF VINTAGE EQ PY1 THEN DO; NPROD=0; GP2=0; QE=0; END;
555
556 *** MAX CAPACITY CALCULATION USED FOR NEXT MONTH'S PROJECTION;
557 NPRODMT= NPROD + NPROD;
558
559 OUTPUT DATV0;
560
561 *** 1ST VINTAGE YEAR SET UP;
562 *** OUTPUT MAX CAPACITY OVER ALL VINTAGES (NPROD);
563 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY FOR MONTH;
564 IF VINTAGE EQ VY1 THEN DO;
565 VINTAGE=999;NPROD= NPRODMT;
566 QE= . ; OUTPUT DATV0; END;
567 DELETE;
568
569 /*****
570 * FOR DEBUG/CHECKING PURPOSES.
571 *****/
572 *PROC PRINT; *TITLE 'DATV0';
573
574 /*****
575 * COMBINE SCHEDULED PRODUCTION AND AVERAGE WELLS 1ST YEAR
576 * PRODUCTION WITH VINTAGE YEAR PARAMETERS AND YEAR-END MAX
577 * CAPACITY DATA - OLD VINTAGE PRODUCTION INFO
578 *****/
579 DATA DATV1; SET DYR1M01 DATV0;
580
581 /*****
582 * SORT THE DATA BY DESCENDING VINTAGE.
583 *****/
584 PROC SORT DATA=DATV1; BY DESCENDING VINTAGE;
585
586 /*****
587 * FOR DEBUG/CHECKING PURPOSES.
588 *****/
589 /*
590 *PROC PRINT; *TITLE 'DATV1';
591 *PROC PRINT DATA=DYR1M01; *TITLE 'DYR1M01';
592 */
593
594 /*****
595 * BRING IN YEAR-END PRODUCTION INFORMATION (INCLUDING MAX AMOUNT
596 * PRODUCTION) FROM OLD VINTAGES AND SCHEDULED PRODUCTION.
597 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 1ST MONTH OF 1ST
598 * PROJECTION YEAR BASED ON THE FOLLOWING CAPACITY (MAX AMOUNT
599 * PRODUCTION) VS. DEMAND (SCHEDULED PRODUCTION) CHECK:
600 * IF CAPACITY > DEMAND,
601 * PROJECTED PRODUCTION = DEMAND
602 * IF CAPACITY < OR = DEMAND,
603 * PROJECTED PRODUCTION = CAPACITY
604 *****/
605 DATA DYR1M01; SET DATV1; *CALC THE DISTRIBUTION FACTORS*;
606 RETAIN QETOT QENEW 0 VPROD SPROD1 NPRODMT;
607 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
608 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QF NPROD;
609
610 MONTH=1; DAYS= 31;
611
612 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
613 IF VINTAGE EQ 999 THEN DO;
614 NPRODMT= NPROD; DELETE;
615 END;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

616
617 ***** 1ST MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
618 *** MAKE SURE PROJECTED CAPACITY MEETS DEMAND FOR NEW VINTAGE YEAR;
619 *** PERFORM PROJECTED PRODUCTION CALCULATIONS;
620 IF VINTAGE EQ PY1 THEN DO;*** NOTE: 1ST YEAR OF PROJECTION##;
621   QE=0.5*WLS*PWB1; HPROD=MAXWEL*ARATE*DAY; GPH=HPROD;
622   NPRODM=QE*DAY;NPRODMT=NPRODMT + NPRODM;VPROD=SPROD;SPROD1=SPROD;
623 *** CAPACITY VS DEMAND CHECK;
624   IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
625 *** PRORATE VINTAGE AGAINST PRODUCTION (NPR) FOR NEW VINTAGE;
626   NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
627   MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
628   QP=QE; YECUM= NPR;GP1=YECUM; GP2= 0;PWELLS=WELLS;GP3=GP1-GPH;
629   OUTPUT; DELETE; END;
630
631 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
632 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S MAXIMUM AMOUNT;
633 *** OF PRODUCTION (CAPACTIY);
634 IF VINTAGE LT PY1 THEN DO;*** NOTE: 1ST YEAR OF PROJECTION##;
635   GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
636 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
637 *** PRORATE VINTAGE AGAINST PRODUCTION (NPR) FOR OLD VINTAGES;
638   NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
639   MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
640 IF B2 GT GPE THEN QE=B1*(1-GPE/B2))*B3;
641 IF B2 LE GPE THEN QE=0;
642   YECUM= YECUM + NPR;
643   END;
644
645 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
646   NEXTM= MONTH + 1; DAYSN= 30;
647 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
648 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
649 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
650   END;
651
652 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
653 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
654   ((B3 - 1)*B1*(1-GP3/B2))*B3;
655   TIME2=TIME1 + DAYSN;
656   QE2= (B1*(1-(GP3/B2))*B3)*
657   (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
658   GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
659   NPROD= GP2E - (YECUM - GP1);
660 IF B2 LE 0 THEN NPROD= 0;
661
662 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
663 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
664 QENEW=QENEW + NPROD; TPR= VPROD; DPR= SPROD1;
665
666 OUTPUT;
667
668 *** INITIALIZATIONS FOR NEXT MONTH;
669 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
670 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QENEW;
671   B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
672   GP2= . ; GP3= . ; OUTPUT; END;*** 1ST VINT YR ID#;
673
674 DELETE;
675
676
677 /*****
678  * FOR DEBUG/CHECKING PURPOSES.
679  *****/;
680 /*
681 *PROC PRINT;'TITLE'1ST PROJ. MONTH';
682 */;
683
684 /*****
685  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
686  *****/;
687 PROC SORT DATA=PYRIM01; BY YR DESCENDING VINTAGE;
688
689 /*****
690  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
691  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
692  * THE SCHEDULE PRODUCTION INFORMATION.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

693 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 2ND MONTH OF 1ST *
694 * PROJECTION YEAR BASED ON THE FOLLOWING CAPACITY (MAX AMOUNT *
695 * PRODUCTION) VS. DEMAND (SCHEDULED PRODUCTION) CHECK: *
696 * IF CAPACITY > DEMAND, *
697 * PROJECTED PRODUCTION = DEMAND *
698 * IF CAPACITY < OR = DEMAND, *
699 * PROJECTED PRODUCTION = CAPACITY *
700 *****/;
701 DATA PYR1M02;
702 *** CALCULATED DISTRIBUTION FACTORS;
703 MERGE DYR1M02 PYR1M01; BY YR;
704
705 RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
706 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
707 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
708
709 MONTH=2;
710
711 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
712 IF VINTAGE EQ 999 THEN DO;
713 NPRODMT= NPROD;
714 DELETE;
715 END;
716
717 ***** 2ND MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
718 *** MAKE SURE PROJECTED CAPACITY MEETS DEMAND FOR NEW VINTAGE YEAR;
719 *** PERFORM PROJECTED PRODUCTION CALCULATIONS;
720 IF VINTAGE EQ PY1 THEN DO;
721 GP3=GP1-GPH;
722 QE= 0;
723 IF MAXWEL GT 0
724 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
725 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
726 NPROD= QE*DAY8;
727 HPROD=MAXWEL*ARATE*DAY8;
728 NPRODMT=NPRODMT + NPROD;
729 VPROD=SPROD;
730 SPROD1=SPROD;
731 *** CAPACITY VS DEMAND CHECK;
732 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
733 *** PRORATE VINTAGE AGAINST PRODUCTION FOR NEW VINTAGE;
734 NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
735 MAXPROD= NPROD;
736 MAXRATE= MAXPROD/DAYS;
737 GPH=GPH + HPROD;
738 PWELLS=WELLS;
739 QP= QE;
740 YECUM= YECUM + NPR;
741 GP1= YECUM;
742 QE= 0;
743 OUTPUT;
744 DELETE;
745 END;
746
747 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
748 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S MAXIMUM AMOUNT;
749 *** OF PRODUCTION (CAPACTIY);
750 IF VINTAGE LT PY1 THEN DO;
751 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
752 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
753 IF B2 LE GP2 THEN QP= 0;
754 *** PRORATE VINTAGE AGAINST PRODUCTION FOR OLD VINTAGES;
755 NPR=(NPROD/NPRODMT)*VPROD;
756 NRATE= NPR/DAYS;
757 GPE=GP2+ NPR/2;
758 MAXPROD= NPROD;
759 MAXRATE= MAXPROD/DAYS;
760 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
761 IF B2 LE GPE THEN QE=0;
762 YECUM= YECUM + NPR;
763 GP2= YECUM - GP1;
764 END;
765
766 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
767 NEXTM= MONTH + 1;
768 DAY8N= 30;
769 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAY8N=31;

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

770 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
771 IF NEXTM EQ 2 THEN DO;
772   DAYSN=28;
773   IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
774   END;
775
776 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
777 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
778   ((B3 - 1)*B1*(1-GP3/B2)**B3);
779 TIME2=TIME1 + DAYSN;
780 QE2= (B1*(1-(GP3/B2))**B3)*
781   (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
782 GP2E= B2*(1 - (QE2/B1)**(1/B3));
783 NPRODM= GP2E - (YECUM - GP1);
784 IF B2 LE 0 THEN NPRODM= 0;
785
786 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
787 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
788 QENEW=QENEW + NPRODM;
789 TPR= VPROD;
790 DPR= SPROD1;
791
792 OUTPUT;
793
794 *** INITIALIZATIONS FOR NEXT MONTH;
795 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
796 IF VINTAGE EQ VY1 THEN DO;
797   VINTAGE=999;
798   QE= . ;
799   NPRODM= QENEW;
800   B1=.; B2=.; B3=.; YECUM=.;
801   GP1=.; GPH=.; NPR=.;
802   QP=.; GP2=.; GP3= . ;
803   OUTPUT;
804   END;
805
806 DELETE;
807
808 /*****
809  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
810  *****/
811 PROC SORT DATA=PYR1M02; BY YR DESCENDING VINTAGE;
812
813 /*****
814  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
815  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
816  * THE SCHEDULE PRODUCTION INFORMATION.
817  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 3RD MONTH OF 1ST
818  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK:
819  *   IF CAPACITY > DEMAND,
820  *     PROJECTED PRODUCTION = DEMAND
821  *   IF CAPACITY < OR = DEMAND,
822  *     PROJECTED PRODUCTION = CAPACITY
823  *****/
824 DATA PYR1M03;
825   MERGE DYR1M03 PYR1M02; BY YR; *CALC. DIST. FACTORS*;
826   RETAIN QENEW 0 VPROD SPROD1 NPRODMT ;
827   KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
828   GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
829
830 MONTH=3;
831
832 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
833 IF VINTAGE EQ 999 THEN DO;
834   NPRODMT= NPRODM;
835   DELETE;
836   END;
837
838 ***** 3RD MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
839 *** MAKE SURE PROJECTED CAPACITY MEETS DEMAND FOR NEW VINTAGE YEAR;
840 *** PERFORM PROJECTED PRODUCTION CALCULATIONS;
841 IF VINTAGE EQ PY1 THEN DO;
842   GP3=GP1-GPH;
843   QE= 0;
844   IF MAXWEL GT 0 THEN
845     QE=(0.5*WLB+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))**PWB3;
846 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

847     NPRODM= QE*DAY;
848     HPROD=MAXWEL*ARATE*DAY;
849     NPRODMT=NPRODMT + NPRODM;
850     VPROD=SPROD;
851     SPROD1=SPROD;
852     *** CAPACITY VS DEMAND CHECK;
853     IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
854     *** PRORATE VINTAGE AGAINST PRODUCTION FOR NEW VINTAGE;
855     NPR= (NPRODM/NPRODMT) *VPROD;NRATE= NPR/DAYS;
856     MAXPROD= NPRODM;
857     MAXRATE= MAXPROD/DAYS;
858     GPH=GPH + HPROD;
859     FWELLS=WELLS;
860     QP= QE;
861     YECUM= YECUM + NPR;
862     GP1= YECUM;
863     QE= 0;
864     OUTPUT;
865     DELETE;
866     END;
867
868     ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
869     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S MAXIMUM AMOUNT;
870     *** OF PRODUCTION (CAPACTIY). PY1 DENOTES 1ST PROJECTION YEAR;
871     IF VINTAGE LT PY1 THEN DO;
872     GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
873     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
874     IF B2 LE GP2 THEN QP= 0;
875     *** PRODUCTION PRORATION FOR OLD VINTAGES;
876     NPR=(NPRODM/NPRODMT)*VPROD;
877     NRATE= NPR/DAYS;
878     GPE=GP2+ NPR/2;
879     MAXPROD= NPRODM;
880     MAXRATE= MAXPROD/DAYS;
881     IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
882     IF B2 LE GPE THEN QE=0;
883     YECUM= YECUM + NPR;
884     GP2= YECUM - GP1;
885     END;
886
887     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
888     NEXTM= MONTH + 1;
889     DAYSN= 30;
890     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
891     OR NEXTM EQ 7 THEN DAYSN=31;
892     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
893     IF NEXTM EQ 2 THEN DO;
894     DAYSN=28;
895     IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
896     END;
897
898     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
899     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
900     ((B3 - 1)*B1*(1-GP3/B2))*B3);
901     TIME2=TIME1 + DAYSN;
902     QE2= (B1*(1-(GP3/B2))*B3)*
903     (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
904     GP2E= B2*(1 - (QE2/B1))*B3/(1-B3)) ;
905     NPRODM= GP2E - (YECUM - GP1) ;
906     IF B2 LE 0 THEN NPRODM= 0;
907
908     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
909     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
910     QENEW=QENEW + NPRODM;
911     TPR= VPROD;
912     DPR= SPROD1;
913
914     OUTPUT;
915
916     *** INITIALIZATIONS FOR NEXT MONTH;
917     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
918     IF VINTAGE EQ VY1 THEN DO;
919     VINTAGE=999;
920     QE= . ;
921     NPRODM= QENEW;
922     B1=.; B2=.; B3=.; YECUM=.;
923     GP1=.; GPH=.; NPR=.;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

924      QP=.; GP2=.; GP3= . ;
925      OUTPUT;
926      END;
927
928      DELETE;
929
930      /*****
931      * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
932      *****/;
933      PROC SORT DATA=PYR1M03; BY YR DESCENDING VINTAGE;
934
935      /*****
936      * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
937      * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
938      * THE SCHEDULE PRODUCTION INFORMATION.                              *
939      * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 4TH MONTH OF 1ST      *
940      * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.          *
941      *****/;
942      DATA PYR1M04;
943      MERGE DYR1M04 PYR1M03; BY YR;
944      RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
945      KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
946      GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
947
948      MONTH=4;
949
950      *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
951      IF VINTAGE EQ 999 THEN DO;
952          NPRODMT= NPROD;
953          DELETE;
954      END;
955
956      ***** 4TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
957      *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
958      IF VINTAGE EQ PY1 THEN DO;
959          GP3=GP1-GPH;
960          QE= 0;
961          IF MAXWEL GT 0 THEN
962              QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
963      ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
964          NPROD= QE*DAY;
965          HPROD=MAXWEL*ARATE*DAY;
966          NPRODMT=NPRODMT + NPROD;
967          VPROD=SPROD;
968          SPROD1=SPROD;
969      *** CAPACITY VS DEMAND CHECK;
970      IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
971      *** PRODUCTION PRORATION FOR NEW VINTAGE;
972      NPR= (NPROD/NPRODMT) *VPROD;
973      NRATE= NPR/DAYS;
974      MAXPROD= NPROD;
975      MAXRATE= MAXPROD/DAYS;
976      GPH=GPH + HPROD;
977      PWELLS=WELLS;
978      QP= QE;
979      YECUM= YECUM + NPR;
980      GP1= YECUM;
981      QE= 0;
982      OUTPUT;
983      DELETE;
984      END;
985
986
987      ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
988      *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
989      IF VINTAGE LT PY1 THEN DO;
990          GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
991          IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
992          IF B2 LE GP2 THEN QP= 0;
993      *** PRODUCTION PRORATION FOR OLD VINTAGES;
994          NPR= (NPROD/NPRODMT) *VPROD;
995          NRATE= NPR/DAYS;
996          GPE=GP2+ NPR/2;
997          MAXPROD= NPROD;
998          MAXRATE= MAXPROD/DAYS;
999          IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1000         IF B2 LE GPE THEN QE=0;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1001     YECUM= YECUM + NPR;
1002     GP2= YECUM - GP1;
1003     END;
1004
1005     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1006     NEXTM= MONTH + 1;
1007     DAYSN= 30;
1008     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1009         OR NEXTM EQ 7 THEN DAYSN=31;
1010     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1011     IF NEXTM EQ 2 THEN DO;
1012         DAYSN=28;
1013         IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1014     END;
1015
1016     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1017     TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
1018         ((B3 - 1)*B1*(1-GP3/B2)**B3);
1019     TIME2=TIME1 + DAYSN;
1020     QE2= (B1*(1-(GP3/B2))**B3)*
1021         (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
1022     GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
1023     NPROD= GP2E - (YECUM - GP1) ;
1024     IF B2 LE 0 THEN NPROD= 0;
1025
1026     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1027     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1028     QENW=QENW + NPROD;
1029     TPR= VPROD;
1030     DPR= SPROD1;
1031
1032     OUTPUT;
1033
1034     *** INITIALIZATIONS FOR NEXT MONTH;
1035     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1036     IF VINTAGE EQ VY1 THEN DO;
1037         VINTAGE=999;
1038         QE= . ;
1039         NPROD= QENW;
1040         B1=.; B2=.; B3=.; YECUM=.;
1041         GP1=.; GPH=.; NPR=.;
1042         QP=.; GP2=.; GP3= . ;
1043         OUTPUT;
1044         END;
1045
1046     DELETE;
1047
1048     /*****
1049     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
1050     *****/;
1051     PROC SORT DATA=PYR1M04; BY YR DESCENDING VINTAGE;
1052
1053     /*****
1054     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
1055     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
1056     * THE SCHEDULE PRODUCTION INFORMATION. *
1057     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 5TH MONTH OF 1ST *
1058     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
1059     *****/;
1060     DATA PYR1M05;
1061     MERGE DYR1M05 PYR1M04; BY YR;
1062     RETAIN QENW 0 VPROD SPROD1 NPRODM ;
1063     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1064     GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
1065
1066     MONTH=5;
1067
1068     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
1069     IF VINTAGE EQ 999 THEN DO;
1070         NPRODMT= NPROD;
1071         DELETE;
1072     END;
1073
1074     ***** 5TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1075     *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1076     IF VINTAGE EQ PY1 THEN DO;
1077         GP3=GP1-GPH;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1078      QE= 0;
1079      IF MAXWEL GT 0 THEN
1080          QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1081  ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1082      NPRODM= QE*DAY;
1083      HPROD=MAXWEL*ARATE*DAY;
1084      NPRODMT=NPRODMT + NPRODM;
1085      VPROD=SPROD;
1086      SPROD1=SPROD;
1087  *** CAPACITY VS DEMAND CHECK;
1088      IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1089  *** PRODUCTION PRORATION FOR NEW VINTAGE;
1090      NPR= (NPRODM/NPRODMT) *VPROD;
1091      NRATE= NPR/DAYS;
1092      MAXPROD= NPRODM;
1093      MAXRATE= MAXPROD/DAYS;
1094      GPH=GPH + HPROD;
1095      PWELLS=WELLS;
1096      QP= QE;
1097      YECUM= YECUM + NPR;
1098      GP1= YECUM;
1099      QE= 0;
1100      OUTPUT;
1101      DELETE;
1102      END;
1103
1104  ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1105  *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1106      IF VINTAGE LT PY1 THEN DO;
1107          GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
1108          IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
1109          IF B2 LE GP2 THEN QP= 0;
1110  *** PRODUCTION PRORATION FOR OLD VINTAGES;
1111          NPR=(NPRODM/NPRODMT)*VPROD;
1112          NRATE= NPR/DAYS;
1113          GPE=GP2+ NPR/2;
1114          MAXPROD= NPRODM;
1115          MAXRATE= MAXPROD/DAYS;
1116          IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1117          IF B2 LE GPE THEN QE=0;
1118          YECUM= YECUM + NPR;
1119          GP2= YECUM - GP1;
1120      END;
1121
1122  *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1123      NEXTM= MONTH + 1;
1124      DAYSN= 30;
1125      IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1126          OR NEXTM EQ 7 THEN DAYSN=31;
1127      IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1128      IF NEXTM EQ 2 THEN DO;
1129          DAYSN=28;
1130          IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1131      END;
1132
1133  *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1134      TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
1135          ((B3 - 1)*B1*(1-GP3/B2))*B3;
1136      TIME2=TIME1 + DAYSN;
1137      QE2= (B1*(1-(GP3/B2))*B3)*
1138          (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
1139      GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
1140      NPRODM= GP2E - (YECUM - GP1) ;
1141      IF B2 LE 0 THEN NPRODM= 0;
1142
1143  *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1144  *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1145      QNEW=QNEW + NPRODM;
1146      TPR= VPROD;
1147      DPR= SPROD1;
1148
1149      OUTPUT;
1150
1151  *** INITIALIZATIONS FOR NEXT MONTH;
1152  *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1153      IF VINTAGE EQ VY1 THEN DO;
1154          VINTAGE=999;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1155     QE= . ;
1156     NPROD= QENW;
1157     B1=.; B2=.; B3=.; YECUM=.;
1158     GP1=.; GPH=.; NPR=.;
1159     QP=.; GP2=.; GP3= . ;
1160     OUTPUT;
1161     END;
1162
1163     DELETE;
1164
1165     /*****
1166     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
1167     *****/;
1168     PROC SORT DATA=PYR1M05; BY YR DESCENDING VINTAGE;
1169
1170     /*****
1171     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
1172     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
1173     * THE SCHEDULE PRODUCTION INFORMATION. *
1174     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 6TH MONTH OF 1ST *
1175     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
1176     *****/;
1177     DATA PYR1M06;
1178     MERGE DYR1M06 PYR1M05; BY YR;
1179     RETAIN QENW 0 VPROD SPROD1 NPRODMT ;
1180     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1181     GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
1182
1183     MONTH=6;
1184
1185     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
1186     IF VINTAGE EQ 999 THEN DO;
1187         NPRODMT= NPROD;
1188         DELETE;
1189     END;
1190
1191     ***** 6TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1192     *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1193     IF VINTAGE EQ PY1 THEN DO;
1194         GP3=GP1-GPH;
1195         QE= 0;
1196         IF MAXWEL GT 0 THEN
1197             QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1198     ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1199     NPROD= QE*DAY;
1200     HPROD=MAXWEL*ARATE*DAY;
1201     NPRODMT=NPRODMT + NPROD;
1202     VPROD=SPROD;
1203     SPROD1=SPROD;
1204     *** CAPACITY VS DEMAND CHECK;
1205     IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1206     *** PRODUCTION PRORATION FOR NEW VINTAGE;
1207     NPR= (NPROD/NPRODMT) *VPROD;
1208     NRATE= NPR/DAYS;
1209     MAXPROD= NPROD;
1210     MAXRATE= MAXPROD/DAYS;
1211     GPH=GPH + HPROD;
1212     PWELLS=WELLS;
1213     QP= QE;
1214     YECUM= YECUM + NPR;
1215     GP1= YECUM;
1216     QE= 0;
1217     OUTPUT;
1218     DELETE;
1219     END;
1220
1221     ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1222     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1223     IF VINTAGE LT PY1 THEN DO;
1224         GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
1225         IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
1226         IF B2 LE GP2 THEN QP= 0;
1227     *** PRODUCTION PRORATION FOR OLD VINTAGES;
1228     NPR=(NPROD/NPRODMT)*VPROD;
1229     NRATE= NPR/DAYS;
1230     GPE=GP2+ NPR/2;
1231     MAXPROD= NPROD;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1232     MAXRATE= MAXPROD/DAYS;
1233     IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1234     IF B2 LE GPE THEN QE=0;
1235     YECUM= YECUM + NPR;
1236     GP2= YECUM - GP1;
1237     END;
1238
1239     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1240     NEXTM= MONTH + 1;
1241     DAYSN= 30;
1242     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1243         OR NEXTM EQ 7 THEN DAYSN=31;
1244     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1245     IF NEXTM EQ 2 THEN DO;
1246         DAYSN=28;
1247     IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1248     END;
1249
1250     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1251     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
1252         ((B3 - 1)*B1*(1-GP3/B2))*B3);
1253     TIME2=TIME1 + DAYSN;
1254     QE2= (B1*(1-(GP3/B2))*B3)*
1255         (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
1256     GP2E= B2*(1 - (QE2/B1)*(1/B3)) ;
1257     NPROD= GP2E - (YECUM - GP1) ;
1258     IF B2 LE 0 THEN NPROD= 0;
1259
1260     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1261     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1262     QENW=QENW + NPROD;
1263     TPR= VPROD;
1264     DPR= SPROD1;
1265
1266     OUTPUT;
1267
1268     *** INITIALIZATIONS FOR NEXT MONTH;
1269     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1270     IF VINTAGE EQ VY1 THEN DO;
1271         VINTAGE=999;
1272         QE= . ;
1273         NPROD= QENW;
1274         B1=.; B2=.; B3=.; YECUM=.;
1275         GP1=.; GPH=.; NPR=.;
1276         QP=.; GP2=.; GP3= . ;
1277         OUTPUT;
1278     END;
1279
1280     DELETE;
1281
1282     /*****
1283     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
1284     *****/;
1285     PROC SORT DATA=PYR1M06; BY YR DESCENDING VINTAGE;
1286
1287     /*****
1288     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
1289     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
1290     * THE SCHEDULE PRODUCTION INFORMATION. *
1291     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 7TH MONTH OF 1ST *
1292     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
1293     *****/;
1294     DATA PYR1M07;
1295     MERGE DYR1M07 PYR1M06; BY YR;
1296     RETAIN QENW 0 VPROD SPROD1 NPRODMT ;
1297     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1298         GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
1299
1300     MONTH=7;
1301
1302     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
1303     IF VINTAGE EQ 999 THEN DO;
1304         NPRODMT= NPROD;
1305     DELETE;
1306     END;
1307
1308     ***** 7TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1309 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1310 IF VINTAGE EQ PY1 THEN DO;
1311   GP3=GP1-GPH;
1312   QE= 0;
1313   IF MAXWEL GT 0 THEN
1314     QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1315 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1316   NPROD= QE*DAY;
1317   HPROD=MAXWEL*ARATE*DAY;
1318   NPROD=MPROD + NPROD;
1319   VPROD=SPROD;
1320   SPROD1=SPROD;
1321 *** CAPACITY VS DEMAND CHECK;
1322 IF SPROD GT NPROD THEN VPROD= NPROD;
1323 *** PRODUCTION PRORATION FOR NEW VINTAGE;
1324 NPR= (NPROD/MPROD) *VPROD;
1325 NRATE= NPR/DAYS;
1326 MAXPROD= MPROD;
1327 MAXRATE= MAXPROD/DAYS;
1328 GPH=GPH + HPROD;
1329 PWELLS=PWELLS;
1330 QP= QE;
1331 YECUM= YECUM + NPR;
1332 GP1= YECUM;
1333 QE= 0;
1334 OUTPUT;
1335 DELETE;
1336 END;
1337
1338 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1339 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1340 IF VINTAGE LT PY1 THEN DO;
1341   GP2=YECUM - GP1 + (NPROD/MPROD)*VPROD/2;
1342   IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
1343   IF B2 LE GP2 THEN QP= 0;
1344 *** PRODUCTION PRORATION FOR OLD VINTAGES;
1345 NPR= (NPROD/MPROD)*VPROD;
1346 NRATE= NPR/DAYS;
1347 GPE=GP2+ NPR/2;
1348 MAXPROD= MPROD;
1349 MAXRATE= MAXPROD/DAYS;
1350 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1351 IF B2 LE GPE THEN QE=0;
1352 YECUM= YECUM + NPR;
1353 GP2= YECUM - GP1;
1354 END;
1355
1356 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1357 NEXTM= MONTH + 1;
1358 DAYSN= 30;
1359 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1360   OR NEXTM EQ 7 THEN DAYSN=31;
1361 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1362 IF NEXTM EQ 2 THEN DO;
1363   DAYSN=28;
1364   IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1365 END;
1366
1367 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1368 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
1369   ((B3 - 1)*B1*(1-GP3/B2))*B3;
1370 TIME2=TIME1 + DAYSN;
1371 QE2= (B1*(1-(GP3/B2))*B3)*
1372   (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
1373 GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
1374 NPROD= GP2E - (YECUM - GP1) ;
1375 IF B2 LE 0 THEN NPROD= 0;
1376
1377 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1378 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1379 QNEW=QNEW + NPROD;
1380 TPR= VPROD;
1381 DPR= SPROD1;
1382
1383 OUTPUT;
1384
1385 *** INITIALIZATIONS FOR NEXT MONTH;

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1386 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1387 IF VINTAGE EQ VY1 THEN DO;
1388     VINTAGE=999;
1389     QE= . ;
1390     NPROD= QENew;
1391     B1=.; B2=.; B3=.; YECUM=.;
1392     GP1=.; GPH=.; NPR=.;
1393     QP=.; GP2=.; GP3= . ;
1394     OUTPUT;
1395     END;
1396
1397 DELETE;
1398
1399 /*****
1400  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
1401  *****/
1402 PROC SORT DATA=PYR1M07; BY YR DESCENDING VINTAGE;
1403
1404 /*****
1405  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
1406  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
1407  * THE SCHEDULE PRODUCTION INFORMATION.                               *
1408  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 8TH MONTH OF 1ST    *
1409  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.           *
1410  *****/
1411 DATA PYR1M08;
1412 MERGE DYR1M08 PYR1M07; BY YR; *CALC. DIST.  FACTORS*;
1413 RETAIN QENew 0 VPROD SPROD1 NPRODMT ;
1414 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1415 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
1416
1417 MONTH=8;
1418
1419 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
1420 IF VINTAGE EQ 999 THEN DO;
1421     NPRODMT= NPROD;
1422     DELETE;
1423 END;
1424
1425 ***** 8TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1426 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1427 IF VINTAGE EQ PY1 THEN DO;
1428     GP3=GP1-GPH;
1429     QE= 0;
1430     IF MAXWEL GT 0 THEN
1431         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1432 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1433 NPROD= QE*DAY;
1434 HPROD=MAXWEL*ARATE*DAY;
1435 NPRODMT=NPRODMT + NPROD;
1436 VPROD=SPROD;
1437 SPROD1=SPROD;
1438 *** CAPACITY VS DEMAND CHECK;
1439 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1440 *** PRODUCTION PRORATION FOR NEW VINTAGE;
1441 NPR= (NPROD/NPRODMT) *VPROD;
1442 NRATE= NPR/DAY;
1443 MAXPROD= NPROD;
1444 MAXRATE= MAXPROD/DAY;
1445 GPH=GPH + HPROD;
1446 PWELLS=WELLS;
1447 QP= QE;
1448 YECUM= YECUM + NPR;
1449 GP1= YECUM;
1450 QE= 0;
1451 OUTPUT;
1452 DELETE;
1453 END;
1454
1455 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1456 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1457 IF VINTAGE LT PY1 THEN DO;
1458     GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
1459     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
1460     IF B2 LE GP2 THEN QP= 0;
1461 *** PRODUCTION PRORATION FOR OLD VINTAGES;
1462 NPR=(NPROD/NPRODMT)*VPROD;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1540 END;
1541
1542 ***** 9TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1543 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1544 IF VINTAGE EQ PY1 THEN DO;
1545 GP3=GP1-GPH;
1546 QE= 0;
1547 IF MAXWEL GT 0 THEN
1548   QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1549 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1550 NPRODM= QE*DAY5;
1551 HPROD=MAXWEL*ARATE*DAY5;
1552 NPRODMT=NPRODMT + NPRODM;
1553 VPROD=SPROD;
1554 SPROD1=SPROD;
1555 *** CAPACITY VS DEMAND CHECK;
1556 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1557 *** PRODUCTION PRORATION FOR NEW VINTAGE;
1558 NPR= (NPRODM/NPRODMT) *VPROD;
1559 NRATE= NPR/DAYS;
1560 MAXPROD= NPRODM;
1561 MAXRATE= MAXPROD/DAYS;
1562 GPH=GPH + HPROD;
1563 PWELLS=WELLS;
1564 QP= QE;
1565 YECUM= YECUM + NPR;
1566 GP1= YECUM;
1567 QE= 0;
1568 OUTPUT;
1569 DELETE;
1570 END;
1571
1572 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1573 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1574 IF VINTAGE LT PY1 THEN DO;
1575 GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
1576 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
1577 IF B2 LE GP2 THEN QP= 0;
1578 *** PRODUCTION PRORATION FOR OLD VINTAGES;
1579 NPR=(NPRODM/NPRODMT)*VPROD;
1580 NRATE= NPR/DAYS;
1581 GPE=GP2+ NPR/2;
1582 MAXPROD= NPRODM;
1583 MAXRATE= MAXPROD/DAYS;
1584 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1585 IF B2 LE GPE THEN QE=0;
1586 YECUM= YECUM + NPR;
1587 GP2= YECUM - GP1;
1588 END;
1589
1590 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1591 NEXTM= MONTH + 1;
1592 DAYSN= 30;
1593 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1594   OR NEXTM EQ 7 THEN DAYSN=31;
1595 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1596 IF NEXTM EQ 2 THEN DO;
1597   DAYSN=28;
1598   IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1599 END;
1600
1601 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1602 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
1603   ((B3 - 1)*B1*(1-GP3/B2))*B3;
1604 TIME2=TIME1 + DAYSN;
1605 QE2= (B1*(1-(GP3/B2))*B3)*
1606   (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
1607 GP2E= B2*(1 - (QE2/B1))*B3;
1608 NPRODM= GP2E - (YECUM - GP1);
1609 IF B2 LE 0 THEN NPRODM= 0;
1610
1611 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1612 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1613 QENEW=QENEW + NPRODM;
1614 TPR= VPROD;
1615 DPR= SPROD1;
1616

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1617 OUTPUT;
1618
1619 *** INITIALIZATIONS FOR NEXT MONTH;
1620 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1621 IF VINTAGE EQ VY1 THEN DO;
1622     VINTAGE=999;
1623     QE= . ;
1624     NPROD= QNEW;
1625     B1=.; B2=.; B3=.; YECUM=.;
1626     GP1=.; GPH=.; NPR=.;
1627     QP=.; GP2=.; GP3= . ;
1628     OUTPUT;
1629     END;
1630
1631 DELETE;
1632
1633 /*****
1634  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
1635  *****/
1636 PROC SORT DATA=PYR1M09; BY YR DESCENDING VINTAGE;
1637
1638 /*****
1639  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
1640  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
1641  * THE SCHEDULE PRODUCTION INFORMATION.                              *
1642  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 10TH MONTH OF 1ST   *
1643  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.          *
1644  *****/
1645 DATA PYR1M10;
1646     MERGE DYR1M10 PYR1M09; BY YR;
1647     RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
1648     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1649           GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
1650
1651     MONTH=10;
1652
1653 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
1654 IF VINTAGE EQ 999 THEN DO;
1655     NPRODMT= NPROD;
1656     DELETE;
1657     END;
1658
1659 ***** 10TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1660 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1661 IF VINTAGE EQ PY1 THEN DO;
1662     GP3=GP1-GPH;
1663     QE= 0;
1664     IF MAXWEL GT 0 THEN
1665         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1666 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1667     NPROD= QE*DAY;
1668     HPROD=MAXWEL*ARATE*DAY;
1669     NPRODMT=NPRODMT + NPROD;
1670     VPROD=SPROD;
1671     SPROD1=SPROD;
1672 *** CAPACITY VS DEMAND CHECK;
1673 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1674 *** PRODUCTION PRORATION FOR NEW VINTAGE;
1675 NPR= (NPROD/NPRODMT) *VPROD;
1676 NRATE= NPR/DAY;
1677 MAXPROD= NPROD;
1678 MAXRATE= MAXPROD/DAY;
1679 GPH=GPH + HPROD;
1680 PWELLS=WELLS;
1681 QP= QE;
1682 YECUM= YECUM + NPR;
1683 GP1= YECUM;
1684 QE= 0;
1685 OUTPUT;
1686 DELETE;
1687 END;
1688
1689 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1690 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1691 IF VINTAGE L1 PY1 THEN DO;
1692     GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
1693     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1694     IF B2 LE GP2 THEN QP= 0;
1695     *** PRODUCTION PRORATION FOR OLD VINTAGES;
1696     NPR=(NPRODM/NPRODMT)*VPROD;
1697     NRATE= NPR/DAYS;
1698     GPE=GP2+ NPR/2;
1699     MAXPROD= NPRODM;
1700     MAXRATE= MAXPROD/DAYS;
1701     IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1702     IF B2 LE GPE THEN QE=0;
1703     YECUM= YECUM + NPR;
1704     GP2= YECUM - GP1;
1705     END;
1706
1707     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1708     NEXTM= MONTH + 1;
1709     DAYSN= 30;
1710     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1711         OR NEXTM EQ 7 THEN DAYSN=31;
1712     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1713     IF NEXTM EQ 2 THEN DO;
1714         DAYSN=28;
1715         IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1716     END;
1717
1718     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1719     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
1720         ((B3 - 1)*B1*(1-GP3/B2))*B3;
1721     TIME2=TIME1 + DAYSN;
1722     QE2= (B1*(1-(GP3/B2))*B3)*
1723         (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
1724     GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
1725     NPRODM= GP2E - (YECUM - GP1) ;
1726     IF B2 LE 0 THEN NPRODM= 0;
1727
1728     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1729     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1730     QENEW=QENEW + NPRODM;
1731     TPR= VPROD;
1732     DPR= SPROD1;
1733
1734     OUTPUT;
1735
1736     *** INITIALIZATIONS FOR NEXT MONTH;
1737     *** VINTAGE=999 DE'OTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1738     IF VINTAGE EQ VY1 THEN DO;
1739         VINTAGE=999;
1740         QE= . ;
1741         NPRODM= QENEW;
1742         B1=.; B2=.; B3=.; YECUM=.;
1743         GP1=.; GPH=.; NPR=.;
1744         QP=.; GP2=.; GP3= . ;
1745         OUTPUT;
1746         END;
1747
1748     DELETE;
1749
1750     /*****
1751     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
1752     *****/;
1753     PROC SORT DATA=PYR1M10; BY YR DESCENDING VINTAGE;
1754
1755     /*****
1756     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
1757     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
1758     * THE SCHEDULE PRODUCTION INFORMATION.
1759     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 11TH MONTH OF 1ST
1760     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
1761     *****/;
1762     DATA PYR1M11;
1763     MERGE DYR1M11 PYR1M10; BY YR;
1764     RETAIN QENEW 0 VPROD SPROD1 NPRODMT ;
1765     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1766         GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
1767
1768     MONTH=11;
1769
1770     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1771 IF VINTAGE EQ 999 THEN DO;
1772     NPRODMT= NPRODM;
1773     DELETE;
1774 END;
1775
1776 ***** 11TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1777 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1778 IF VINTAGE EQ PY1 THEN DO;
1779     GP3=GP1-GPH;
1780     QE= 0;
1781     IF MAXWEL GT 0 THEN
1782         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1783 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1784     NPRODM= QE*DAY;
1785     HPROD=MAXWEL*ARATE*DAY;
1786     NPRODMT=NPRODMT + NPRODM;
1787     VPROD=SPROD;
1788     SPROD1=SPROD;
1789 *** CAPACITY VS DEMAND CHECK;
1790 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1791 *** PRODUCTION PRORATION FOR NEW VINTAGE;
1792 NPR= (NPRODM/NPRODMT) *VPROD;
1793 NRATE= NPR/DAYS;
1794 MAXPROD= NPRODM;
1795 MAXRATE= MAXPROD/DAYS;
1796 GPH=GPH + HPROD;
1797 PWELLS=WELLS;
1798 QP= QE;
1799 YECUM= YECUM + NPR;
1800 GP1= YECUM;
1801 QE= 0;
1802 OUTPUT;
1803 DELETE;
1804 END;
1805
1806 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1807 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1808 IF VINTAGE LT PY1 THEN DO;
1809     GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
1810     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
1811     IF B2 LE GP2 THEN QP= 0;
1812 *** PRODUCTION PRORATION FOR OLD VINTAGES;
1813 NPR=(NPRODM/NPRODMT)*VPROD;
1814 NRATE= NPR/DAYS;
1815 GPE=GP2+ NPR/2;
1816 MAXPROD= NPRODM;
1817 MAXRATE= MAXPROD/DAYS;
1818 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
1819 IF B2 LE GPE THEN QE=0;
1820 YECUM= YECUM + NPR;
1821 GP2= YECUM - GP1;
1822 END;
1823
1824 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
1825 NEXTM= MONTH + 1;
1826 DAYSN= 30;
1827 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
1828     OR NEXTM EQ 7 THEN DAYSN=31;
1829 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
1830 IF NEXTM EQ 2 THEN DO;
1831     DAYSN=28;
1832     IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
1833 END;
1834
1835 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1836 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
1837     ((B3 - 1)*B1*(1-GP3/B2))*B3;
1838 TIME2=TIME1 + DAYSN;
1839 QE2= (B1*(1-(GP3/B2))*B3)*
1840     (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
1841 GP2E= B2*(1 - (QE2/B1))*B3;
1842 NPRODM= GP2E - (YECUM - GP1) ;
1843 IF B2 LE 0 THEN NPRODM= 0;
1844
1845 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1846 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1847 QENEW=QENEW + NPRODM;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1848 TPR= VPROD;
1849 DPR= SPROD1;
1850
1851 OUTPUT;
1852
1853 *** INITIALIZATIONS FOR NEXT MONTH;
1854 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1855 IF VINTAGE EQ VY1 THEN DO;
1856     VINTAGE=999;
1857     QE= . ;
1858     NPRODM= QENNEW;
1859     B1=.; B2=.; B3=.; YECUM=.;
1860     GP1=.; GPH=.; NPR=.;
1861     QP=.; GP2=.; GP3= . ;
1862     OUTPUT;
1863     END;
1864
1865 DELETE;
1866
1867 /*****
1868  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
1869  *****/;
1870 PROC SORT DATA=PYR1M11; BY YR DESCENDING VINTAGE;
1871
1872 /*****
1873  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
1874  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
1875  * THE SCHEDULE PRODUCTION INFORMATION.
1876  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 12TH MONTH OF 1ST
1877  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
1878  *****/;
1879
1880 DATA PYR1M12;
1881     MERGE DYR1M12 PYR1M11; BY YR; *CALC. DIST. FACTORS*;
1882     RETAIN QENNEW 0 VPROD SPROD1 NPRODMT ;
1883     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
1884           GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
1885
1886     MONTH=12;
1887
1888 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
1889 IF VINTAGE EQ 999 THEN DO;
1890     NPRODMT= NPRODM;
1891     DELETE;
1892     END;
1893
1894 ***** 12TH MONTH OF 1ST YEAR OF PROJECTION FOR NEW VINTAGE *****;
1895 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
1896 IF VINTAGE EQ PY1 THEN DO;
1897     GP3=GP1-GPH;
1898     QE= 0;
1899     IF MAXWEL GT 0 THEN
1900         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
1901 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
1902     NPRODM= QE*DAY;
1903     HPROD=MAXWEL*ARATE*DAY;
1904     NPRODMT=NPRODMT + NPRODM;
1905     VPROD=SPROD;
1906     SPROD1=SPROD;
1907 *** CAPACITY VS DEMAND CHECK;
1908 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
1909 *** PRODUCTION PRORATION FOR NEW VINTAGE;
1910 NPR= (NPRODM/NPRODMT) *VPROD;
1911 NRATE= NPR/DAYS;
1912 MAXPROD= NPRODM;
1913 MAXRATE= MAXPROD/DAYS;
1914 GPH=GPH + HPROD;
1915 PWELLS=WELLS;
1916 QP= QE;
1917 YECUM= YECUM + NPR;
1918 GP1= YECUM;
1919 GP3=GP1-GPH;
1920 *** CALCULATE B1, B2, B3 PARAMETERS FOR FIRST PROJECTION YEAR;
1921 B1=PWB1*MAXWEL;
1922 B2=PWB2*MAXWEL;
1923 B3=PWB3;
1924 QE= B1*(1-GP3/(B2))*B3;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

1925
1926 *** CONVERT NEW VINTAGE CAPACITY TO OLD VINTAGE CAPACITY;
1927 *** SINCE A NEW PROJECTION YEAR WILL BE STARTING NEXT MONTH;
1928 ***;
1929 *** GET NUMBER OF DAYS. PERFORM CAPACITY CALCULATIONS;
1930 DAYS= 31;
1931 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
1932 ((B3 - 1)*B1*(1-GP3/B2)**B3);
1933 TIME2=TIME1 + DAYS;
1934 QE2= (B1*(1-(GP3/B2))**B3)*
1935 (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
1936 GP2E= B2*(1 - (QE2/B1)**(1/B3)) - GP3 ;
1937 NPROD= GP2E - (YECUM - GP1);
1938 IF B2 LE 0 THEN NPROD= 0;
1939 *** GET SUM OF MAX PRODUCTION;
1940 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1941 QENW=QENW + NPROD;
1942 TPR= VPROD;
1943 DPR= SPROD1;
1944
1945 OUTPUT;
1946 DELETE;
1947 END;
1948
1949
1950 ***** OLD VINTAGES - PRIOR TO 1ST YEAR OF PROJECTION *****;
1951 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
1952 IF VINTAGE LT PY1 THEN DO;
1953 GP2=YECUM - GP1 + (NPROD/NPRODM)*VPROD/2;
1954 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))**B3;
1955 IF B2 LE GP2 THEN QP= 0;
1956 *** PRODUCTION PRORATION FOR OLD VINTAGES;
1957 NPR=(NPROD/NPRODM)*VPROD;
1958 NRATE= NPR/DAYS;
1959 GPE=GP2+ NPR/2;
1960 MAXPROD= NPROD;
1961 MAXRATE= MAXPROD/DAYS;
1962 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))**B3;
1963 IF B2 LE GPE THEN QE=0;
1964 YECUM= YECUM + NPR;
1965 END;
1966
1967
1968 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
1969 DAYS=31;
1970 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
1971 ((B3 - 1)*B1*(1-GP3/B2)**B3);
1972 TIME2=TIME1 + DAYS;
1973 QE2= (B1*(1-(GP3/B2))**B3)*
1974 (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
1975 GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
1976 NPROD= GP2E - (YECUM - GP1) ;
1977 IF B2 LE 0 THEN NPROD= 0;
1978
1979 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
1980 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
1981 QENW=QENW + NPROD;
1982 TPR= VPROD;
1983 DPR= SPROD1;
1984
1985 OUTPUT;
1986
1987 *** INITIALIZATIONS FOR NEXT MONTH;
1988 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
1989 IF VINTAGE EQ VY1 THEN DO;
1990 VINTAGE=999;
1991 QE= . ;
1992 NPROD= QENW;
1993 B1=.; B2=.; B3=.; YECUM=.;
1994 GP1=.; GPH=.; NPR=.;
1995 QP=.; GP2=.; GP3= . ;
1996 OUTPUT;
1997 END;
1998
1999 DELETE;
2000
2001 /*****

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2002      * FOR DEBUG/CHECK PURPOSES
2003      *****/
2004      /*
2005      PROC PRINT;
2006          TITLE 'MONTH 12 1ST YR'; *ID VINTAGE;
2007          ID VINTAGE;
2008      *//;
2009      /*****
2010          * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
2011      *****/
2012      PROC SORT DATA=PYR1M12; BY YR DESCENDING VINTAGE;
2013
2014      /*****
2015          * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
2016          * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
2017          * THE SCHEDULE PRODUCTION INFORMATION.                            *
2018          * PERFORM INITIALIZATION FOR NEXT MONTH'S PROJECTION.              *
2019      *****/
2020      DATA DATV2;
2021          SET DYR2M01 PYR1M12;
2022          YR=19PY2;
2023          IF VINTAGE EQ PY2 THEN DO;
2024              NPRODM=0;
2025              GP2=0;
2026              QE=0;
2027          END;
2028
2029      /*****
2030          * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
2031      *****/
2032      PROC SORT DATA=DATV2; BY DESCENDING VINTAGE;
2033
2034      /*****
2035          * FOR DEBUG/CHECK PURPOSES
2036      *****/
2037      *PROC PRINT; *TITLE 'DATV2';
2038      *PROC PRINT DATA=DYR2M01; *TITLE 'DYR2M01';
2039
2040      /*****
2041          * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
2042          * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
2043          * THE SCHEDULE PRODUCTION INFORMATION.                            *
2044          * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 1ST MONTH OF 2ND      *
2045          * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.          *
2046      *****/
2047      DATA PYR2M01;
2048          SET DATV2;
2049          RETAIN QETOT QENEW 0 VPROD SPROD1 NPRODMT;
2050          KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2051          GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
2052
2053          MONTH=1;
2054          DAYS= 31;
2055
2056          *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2057          IF VINTAGE EQ 999 THEN DO;
2058              NPRODMT= NPRODM;
2059              DELETE;
2060          END;
2061
2062          ***** 1ST MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2063          *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2064          IF VINTAGE EQ PY2 THEN DO;
2065              QE=0.5*WLS*PWB1;
2066              HPROD=MAXWEL*ARATE*DAYS;
2067              GPH=HPROD;
2068              NPRODM= QE*DAYS;
2069              NPRODMT=NPRODMT + NPRODM;
2070              VPROD=SPROD;
2071              SPROD1=SPROD;
2072          *** CAPACITY VS DEMAND CHECK;
2073          IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2074          *** PRODUCTION PRORATION FOR NEW VINTAGE;
2075          NPR= (NPRODM/NPRODMT) *VPROD;
2076          NRATE= NPR/DAYS;

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2078     MAXPROD= NPROD;
2079     MAXRATE= MAXPROD/DAYS;
2080     QP= QE;
2081     YECUM= NPR;
2082     GP1= YECUM;
2083     GP2= 0;
2084     PWELLS=WELLS;
2085     GP3=GP1-YECUM;
2086     OUTPUT;
2087     DELETE;
2088     END;
2089
2090     ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2091     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2092     IF VINTAGE LT PY2 THEN DO;
2093         GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
2094         IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2095         IF B2 LE GP2 THEN QP= 0;
2096     *** PRODUCTION PRORATION FOR OLD VINTAGES;
2097         NPR=(NPROD/NPRODMT)*VPROD;
2098         NRATE= NPR/DAYS;
2099         GPE=GP2+ NPR/2;
2100         MAXPROD= NPROD;
2101         MAXRATE= MAXPROD/DAYS;
2102         IF B2 GT GPE THEN QE=B1*(1-GPE/B2)**B3;
2103         IF B2 LE GPE THEN QE=0;
2104         YECUM= YECUM + NPR;
2105     END;
2106
2107     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2108     NEXTM= MONTH + 1;
2109     DAYSN= 30;
2110     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2111         OR NEXTM EQ 7 THEN DAYSN=31;
2112     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2113     IF NEXTM EQ 2 THEN DO;
2114         DAYSN=28;
2115         IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2116     END;
2117
2118     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2119     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
2120         ((B3 - 1)*B1*(1-GP3/B2)**B3);
2121     TIME2=TIME1 + DAYSN;
2122     QE2= (B1*(1-(GP3/B2))**B3)*
2123         (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
2124     GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
2125     NPROD= GP2E - (YECUM - GP1) ;
2126     IF B2 LE 0 THEN NPROD= 0;
2127
2128     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2129     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2130     QNEW=QNEW + NPROD;
2131     TPR= VPROD;
2132     DPR= SPROD1;
2133
2134     OUTPUT;
2135
2136     *** INITIALIZATIONS FOR NEXT MONTH;
2137     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2138     IF VINTAGE EQ VY1 THEN DO;
2139         VINTAGE=999;
2140         QE= . ;
2141         NPROD= QNEW;
2142         B1=.; B2=.; B3=.; YECUM=.;
2143         GP1=.; GPH=.; NPR=.;
2144         QP=.; GP2=.; GP3= . ;
2145         OUTPUT;
2146     END;
2147
2148     DELETE;
2149
2150     /*****
2151     * FOR DEBUG/CHECK PURPOSES
2152     *****/
2153     *PROC PRINT; *TITLE 'MONTH 1 2ND YR'; *ID VINTAGE;
2154

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2155 /*****
2156 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
2157 *****/
2158 PROC SORT DATA=PYR2M01; BY YR DESCENDING VINTAGE;
2159
2160 /*****
2161 * FOR DEBUG/CHECK PURPOSES *
2162 *****/
2163 *PROC PRINT; *TITLE '1ST PROJ. MONTH';
2164
2165 /*****
2166 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
2167 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
2168 * THE SCHEDULE PRODUCTION INFORMATION. *
2169 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 2ND MONTH OF 2ND *
2170 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
2171 *****/
2172 DATA PYR2M02;
2173     MERGE DYR2M02 PYR2M01; BY YR;
2174     RETAIN QENew 0 VPROD SPROD1 NPRODMT ;
2175     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2176         GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QF NPRODM;
2177
2178     MONTH=2;
2179
2180     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2181     IF VINTAGE EQ 999 THEN DO;
2182         NPRODMT= NPRODM;
2183         DELETE;
2184     END;
2185
2186     ***** 2ND MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2187     *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2188     IF VINTAGE EQ PY2 THEN DO;
2189         GP3=GP1-GPH;
2190         QE= 0;
2191         IF MAXWEL GT 0 THEN
2192             QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
2193     ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2194         NPRODM= QE*DAY;
2195         HPROD=MAXWEL*ARATE*DAY;
2196         NPRODMT=NPRODMT + NPRODM;
2197         VPROD=SPROD;
2198         SPROD1=SPROD;
2199     *** CAPACITY VS DEMAND CHECK;
2200     IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2201     *** PRODUCTION PRORATION FOR NEW VINTAGE;
2202     NPR= (NPRODM/NPRODMT) *VPROD;
2203     NRATE= NPR/DAYS;
2204     MAXPROD= NPRODM;
2205     MAXRATE= MAXPROD/DAYS;
2206     GPH=GPH + HPROD;
2207     PWELLS=WELLS;
2208     QF= QE;
2209     YECUM= YECUM + NPR;
2210     GP1= YECUM;
2211     QE= 0;
2212     OUTPUT;
2213     DELETE;
2214     END;
2215
2216     ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2217     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2218     IF VINTAGE LT PY2 THEN DO;
2219         GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
2220         IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2221         IF B2 LE GP2 THEN QP= 0;
2222     *** PRODUCTION PRORATION FOR OLD VINTAGES;
2223     NPR=(NPRODM/NPRODMT)*VPROD;
2224     NRATE= NPR/DAYS;
2225     GPE=GP2+ NPR/2;
2226     MAXPROD= NPRODM;
2227     MAXRATE= MAXPROD/DAYS;
2228     IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2229     IF B2 LE GPE THEN QE=0;
2230     YECUM= YECUM + NPR;
2231     GP2= YECUM - GP1;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2232     END;
2233
2234 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2235 NEXTM= MONTH + 1;
2236 DAYSN= 30;
2237 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2238     OR NEXTM EQ 7 THEN DAYSN=31;
2239 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2240 IF NEXTM EQ 2 THEN DO;
2241     DAYSN=28;
2242     IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2243 END;
2244
2245 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2246 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
2247     ((B3 - 1)*B1*(1-GP3/B2)**B3);
2248 TIME2=TIME1 + DAYSN;
2249 QE2= (B1*(1-(GP3/B2))**B3)*
2250     (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**B3/(1-B3));
2251 GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
2252 NPROD= GP2E - (YECUM - GP1) ;
2253 IF B2 LE 0 THEN NPROD= 0;
2254
2255 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2256 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2257 QENW=QENW + NPROD;
2258 TPR= VPROD;
2259 DPR= SPROD1;
2260
2261 OUTPUT;
2262
2263 *** INITIALIZATIONS FOR NEXT MONTH;
2264 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2265 IF VINTAGE EQ VY1 THEN DO;
2266     VINTAGE=999;
2267     QE= . ;
2268     NPROD= QENW;
2269     B1=. ; B2=. ; B3=. ; YECUM=. ;
2270     GP1=. ; GPH=. ; NPR=. ;
2271     QP=. ; GP2=. ; GP3= . ;
2272     OUTPUT;
2273 END;
2274
2275 DELETE;
2276
2277 /*****
2278  * FOR DEBUG/CHECK PURPOSES
2279  *****/;
2280 *PROC PRINT; *TITLE 'MONTH 2 2ND YR'; *ID VINTAGE;
2281
2282 /*****
2283  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
2284  *****/;
2285 PROC SORT DATA=PVR2M02; BY YR DESCENDING VINTAGE;
2286
2287 /*****
2288  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
2289  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
2290  * THE SCHEDULE PRODUCTION INFORMATION.
2291  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 3RD MONTH OF 2ND
2292  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
2293  *****/;
2294 DATA PVR2M03;
2295     MERGE DVR2M03 PVR2M02; BY YR;
2296     RETAIN QENW 0 VPROD SPROD1 NPRODMT ;
2297     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2298         GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
2299
2300     MONTH=3;
2301
2302 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2303 IF VINTAGE EQ 999 THEN DO;
2304     NPRODMT= NPROD;
2305     DELETE;
2306 END;
2307
2308 ***** 3RD MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2309 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2310 IF VINTAGE EQ PY2 THEN DO;
2311   GP3=GP1-GPH;
2312   QE= 0;
2313   IF MAXWEL GT 0 THEN
2314     QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
2315 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2316   NPRODM= QE*DAY;
2317   HPROD=MAXWEL*ARATE*DAY;
2318   NPRODMT=NPRODMT + NPRODM;
2319   VPROD=SPROD;
2320   SPROD1=SPROD;
2321 *** CAPACITY VS DEMAND CHECK;
2322 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2323 *** PRODUCTION PRORATION FOR NEW VINTAGE;
2324 NPR= (NPRODM/NPRODMT) *VPROD;
2325 NRATE= NPR/DAYS;
2326 MAXPROD= NPRODM;
2327 MAXRATE= MAXPROD/DAYS;
2328 GPH=GPH + HPROD;
2329 PWELLS=WELLS;
2330 QP= QE;
2331 YECUM= YECUM + NPR;
2332 GP1= YECUM;
2333 QE= 0;
2334 OUTPUT;
2335 DELETE;
2336 END;
2337
2338 ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2339 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2340 IF VINTAGE LT PY2 THEN DO;
2341   GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
2342   IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2343   IF B2 LE GP2 THEN QP= 0;
2344 *** PRODUCTION PRORATION FOR OLD VINTAGES;
2345 NPR=(NPRODM/NPRODMT)*VPROD;
2346 NRATE= NPR/DAYS;
2347 GPE=GP2+ NPR/2;
2348 MAXPROD= NPRODM;
2349 MAXRATE= MAXPROD/DAYS;
2350 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2351 IF B2 LE GPE THEN QE=0;
2352 YECUM= YECUM + NPR;
2353 GP2= YECUM - GP1;
2354 END;
2355
2356 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2357 NEXTM= MONTH + 1;
2358 DAYSN= 30;
2359 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2360   OR NEXTM EQ 7 THEN DAYSN=31;
2361 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2362 IF NEXTM EQ 2 THEN DO;
2363   DAYSN=28;
2364   IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2365 END;
2366
2367 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2368 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
2369 ((B3 - 1)*B1*(1-GP3/B2))*B3;
2370 TIME2=TIME1 + DAYSN;
2371 QE2= (B1*(1-(GP3/B2))*B3)*
2372 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
2373 GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
2374 NPRODM= GP2E - (YECUM - GP1) ;
2375 IF B2 LE 0 THEN NPRODM= 0;
2376
2377 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2378 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2379 QNEW=QNEW + NPRODM;
2380 TPR= VPROD;
2381 DPR= SPROD1;
2382
2383 OUTPUT;
2384
2385 *** INITIALIZATIONS FOR NEXT MONTH;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2386 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2387 IF VINTAGE EQ VY1 THEN DO;
2388     VINTAGE=999;
2389     QE= . ;
2390     NPRODM= QENNEW;
2391     B1=.; B2=.; B3=.; YECUM=.;
2392     GP1=.; GPH=.; NPR=.;
2393     QP=.; GP2=.; GP3= . ;
2394     OUTPUT;
2395     END;
2396
2397 DELETE;
2398
2399 /*****
2400  * FOR DEBUG/CHECK PURPOSES
2401  *****/;
2402 *PROC PRINT,*TITLE'MONTH 3  2ND YR';*ID VINTAGE;
2403
2404 /*****
2405  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
2406  *****/;
2407 PROC SORT DATA=PYR2M03; BY YR DESCENDING VINTAGE;
2408
2409 /*****
2410  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
2411  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
2412  * THE SCHEDULE PRODUCTION INFORMATION.
2413  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 4TH MONTH OF 2ND
2414  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
2415  *****/;
2416 DATA PYR2M04;
2417     MERGE DYR2M04 PYR2M03; BY YR;
2418     RETAIN QENNEW 0 VPROD SPROD1 NPRODMT ;
2419     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2420     GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
2421
2422     MONTH=4;
2423
2424 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2425 IF VINTAGE EQ 999 THEN DO;
2426     NPRODMT= NPRODM;
2427     DELETE;
2428     END;
2429
2430 ***** 4TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2431 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2432 IF VINTAGE EQ PY2 THEN DO;
2433     GP3=GP1-GPH;
2434     QE= 0;
2435     IF MAXWEL GT 0 THEN
2436         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
2437 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2438     NPRODM= QE*DAY;
2439     HPROD=MAXWEL*ARATE*DAY;
2440     NPRODMT=NPRODMT + NPRODM;
2441     VPROD=SPROD;
2442     SPROD1=SPROD;
2443 ***     CAPACITY VS DEMAND CHECK;
2444     IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2445 ***     PRODUCTION PRORATION FOR NEW VINTAGE;
2446     NPR= (NPRODM/NPRODMT) *VPROD;
2447     NRATE= NPR/DAYS;
2448     MAXPROD= NPRODM;
2449     MAXRATE= MAXPROD/DAYS;
2450     GPH=GPH + HPROD;
2451     PWELLS=WELLS;
2452     QP= QE;
2453     YECUM= YECUM + NPR;
2454     GP1= YECUM;
2455     QE= 0;
2456     OUTPUT;
2457     DELETE;
2458     END;
2459
2460 ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2461 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2462 IF VINTAGE LT PY2 THEN DO;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2463 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
2464 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2465 IF B2 LE GP2 THEN QP= 0;
2466 *** PRODUCTION PRORATION FOR OLD VINTAGES;
2467 NPR=(NPROD/NPRODMT)*VPROD;
2468 NRATE= NPR/DAYS;
2469 GPE=GP2+ NPR/2;
2470 MAXPROD= NPROD;
2471 MAXRATE= MAXPROD/DAYS;
2472 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2473 IF B2 LE GPE THEN QE=0;
2474 YECUM= YECUM + NPR;
2475 GP2= YECUM - GP1;
2476 END;
2477
2478 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2479 NEXTM= MONTH + 1;
2480 DAYSN= 30;
2481 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2482 OR NEXTM EQ 7 THEN DAYSN=31;
2483 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2484 IF NEXTM EQ 2 THEN DO;
2485 DAYSN=28;
2486 IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2487 END;
2488
2489 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2490 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
2491 ((B3 - 1)*B1*(1-GP3/B2))*B3;
2492 TIME2=TIME1 + DAYSN;
2493 QE2= (B1*(1-(GP3/B2))*B3)*
2494 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
2495 GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
2496 NPROD= GP2E - (YECUM - GP1) ;
2497 IF B2 LE 0 THEN NPROD= 0;
2498
2499 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2500 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2501 QNEW=QNEW + NPROD;
2502 TPR= VPROD;
2503 DPR= SPROD1;
2504
2505 OUTPUT;
2506
2507 *** INITIALIZATIONS FOR NEXT MONTH;
2508 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2509 IF VINTAGE EQ VY1 THEN DO;
2510 VINTAGE=999;
2511 QE= . ;
2512 NPROD= QNEW;
2513 B1=.; B2=.; B3=.; YECUM=.;
2514 GP1=.; GPH=.; NPR=.;
2515 QP=.; GP2=.; GP3= . ;
2516 OUTPUT;
2517 END;
2518
2519 DELETE;
2520
2521 /*****
2522 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
2523 *****/;
2524 PROC SORT DATA=PYR2M04; BY YR DESCENDING VINTAGE;
2525
2526 /*****
2527 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
2528 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
2529 * THE SCHEDULE PRODUCTION INFORMATION. *
2530 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 5TH MONTH OF 2ND *
2531 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
2532 *****/;
2533 DATA PYR2M05;
2534 MERGE DYR2M05 PYR2M04; BY YR,*CALC. DIST. FACTORS*;
2535 RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
2536 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2537 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
2538
2539 MONTH=5;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2540
2541 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2542 IF VINTAGE EQ 999 THEN DO;
2543     NPRODMT= NPROD;
2544     DELETE;
2545 END;
2546
2547 ***** 5TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2548 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2549 IF VINTAGE EQ PY2 THEN DO;
2550     GP3=GP1-GPH;
2551     QE= 0;
2552     IF MAXWEL GT 0 THEN
2553         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
2554 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2555     NPROD= QE*DAY;
2556     HPROD=MAXWEL*ARATE*DAY;
2557     NPRODMT=NPRODMT + NPROD;
2558     VPROD=SPROD;
2559     SPROD1=SPROD;
2560 *** CAPACITY VS DEMAND CHECK;
2561 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2562 *** PRODUCTION PRORATION FOR NEW VINTAGE;
2563 NPR= (NPROD/NPRODMT) *VPROD;
2564 NRATE= NPR/DAY;
2565 MAXPROD= NPROD;
2566 MAXRATE= MAXPROD/DAY;
2567 GPH=GPH + HPROD;
2568 PWELLS=WELLS;
2569 QP= QE;
2570 YECUM= YECUM + NPR;
2571 GP1= YECUM;
2572 QE= 0;
2573 OUTPUT;
2574 DELETE;
2575 END;
2576
2577 ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2578 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2579 IF VINTAGE LT PY2 THEN DO;
2580     GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
2581     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2582     IF B2 LE GP2 THEN QP= 0;
2583 *** PRODUCTION PRORATION FOR OLD VINTAGES;
2584 NPR=(NPROD/NPRODMT)*VPROD;
2585 NRATE= NPR/DAY;
2586 GPE=GP2+ NPR/2;
2587 MAXPROD= NPROD;
2588 MAXRATE= MAXPROD/DAY;
2589 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2590 IF B2 LE GPE THEN QE=0;
2591 YECUM= YECUM + NPR;
2592 GP2= YECUM - GP1;
2593 END;
2594
2595 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2596 NEXTM= MONTH + 1;
2597 DAYSN= 30;
2598 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2599     OR NEXTM EQ 7 THEN DAYSN=31;
2600 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2601 IF NEXTM EQ 2 THEN DO;
2602     DAYSN=28;
2603     IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2604 END;
2605
2606 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2607 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
2608     ((B3 - 1)*B1*(1-GP3/B2))*B3;
2609 TIME2=TIME1 + DAYSN;
2610 QE2= (B1*(1-(GP3/B2))*B3)*
2611     (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
2612 GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
2613 NPROD= GP2E - (YECUM - GP1) ;
2614 IF B2 LE 0 THEN NPROD= 0;
2615
2616 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2617 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2618 QENew=QENew + NPROD;
2619 TPR= VPROD;
2620 DPR= SPROD1;
2621
2622 OUTPUT;
2623
2624 *** INITIALIZATIONS FOR NEXT MONTH;
2625 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2626 IF VINTAGE EQ VY1 THEN DO;
2627     VINTAGE=999;
2628     QE= . ;
2629     NPROD= QENew;
2630     B1=. ; B2=. ; B3=. ; YECUM=. ;
2631     GP1=. ; GPH=. ; NPR=. ;
2632     QP=. ; GP2=. ; GP3= . ;
2633     OUTPUT;
2634     END;
2635
2636 DELETE;
2637
2638 /*****
2639  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
2640  *****/
2641 PROC SORT DATA=PYR2M05; BY YR DESCENDING VINTAGE;
2642
2643 /*****
2644  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
2645  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
2646  * THE SCHEDULE PRODUCTION INFORMATION.                               *
2647  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 6TH MONTH OF 2ND      *
2648  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.           *
2649  *****/
2650 DATA PYR2M06;
2651     MERGE DYR2M06 PYR2M05; BY YR,*CALC. DIST.  FACTORS*;
2652     RETAIN QENew 0 VPROD SPROD1 NPROD;
2653     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2654           GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
2655
2656     MONTH=6;
2657
2658 *** GET FIRST VALUE OF NPROD - CAPACITY OF ALL PREVIOUS VINTAGES;
2659 IF VINTAGE EQ 999 THEN DO;
2660     NPROD= NPROD;
2661     DELETE;
2662 END;
2663
2664 ***** 6TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2665 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2666 IF VINTAGE EQ PY2 THEN DO;
2667     GP3=GP1-GPH;
2668     QE= 0;
2669     IF MAXWEL GT 0 THEN
2670         QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
2671 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2672     NPROD= QE*DAY;
2673     HPROD=MAXWEL*ARATE*DAY;
2674     NPROD=NPROD + NPROD;
2675     VPROD=SPROD;
2676     SPROD1=SPROD;
2677 *** CAPACITY VS DEMAND CHECK;
2678 IF SPROD GT NPROD THEN VPROD= NPROD;
2679 *** PRODUCTION PRORATION FOR NEW VINTAGE;
2680 NPR= (NPROD/NPROD)*VPROD;
2681 NRATE= NPR/DAY;
2682 MAXPROD= NPROD;
2683 MAXRATE= MAXPROD/DAY;
2684 GPH=GPH + HPROD;
2685 PWELLS=WELLS;
2686 QP= QE;
2687 YECUM= YECUM + NPR;
2688 GP1= YECUM;
2689 QE= 0;
2690 OUTPUT;
2691 DELETE;
2692 END;
2693

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2694 ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2695 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2696 IF VINTAGE LT PY2 THEN DO;
2697   GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
2698   IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2699   IF B2 LE GP2 THEN QP= 0;
2700 *** PRODUCTION PRORATION FOR OLD VINTAGES;
2701   NPR=(NPROD/NPRODMT)*VPROD;
2702   NRATE= NPR/DAYS;
2703   GPE=GP2+ NPR/2;
2704   MAXPROD= NPROD;
2705   MAXRATE= MAXPROD/DAYS;
2706   IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2707   IF B2 LE GPE THEN QE=0;
2708   YECUM= YECUM + NPR;
2709   GP2= YECUM - GP1;
2710   END;
2711
2712 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2713   NEXTM= MONTH + 1;
2714   DAYS= 30;
2715   IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2716       OR NEXTM EQ 7 THEN DAYS=31;
2717   IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYS=31;
2718   IF NEXTM EQ 2 THEN DO;
2719     DAYS=28;
2720     IF (INT(YR/4) * 4) EQ YR THEN DAYS=29;
2721   END;
2722
2723 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2724   TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
2725     ((B3 - 1)*B1*(1-GP3/B2))*B3;
2726   TIME2=TIME1 + DAYS;
2727   QE2= (B1*(1-(GP3/B2))*B3)*
2728     (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
2729   GP2E= B2*(1 - (QE2/B1))*B3/(1-B3)) ;
2730   NPROD= GP2E - (YECUM - GP1) ;
2731   IF B2 LE 0 THEN NPROD= 0;
2732
2733 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2734 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2735   QENEW=QENEW + NPROD;
2736   TPR= VPROD;
2737   DPR= SPROD1;
2738
2739   OUTPUT;
2740
2741 *** INITIALIZATIONS FOR NEXT MONTH;
2742 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2743 IF VINTAGE EQ VY1 THEN DO;
2744   VINTAGE=999;
2745   QE= . ;
2746   NPROD= QENEW;
2747   B1=.; B2=.; B3=.; YECUM=.;
2748   GP1=.; GPH=.; NPR=.;
2749   QP=.; GP2=.; GP3= . ;
2750   OUTPUT;
2751   END;
2752
2753 DELETE;
2754
2755 /*****
2756  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
2757  *****/
2758 PROC SORT DATA=PYR2M06; BY YR DESCENDING VINTAGE;
2759
2760 /*****
2761  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
2762  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
2763  * THE SCHEDULE PRODUCTION INFORMATION.                               *
2764  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 7TH MONTH OF 2ND    *
2765  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.           *
2766  *****/
2767 DATA PYR2M07;
2768   MERGE DYR2M07 PYR2M06; BY YR; *CALC. DIST.  FACTORS*;
2769   RETAIN QENEW 0 VPROD SPROD1 NPRODMT ;
2770   KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2771      GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP (PROD);
2772
2773      MONTH=7;
2774
2775      *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2776      IF VINTAGE EQ 999 THEN DO;
2777          NPRODMT= NPROD;
2778          DELETE;
2779      END;
2780
2781      ***** 7TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2782      *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2783      IF VINTAGE EQ PY2 THEN DO;
2784          GP3=GP1-GPH;
2785          QE= 0;
2786          IF MAXWEL GT 0 THEN
2787              QE= (0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWJ3;
2788      ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2789          NPROD= QE*DAY;
2790          HPROD=MAXWEL*ARATE*DAY;
2791          NPRODMT=NPRODMT + NPROD;
2792          VPROD=SPROD;
2793          SPROD1=SPROD;
2794      *** CAPACITY VS DEMAND CHECK;
2795      IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2796      *** PRODUCTION PRORATION FOR NEW VINTAGE;
2797          NPR= (NPROD/NPRODMT) *VPROD;
2798          NRATE= NPR/DAYS;
2799          MAXPROD= NPROD;
2800          MAXRATE= MAXPROD/DAYS;
2801          GPH=GPH + HPROD;
2802          PWELLS=WELLS;
2803          QP= QE;
2804          YECUM= YECUM + NPR;
2805          GP1= YECUM;
2806          QE= 0;
2807          OUTPUT;
2808          DELETE;
2809      END;
2810
2811      ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2812      *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2813      IF VINTAGE LT PY2 THEN DO;
2814          GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
2815          IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2816          IF B2 LE GP2 THEN QP= 0;
2817      *** PRODUCTION PRORATION FOR OLD VINTAGES;
2818          NPR= (NPROD/NPRODMT)*VPROD;
2819          NRATE= NPR/DAYS;
2820          GPE=GP2+ NPR/2;
2821          MAXPROD= NPROD;
2822          MAXRATE= MAXPROD/DAYS;
2823          IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2824          IF B2 LE GPE THEN QE=0;
2825          YECUM= YECUM + NPR;
2826          GP2= YECUM - GP1;
2827      END;
2828
2829
2830      *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2831      NEXTM= MONTH + 1;
2832      DAYSN= 30;
2833      IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2834          OR NEXTM EQ 7 THEN DAYSN=31;
2835      IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2836      IF NEXTM EQ 2 THEN DO;
2837          DAYSN=28;
2838          IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2839      END;
2840
2841      *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2842      TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
2843          ((B3 - 1)*B1*(1-GP3/B2))*B3);
2844      TIME2= TIME1 + DAYSN;
2845      QE2= B1*(1-(GP3/B2))*B3*
2846          (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
2847      GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2848 NPROD= GP2E - (YECUM - GP1) ;
2849 IF B2 LE 0 THEN NPROD= 0;
2850
2851 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2852 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2853 QENW=QENW + NPROD;
2854 TPR= VPROD;
2855 DPR= SPROD1;
2856
2857 OUTPUT;
2858
2859 *** INITIALIZATIONS FOR NEXT MONTH;
2860 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2861 IF VINTAGE EQ VY1 THEN DO;
2862 VINTAGE=999;
2863 QE= . ;
2864 NPROD= QENW;
2865 B1=. ; B2=. ; B3=. ; YECUM=. ;
2866 GP1=. ; GPH=. ; NPR=. ;
2867 QP=. ; GP2=. ; GP3= . ;
2868 OUTPUT;
2869 END;
2870
2871 DELETE;
2872
2873 /*****
2874 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
2875 *****/
2876 PROC SORT DATA=PYR2M07; BY YR DESCENDING VINTAGE;
2877
2878 /*****
2879 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
2880 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
2881 * THE SCHEDULE PRODUCTION INFORMATION. *
2882 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 8TH MONTH OF 2ND *
2883 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
2884 *****/
2885 DATA PYR2M08;
2886 MERGE DYR2M08 PYR2M07; BY YR;*CALC. DIST. FACTORS*;
2887 RETAIN QENW 0 VPROD SPROD1 NPRODMT ;
2888 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
2889 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
2890
2891 MONTH=8;
2892
2893 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
2894 IF VINTAGE EQ 999 THEN DO;
2895 NPRODMT= NPROD;
2896 DELETE;
2897 END;
2898
2899 ***** 8TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
2900 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
2901 IF VINTAGE EQ PY2 THEN DO;
2902 GP3=GP1-GPH;
2903 QE= 0;
2904 IF MAXWEL GT 0 THEN
2905 QE=(0.5*WLS+LWILL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
2906 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
2907 NPROD= QE*DAY;
2908 HPROD=MAXWEL*ARATE*DAY;
2909 NPRODMT=NPRODMT + NPROD;
2910 VPROD=SPROD;
2911 SPROD1=SPROD;
2912 *** CAPACITY VS DEMAND CHECK;
2913 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
2914 *** PRODUCTION PRORATION FOR NEW VINTAGE;
2915 NPR= (NPROD/NPRODMT) *VPROD;
2916 NRATE= NPR/DAY;
2917 MAXPROD= NPROD;
2918 MAXRATE= MAXPROD/DAY;
2919 GPH=GPH + HPROD;
2920 PWELLS=WELLS;
2921 QP= QE;
2922 YECUM= YECUM + NPR;
2923 GP1= YECUM;
2924 QE= 0;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

2925     OUTPUT;
2926     DELETE;
2927     END;
2928
2929     ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
2930     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
2931     IF VINTAGE LT PY2 THEN DO;
2932         GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
2933         IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
2934         IF B2 LE GP2 THEN QP= 0;
2935     *** PRODUCTION PRORATION FOR OLD VINTAGES;
2936         NPR=(NPRODM/NPRODMT)*VPROD;
2937         NRATE= NPR/DAYS;
2938         GPE=GP2+ NPR/2;
2939         MAXPROD= NPRODM;
2940         MAXRATE= MAXPROD/DAYS;
2941         IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
2942         IF B2 LE GPE THEN QE=0;
2943         YECUM= YECUM + NPR;
2944         GP2= YECUM - GP1;
2945     END;
2946
2947     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
2948     NEXTM= MONTH + 1;
2949     DAYSN= 30;
2950     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
2951         OR NEXTM EQ 7 THEN DAYSN=31;
2952     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
2953     IF NEXTM EQ 2 THEN DO;
2954         DAYSN=28;
2955         IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
2956     END;
2957
2958     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
2959     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
2960         ((B3 - 1)*B1*(1-GP3/B2))*B3;
2961     TIME2=TIME1 + DAYSN;
2962     QE2= (B1*(1-(GP3/B2))*B3)*
2963         (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
2964     GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
2965     NPRODM= GP2E - (YECUM - GP1) ;
2966     IF B2 LE 0 THEN NPRODM= 0;
2967
2968     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
2969     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
2970     QENW=QENW + NPRODM;
2971     TPR= VPROD;
2972     DPR= SPROD1;
2973
2974     OUTPUT;
2975
2976     *** INITIALIZATIONS FOR NEXT MONTH;
2977     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
2978     IF VINTAGE EQ VY1 THEN DO;
2979         VINTAGE=999;
2980         QE= . ;
2981         NPRODM= QENW;
2982         B1=.; B2=.; B3=.; YECUM=.;
2983         GP1=.; GPH=.; NPR=.;
2984         QP=.; GP2=.; GP3= . ;
2985         OUTPUT;
2986     END;
2987
2988     DELETE;
2989
2990     /*****
2991     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
2992     *****/;
2993     PROC SORT DATA=PYR2M08; BY YR DESCENDING VINTAGE;
2994
2995     /*****
2996     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
2997     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
2998     * THE SCHEDULE PRODUCTION INFORMATION. *
2999     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 9TH MONTH OF 2ND *
3000     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
3001     *****/;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3002 DATA PYR2M09;
3003     MERGE DYR2M09 PYR2M08; BY YR;*CALC. DIST.  FACTORS*;
3004     RETAIN QENNEW 0 VPROD SPROD1 NPRODMT ;
3005     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3006         GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3007
3008     MONTH=9;
3009
3010     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3011     IF VINTAGE EQ 999 THEN DO;
3012         NPRODMT= NPRODM;
3013         DELETE;
3014     END;
3015
3016     ***** 9TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
3017     *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3018     IF VINTAGE EQ PY2 THEN DO;
3019         GP3=GP1-GPH;
3020         QE= 0;
3021         IF MAXWEL GT 0 THEN
3022             QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
3023     ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3024         NPRODM= QE*DAY5;
3025         HPROD=MAXWEL*ARATE*DAY5;
3026         NPRODMT=NPRODMT + NPRODM;
3027         VPROD=SPROD;
3028         SPROD1=SPROD;
3029     *** CAPACITY VS DEMAND CHECK;
3030     IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3031     *** PRODUCTION PRORATION FOR NEW VINTAGE;
3032     NPR= (NPRODM/NPRODMT) *VPROD;
3033     NRATE= NPR/DAYS;
3034     MAXPROD= NPRODM;
3035     MAXRATE= MAXPROD/DAYS;
3036     GPH=GPH + HPROD;
3037     PWELLS=WELLS;
3038     QP= QE;
3039     YECUM= YECUM + NPR;
3040     GP1= YECUM;
3041     QE= 0;
3042     OUTPUT;
3043     DELETE;
3044     END;
3045
3046     ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
3047     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3048     IF VINTAGE LT PY2 THEN DO;
3049         GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
3050         IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
3051         IF B2 LE GP2 THEN QP= 0;
3052     *** PRODUCTION PRORATION FOR OLD VINTAGES;
3053     NPR=(NPRODM/NPRODMT)*VPROD;
3054     NRATE= NPR/DAYS;
3055     GPE=GP2+ NPR/2;
3056     MAXPROD= NPRODM;
3057     MAXRATE= MAXPROD/DAYS;
3058     IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3059     IF B2 LE GPE THEN QE=0;
3060     YECUM= YECUM + NPR;
3061     GP2= YECUM - GP1;
3062     END;
3063
3064     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3065     NEXTM= MONTH + 1;
3066     DAY5N= 30;
3067     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
3068         OR NEXTM EQ 7 THEN DAY5N=31;
3069     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAY5N=31;
3070     IF NEXTM EQ 2 THEN DO;
3071         DAY5N=28;
3072         IF (INT(YR/4) * 4) EQ YR THEN DAY5N=29;
3073     END;
3074
3075     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3076     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
3077         ((B3 - 1)*B1*(1-GP3/B2))*B3);
3078     TIME2=TIME1 + DAY5N;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3079  QE2= (B1*(1-(GP3/B2))**B3)*
3080      (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**(B3/(1-B3));
3081  GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
3082  NPRODM= GP2E - (YECUM - GP1) ;
3083  IF B2 LE 0 THEN NPRODM= 0;
3084
3085  *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3086  *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3087  QENew=QENew + NPRODM;
3088  TPR= VPROD;
3089  DPR= SPROD1;
3090
3091  OUTPUT;
3092
3093  *** INITIALIZATIONS FOR NEXT MONTH;
3094  *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3095  IF VINTAGE EQ VY1 THEN DO;
3096      VINTAGE=999;
3097      QE= . ;
3098      NPRODM= QENew;
3099      B1=.; B2=.; B3=.; YECUM=.;
3100      GP1=.; GPH=.; NPR=.;
3101      QP=.; GP2=.; GP3= . ;
3102      OUTPUT;
3103      END;
3104
3105  DELETE;
3106
3107  /*****
3108   * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
3109   *****/
3110  PROC SORT DATA=PYR2M09; BY YR DESCENDING VINTAGE;
3111
3112  /*****
3113   * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
3114   * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
3115   * THE SCHEDULE PRODUCTION INFORMATION.                               *
3116   * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 10TH MONTH OF 2ND    *
3117   * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.           *
3118   *****/
3119  DATA PYR2M10;
3120      MERGE DYR2M10 PYR2M09; BY YR; *CALC. DIST.  FACTORS*;
3121      RETAIN QENew 0 VPROD SPROD1 NPRODMT ;
3122      KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3123           GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3124
3125      MONTH=10;
3126
3127  *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3128  IF VINTAGE EQ 999 THEN DO;
3129      NPRODMT= NPRODM;
3130      DELETE;
3131      END;
3132
3133  ***** 10TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
3134  *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3135  IF VINTAGE EQ PY2 THEN DO;
3136      GP3=GP1-GPH;
3137      QE= 0;
3138      IF MAXWEL GT 0 THEN
3139          QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))**PWB3;
3140  ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3141      NPRODM= QE*DAY5;
3142      HPROD=MAXWEL*ARATE*DAY5;
3143      NPRODMT=NPRODMT + NPRODM;
3144      VPROD=SPROD;
3145      SPROD1=SPROD;
3146  *** CAPACITY VS DEMAND CHECK;
3147      IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3148  *** PRODUCTION PRORATION FOR NEW VINTAGE;
3149      NPR= (NPRODM/NPRODMT) *VPROD;
3150      NRATE= NPR/DAY5;
3151      MAXPROD= NPRODM;
3152      MAXRATE= MAXPROD/DAY5;
3153      GPH=GPH + HPROD;
3154      PWELLS=WELLS;
3155      QP= QE;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3156      YECUM= YECUM + NPR;
3157      GP1= YECUM;
3158      QE= 0;
3159      OUTPUT;
3160      DELETE;
3161      END;
3162
3163      ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
3164      *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3165      IF VINTAGE LT PY2 THEN DO;
3166          GP2=YECUM - GP1 + (NPROD/NPRODM)*VPROD/2;
3167          IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
3168          IF B2 LE GP2 THEN QP= 0;
3169      *** PRODUCTION PRORATION FOR OLD VINTAGES;
3170          NPR=(NPROD/NPRODM)*VPROD;
3171          NRATE= NPR/DAYS;
3172          GPE=GP2+ NPR/2;
3173          MAXPROD= NPROD;
3174          MAXRATE= MAXPROD/DAYS;
3175          IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3176          IF B2 LE GPE THEN QE=0;
3177          YECUM= YECUM + NPR;
3178          GP2= YECUM - GP1;
3179          END;
3180
3181      *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3182      NEXTM= MONTH + 1;
3183      DAYSN= 30;
3184      IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
3185          OR NEXTM EQ 7 THEN DAYSN=31;
3186      IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3187      IF NEXTM EQ 2 THEN DO;
3188          DAYSN=28;
3189          IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3190      END;
3191
3192      *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3193      TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
3194          ((B3 - 1)*B1*(1-GP3/B2))*B3;
3195      TIME2=TIME1 + DAYSN;
3196      QE2= (B1*(1-(GP3/B2))*B3)*
3197          (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
3198      GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
3199      NPROD= GP2E - (YECUM - GP1) ;
3200      IF B2 LE 0 THEN NPROD= 0;
3201
3202      *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3203      *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3204      QENW=QENW + NPROD;
3205      TPR= VPROD;
3206      DPR= SPROD1;
3207
3208      OUTPUT;
3209
3210      *** INITIALIZATIONS FOR NEXT MONTH;
3211      *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3212      IF VINTAGE EQ VY1 THEN DO;
3213          VINTAGE=999;
3214          QE= . ;
3215          NPROD= QENW;
3216          B1=.; B2=.; B3=.; YECUM=.;
3217          GP1=.; GPE=.; NPR=.;
3218          QP=.; GP2=.; GP3= . ;
3219          OUTPUT;
3220          END;
3221
3222      DELETE;
3223
3224      /*****
3225      * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
3226      *****/;
3227      PROC SORT DATA=PYR2M10; BY YR DESCENDING VINTAGE;
3228
3229      /*****
3230      * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
3231      * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
3232      * THE SCHEDULE PRODUCTION INFORMATION. *

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3233      * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 11TH MONTH OF 2ND      *
3234      * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.              *
3235      *****/
3236      DATA PYR2M11;
3237      MERGE DYR2M11 PYR2M10; BY YR; *CALC. DIST.  FACTORS*;
3238      RETAIN QENew 0 VPROD SPROD1 NPRODMT ;
3239      KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3240      GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3241
3242      MONTH=11;
3243
3244      *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3245      IF VINTAGE EQ 999 THEN DO;
3246          NPRODMT= NPRODM;
3247          DELETE;
3248      END;
3249
3250      ***** 11TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
3251      *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3252      IF VINTAGE EQ PY2 THEN DO;
3253          GP3=GP1-GPH;
3254          QE= 0;
3255          IF MAXWEL GT 0 THEN
3256              QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
3257      ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3258          NPRODM= QE*DAY;
3259          HPROD=MAXWEL*ARATE*DAY;
3260          NPRODMT=NPRODMT + NPRODM;
3261          VPROD=SPROD;
3262          SPROD1=SPROD;
3263      *** CAPACITY VS DEMAND CHECK;
3264      IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3265      *** PRODUCTION PRORATION FOR NEW VINTAGE;
3266          NPR= (NPRODM/NPRODMT) *VPROD;
3267          NRATE= NPR/DAYS;
3268          MAXPROD= NPRODM;
3269          MAXRATE= MAXPROD/DAYS;
3270          GPH=GPH + HPROD;
3271          PWELLS=WELLS;
3272          QP= QE;
3273          YECUM= YECUM + NPR;
3274          GP1= YECUM;
3275          QP= 0;
3276          OUTPUT;
3277          DELETE;
3278      END;
3279
3280      ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
3281      *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3282      IF VINTAGE LT PY2 THEN DO;
3283          GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
3284          IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;
3285          IF B2 LE GP2 THEN QP= 0;
3286      *** PRODUCTION PRORATION FOR OLD VINTAGES;
3287          NPR= (NPRODM/NPRODMT) *VPROD;
3288          NRATE= NPR/DAYS;
3289          GPE=GP2+ NPR/2;
3290          MAXPROD= NPRODM;
3291          MAXRATE= MAXPROD/DAYS;
3292          IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3293          IF B2 LE GPE THEN QE=0;
3294          YECUM= YECUM + NPR;
3295          GP2= YECUM - GP1;
3296      END;
3297
3298      *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3299      NEXTM= MONTH + 1;
3300      DAYSN= 30;
3301      IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5
3302          OR NEXTM EQ 7 THEN DAYSN=31;
3303      IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3304      IF NEXTM EQ 2 THEN DO;
3305          DAYSN=28;
3306          IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3307      END;
3308
3309      *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3310 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
3311 ((B3 - 1)*B1*(1-GP3/B2)**B3);
3312 TIME2=TIME1 + DAYSN;
3313 QE2= (B1*(1-(GP3/B2))**B3)*
3314 (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
3315 GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
3316 NPRODM= GP2E - (YECUM - GP1) ;
3317 IF B2 LE 0 THEN NPRODM= 0;
3318
3319 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3320 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3321 QENEW=QENEW + NPRODM;
3322 TPR= VPROD;
3323 DPR= SPROD1;
3324
3325 OUTPUT;
3326
3327 *** INITIALIZATIONS FOR NEXT MONTH;
3328 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3329 IF VINTAGE EQ VY1 THEN DO;
3330 VINTAGE=999;
3331 QE= . ;
3332 NPRODM= QENEW;
3333 B1=.; B2=.; B3=.; YECUM=.;
3334 GP1=.; GPH=.; NPR=.;
3335 QP=.; GP2=.; GP3= . ;
3336 OUTPUT;
3337 END;
3338
3339 DELETE;
3340
3341 /*****
3342 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
3343 *****/;
3344 PROC SORT DATA=PYR2M11; BY YR DESCENDING VINTAGE;
3345
3346 /*****
3347 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
3348 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
3349 * THE SCHEDULE PRODUCTION INFORMATION. *
3350 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 12TH MONTH OF 2ND *
3351 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
3352 *****/;
3353 DATA PYR2M12;
3354 MERGE DYR2M12 PYR2M11; BY YR;*CALC. DIST. FACTORS*;
3355 RETAIN QENEW 0 VPROD SPROD1 NPRODMT ;
3356 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3357 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3358
3359 MONTH=12;
3360
3361 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3362 IF VINTAGE EQ 999 THEN DO;
3363 NPRODMT= NPRODM;
3364 DELETE;
3365 END;
3366
3367 ***** 12TH MONTH OF 2ND YEAR OF PROJECTION FOR NEW VINTAGE *****;
3368 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3369 IF VINTAGE EQ PY2 THEN DO;
3370 GP3=GP1-GPH;
3371 QE= 0;
3372 IF MAXWEL GT 0 THEN
3373 QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))**PWB3;
3374 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3375 NPRODM= QE*DAYSN;
3376 HPROD=MAXWEL*ARATE*DAYSN;
3377 NPRODMT=NPRODMT + NPRODM;
3378 VPROD=SPROD;
3379 SPROD1=SPROD;
3380 *** CAPACITY VS DEMAND CHECK;
3381 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3382 *** PRODUCTION PRORATION FOR NEW VINTAGE;
3383 NPR= (NPRODM/NPRODMT) *VPROD;
3384 NRATE= NPR/DAYS;
3385 MAXPROD= NPRODM;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3387     MAXRATE= MAXPROD/DAYS;
3388     GPH=GPH + HPROD;
3389     PWELLS=WELLS;
3390     QP= QE;
3391     YECUM= YECUM + NPR;
3392     GP1= YECUM;
3393     GP3=GP1-GPH;
3394     ***   CALCULATE B1, B2, B3 PARAMETERS FOR 2ND PROJECTION YEAR;
3395     B1=PWB1*MAXWEL;
3396     B2=PWB2*MAXWEL;
3397     B3=PWB3;
3398     QE= B1*(1-GP3/(B2))**B3;
3399
3400     ***   CONVERT NEW VINTAGE CAPACITY TO OLD VINTAGE CAPACITY;
3401     ***   SINCE A NEW PROJECTION YEAR WILL BE STARTING NEXT MONTH;
3402     ***;
3403     ***   GET NUMBER OF DAYS. PERFORM CAPACITY CALCULATIONS;
3404     DAYS= 31;
3405     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
3406     ((B3 - 1)*B1*(1-GP3/B2)**B3);
3407     TIME2=TIME1 + DAYS;
3408     QE2= (B1*(1-(GP3/B2))**B3)*
3409     (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
3410     GP2E= B2*(1 - (QE2/B1)**(1/B3)) - GP3 ;
3411     NPROD= GP2E - (YECUM - GP1);
3412     IF B2 LE 0 THEN NPROD= 0;
3413     ***   GET SUM OF MAX PRODUCTION;
3414     ***   SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3415     QENW=QENW + NPROD;
3416     TPR= VPROD;
3417     DPR= SPROD1;
3418
3419     OUTPUT;
3420     DELETE;
3421     END;
3422
3423     ***** OLD VINTAGES - PRIOR TO 2ND YEAR OF PROJECTION *****;
3424     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3425     IF VINTAGE LT PY2 THEN DO;
3426     GP2=YECUM - GP1 + (NPROD/NPRODM)*VPROD/2;
3427     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))**B3;
3428     IF B2 LE GP2 THEN QP= 0;
3429     ***   PRODUCTION PRORATION FOR OLD VINTAGES;
3430     NPR=(NPROD/NPRODM)*VPROD;
3431     NRATE= NPR/DAYS;
3432     GPE=GP2+ NPR/2;
3433     MAXPROD= NPROD;
3434     MAXRATE= MAXPROD/DAYS;
3435     IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))**B3;
3436     IF B2 LE GPE THEN QE=0;
3437     YECUM= YECUM + NPR;
3438     END;
3439
3440
3441     *** GET NUMBER OF DAYS AND CALCULATE MAX PRODUCTION;
3442     *** (FROM OLD VINTAGES) FOR NEXT MONTH;
3443     DAYS= 31;
3444     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
3445     ((B3 - 1)*B1*(1-GP3/B2)**B3);
3446     TIME2=TIME1 + DAYS;
3447     QE2= (B1*(1-(GP3/B2))**B3)*
3448     (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
3449     GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
3450     NPROD= GP2E - (YECUM - GP1) ;
3451     IF B2 LE 0 THEN NPROD= 0;
3452
3453     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3454     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3455     QENW=QENW + NPROD;
3456     TPR= VPROD;
3457     DPR= SPROD1;
3458
3459     OUTPUT;
3460
3461     *** INITIALIZATIONS FOR NEXT MONTH;
3462     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3463     IF VINTAGE EQ VY1 THEN DO;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3464     VINTAGE=999;
3465     QE= . ;
3466     NPRODM= QENNEW;
3467     B1=.; B2=.; B3=.; YECUM=.;
3468     GP1=.; GPH=.; NPR=.;
3469     QP=.; GP2=.; GP3= . ;
3470     OUTPUT;
3471     END;
3472
3473     DELETE;
3474
3475     /*****
3476     * FOR DEBUG/CHECK PURPOSES.
3477     *****/;
3478     *PROC PRINT; *TITLE 'MONTH 12 2ND YR'; *ID VINTAGE;
3479
3480     /*****
3481     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
3482     *****/;
3483     PROC SORT DATA=PYR2M12; BY YR DESCENDING VINTAGE;
3484
3485     /*****
3486     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
3487     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
3488     * THE SCHEDULE PRODUCTION INFORMATION.
3489     * PERFORM INITIALIZATION FOR NEXT MONTH'S PROJECTION.
3490     *****/;
3491     DATA DATV3;
3492     SET DYR3M01 PYR2M12;
3493     YR=19PY3;
3494
3495     IF VINTAGE EQ PY3 THEN DO;
3496     NPRODM=0;
3497     GP2=0;
3498     QE=0;
3499     END;
3500
3501     /*****
3502     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
3503     *****/;
3504     PROC SORT DATA=DATV3; BY DESCENDING VINTAGE;
3505
3506     /*****
3507     * FOR DEBUG/CHECK PURPOSES.
3508     *****/;
3509     *PROC PRINT; *TITLE 'DATV3';
3510     *PROC PRINT DATA=DYR3M01; *TITLE 'DYR3M01';
3511
3512     /*****
3513     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
3514     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
3515     * THE SCHEDULE PRODUCTION INFORMATION.
3516     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 1ST MONTH OF 3RD
3517     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
3518     *****/;
3519     DATA PYR3M01;
3520     SET DATV3; *CALC THE DISTRIBUTION FACTORS*;
3521     RETAIN QRTOT QENNEW 0 VPROD SPROD1 NPRODMT;
3522     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3523     GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3524
3525     MONTH=1;
3526     DAYS= 31;
3527
3528     *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3529     IF VINTAGE EQ 999 THEN DO;
3530     NPRODMT= NPRODM; DELETE;
3531     END;
3532
3533     ***** 1ST MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
3534     *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3535     IF VINTAGE EQ PY3 THEN DO;
3536     QE=0.5*WLS*PWB1; HPROD=MAXWEL*ARATE*DAYS; GPH=HPROD;
3537     NPRODM=QE*DAYS; NPRODMT=NPRODMT + NPRODM; VPROD=SPROD; SPROD1=SPROD;
3538     *** CAPACITY VS DEMAND CHECK;
3539     IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3540     *** PRODUCTION PRORATION FOR NEW VINTAGE;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3541     NPR= (NPRODM/NPRODMT) *VPROD;NRATE= NPR/DAYS;
3542     MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
3543     QP=QE; YECUM= NPR;GP1=YECUM; GP2= 0;PWELLS=WELLS;GP3=GP1-GPH;
3544     OUTPUT; DELETE; END;
3545
3546     ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
3547     *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3548     IF VINTAGE LT PY3 THEN DO;*** NOTE: 1ST YEAR OF PROJECTION***;
3549         GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
3550     IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
3551     *** PRODUCTION PRORATION FOR OLD VINTAGES;
3552     NPR=(NPRODM/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
3553     MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
3554     IF B2 GT GPE THEN QE=B1*(1-GPE/B2)*B3;
3555     IF B2 LE GPE THEN QE=0;
3556     YECUM= YECUM + NPR;
3557     END;
3558
3559     *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3560     NEXTM= MONTH + 1; DAYSN= 30;
3561     IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
3562     IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3563     IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3564     END;
3565
3566     *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3567     TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
3568         ((B3 - 1)*B1*(1-GP3/B2)*B3);
3569     TIME2=TIME1 + DAYSN;
3570     QE2= (B1*(1-(GP3/B2))*B3)*
3571         (1 + B1*(B3-1)*(1-GP3/B2)*B3 *TIME2 / (B2-GP3))*B3/(1-B3);
3572     GP2E= B2*(1 - (QE2/B1))*B3;
3573     NPRODM= GP2E - (YECUM - GP1);
3574     IF B2 LE 0 THEN NPRODM= 0;
3575
3576     *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3577     *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3578     QENEW=QENEW + NPRODM; TPR= VPROD; DPR= SPROD1;
3579
3580     OUTPUT;
3581
3582     *** INITIALIZATIONS FOR NEXT MONTH;
3583     *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3584     IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPRODM= QENEW;
3585     B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
3586     GP2= . ; GP3= . ; OUTPUT; END;*** 1ST VINT YR ID#;
3587
3588     DELETE;
3589
3590     /*****
3591     * FOR DEBUG/CHECK PURPOSES.
3592     *****/;
3593     *PROC PRINT; *TITLE'MONTH 1 3RD YR'; *ID VINTAGE;
3594
3595     /*****
3596     * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
3597     *****/;
3598     PROC SORT DATA=PYR3M01; BY YR DESCENDING VINTAGE;
3599
3600     /*****
3601     * FOR DEBUG/CHECK PURPOSES.
3602     *****/;
3603     *PROC PRINT; *TITLE'1ST PROJ. MONTH';
3604
3605     /*****
3606     * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
3607     * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
3608     * THE SCHEDULE PRODUCTION INFORMATION.
3609     * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 2ND MONTH OF 3RD
3610     * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
3611     *****/;
3612     DATA PYR3M02;MERGE DYR3M02 PYR3M01;BY YR; *CALC. DIST. FACTORS*;
3613     RETAIN QENEW 0 VPROD SPROD1 NPRODMT ;
3614     KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3615     GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3616
3617     MONTH=2;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3618
3619 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3620 IF VINTAGE EQ 999 THEN DO;
3621   NPRODMT= NPROD; DELETE;
3622 END;
3623
3624 ***** 2ND MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
3625 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3626 IF VINTAGE EQ PY3 THEN DO; *** NOTE: 1ST YEAR OF PROJECTION##;
3627   GP3=GP1-GPH;
3628   QE= 0;
3629 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
3630 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3631   NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
3632   NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
3633 *** CAPACITY VS DEMAND CHECK;
3634   IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3635 *** PRODUCTION PRORATION FOR NEW VINTAGE;
3636   NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
3637   MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
3638   GPH=GPH + HPROD;PWELLS=WELLS;
3639   QP= QE;
3640   YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
3641 OUTPUT; DELETE; END;
3642
3643 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
3644 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3645 IF VINTAGE LT PY3 THEN DO;
3646   GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
3647 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
3648 *** PRODUCTION PRORATION FOR OLD VINTAGES;
3649   NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
3650   MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
3651 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3652 IF B2 LE GPE THEN QE=0;
3653   YECUM= YECUM + NPR;GP2= YECUM - GP1;
3654 END;
3655
3656 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3657 NEXTM= MONTH + 1; DAYSN= 30;
3658 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
3659 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3660 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3661 END;
3662
3663 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3664 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
3665   ((B3 - 1)*B1*(1-GP3/B2))*B3;
3666 TIME2=TIME1 + DAYSN;
3667 QE2= (B1*(1-(GP3/B2))*B3)*
3668   (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
3669 GP2E= B2*(1 - (QE2/B1))*B3/(1-B3)) ;
3670 NPROD= GP2E - (YECUM - GP1) ;
3671 IF B2 LE 0 THEN NPROD= 0;
3672
3673 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3674 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3675 QENEW=QENEW + NPROD; TPR= VPROD; DPR= SPROD1;
3676
3677 OUTPUT;
3678
3679 *** INITIALIZATIONS FOR NEXT MONTH;
3680 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3681 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QENEW;
3682 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
3683 GP2= . ; GP3= . ; OUTPUT; END;*** 1ST VINT YR ID#;
3684
3685 DELETE;
3686
3687 /*****
3688 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
3689 *****/
3690 PROC SORT DATA=PYR3M02; BY YR DESCENDING VINTAGE;
3691
3692 /*****
3693 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
3694 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3695 * THE SCHEDULE PRODUCTION INFORMATION. *
3696 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 3RD MONTH OF 3RD *
3697 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
3698 *****/;
3699 DATA PYR3M03;MERGE DYR3M03 PYR3M02;BY YR;*CALC. DIST. FACTORS*;
3700 RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
3701 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3702 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
3703
3704 MONTH=3;
3705
3706 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3707 IF VINTAGE EQ 999 THEN DO;
3708 NPRODMT= NPROD; DELETE;
3709 END;
3710
3711 ***** 3RD MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
3712 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3713 IF VINTAGE EQ PY3 THEN DO;
3714 GP3=GP1-GPH;
3715 QE= 0;
3716 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
3717 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3718 NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
3719 NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
3720 *** CAPACITY VS DEMAND CHECK;
3721 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3722 *** PRODUCTION PRORATION FOR NEW VINTAGE;
3723 NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
3724 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
3725 GPH=GPH + HPROD;PWELLS=WELLS;
3726 QP= QE;
3727 YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
3728 OUTPUT; DELETE; END;
3729
3730 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
3731 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3732 IF VINTAGE LT PY3 THEN DO;*** NOTE: 1ST YEAR OF PROJECTION**
3733 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
3734 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
3735 *** PRODUCTION PRORATION FOR OLD VINTAGES;
3736 NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
3737 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
3738 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3739 IF B2 LE GPE THEN QE=0;
3740 YECUM= YECUM + NPR;GP2= YECUM - GP1;
3741 END;
3742
3743 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3744 NEXTM= MONTH + 1; DAYSN= 30;
3745 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
3746 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3747 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3748 END;
3749
3750 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3751 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
3752 ((B3 - 1)*B1*(1-GP3/B2))*B3;
3753 TIME2=TIME1 + DAYSN;
3754 QE2= (B1*(1-(GP3/B2))*B3)*
3755 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
3756 GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
3757 NPROD= GP2E - (YECUM - GP1) ;
3758 IF B2 LE 0 THEN NPROD= 0;
3759
3760 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3761 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;
3762 QNEW=QNEW + NPROD; TPR= VPROD; DPR= SPROD1;
3763
3764 OUTPUT;
3765
3766 *** INITIALIZATIONS FOR NEXT MONTH;
3767 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3768 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QNEW;
3769 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
3770 GP2= . ; GP3= . ; OUTPUT; END;*** 1ST VINT YR ID#;
3771

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3772 DELETE;
3773
3774 /*****
3775  * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.
3776  *****/;
3777 PROC SORT DATA=PYR3M03; BY YR DESCENDING VINTAGE;
3778
3779 /*****
3780  * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,
3781  * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND
3782  * THE SCHEDULE PRODUCTION INFORMATION.
3783  * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 4TH MONTH OF 3RD
3784  * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.
3785  *****/;
3786 DATA PYR3M04;MERGE DYR3M04 PYR3M03;BY YR;*CALC. DIST. FACTORS*;
3787 RETAIN QNEW 0 VPROD SPROD1 NPRODMT;
3788 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3789 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
3790
3791 MONTH=4;
3792
3793 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3794 IF VINTAGE EQ 999 THEN DO;
3795 NPRODMT= NPROD; DELETE;
3796 END;
3797
3798 ***** 4TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
3799 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3800 IF VINTAGE EQ PY3 THEN DO;## NOTE: 1ST YEAR OF PROJECTION##;
3801 GP3=GP1-GPH;
3802 QE= 0;
3803 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
3804 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3805 NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
3806 NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
3807 *** CAPACITY VS DEMAND CHECK;
3808 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3809 *** PRODUCTION PRORATION FOR NEW VINTAGE;
3810 NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
3811 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
3812 GPH=GPH + HPROD;PWELLS=WELLS;
3813 QP= QE;
3814 YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
3815 OUTPUT; DELETE; END;
3816
3817 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
3818 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3819 IF VINTAGE LT PY3 THEN DO;
3820 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
3821 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
3822 *** PRODUCTION PRORATION FOR OLD VINTAGES;
3823 NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
3824 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
3825 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3826 IF B2 LE GPE THEN QE=0;
3827 YECUM= YECUM + NPR;GP2= YECUM - GP1;
3828 END;
3829
3830 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3831 NEXTM= MONTH + 1; DAYSN= 30;
3832 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
3833 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3834 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3835 END;
3836
3837 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3838 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
3839 ((B3 - 1)*B1*(1-GP3/B2))*B3;
3840 TIME2=TIME1 + DAYSN;
3841 QE2= (B1*(1-(GP3/B2))*B3)*
3842 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
3843 GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
3844 NPROD= GP2E - (YECUM - GP1) ;
3845 IF B2 LE 0 THEN NPROD= 0;
3846
3847 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES;
3848 *** SAVE PROJECTED AND SCHEDULED PRODUCTION VALUES;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3849 QENew=QENew + NPROD; TPR= VPROD; DPR= SPROD1;
3850
3851 OUTPUT;
3852
3853 *** INITIALIZATIONS FOR NEXT MONTH;
3854 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3855 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QENew;
3856 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
3857 GP2= . ; GP3= . ; OUTPUT; END;*** 1ST VINT YR ID#;
3858
3859 DELETE;
3860
3861 /*****
3862 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
3863 *****/
3864 PROC SORT DATA=PYR3M04; BY YR DESCENDING VINTAGE;
3865
3866 /*****
3867 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
3868 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
3869 * THE SCHEDULE PRODUCTION INFORMATION. *
3870 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 5TH MONTH OF 3RD *
3871 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
3872 *****/
3873 DATA PYR3M05;MERGE DYR3M05 PYR3M04;BY YR;*CALC. DIST. FACTORS*;
3874 RETAIN QENew 0 VPROD SPROD1 NPROD;
3875 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3876 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
3877
3878 MONTH=5;
3879
3880 *** GET FIRST VALUE OF NPROD - CAPACITY OF ALL PREVIOUS VINTAGES;
3881 IF VINTAGE EQ 999 THEN DO;
3882 NPROD= NPROD; DELETE;
3883 END;
3884
3885 ***** 5TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
3886 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3887 IF VINTAGE EQ PY3 THEN DO;*** NOTE: 1ST YEAR OF PROJECTION***;
3888 GP3=GP1-GPH;
3889 QE= 0;
3890 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
3891 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3892 NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
3893 NPROD=NPROD + NPROD; VPROD=SPROD; SPROD1=SPROD;
3894 *** CAPACITY VS DEMAND CHECK;
3895 IF SPROD GT NPROD THEN VPROD= NPROD;
3896 *** PRODUCTION PRORATION FOR NEW VINTAGE;
3897 NPR= (NPROD/NPROD)*VPROD;NRATE= NPR/DAY;
3898 MAXPROD= NPROD; MAXRATE= MAXPROD/DAY;
3899 GPH=GPH + HPROD;PWELLS=WELLS;
3900 QP= QE;
3901 YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
3902 OUTPUT; DELETE; END;
3903
3904 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
3905 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3906 IF VINTAGE LT PY3 THEN DO;
3907 GP2=YECUM - GP1 + (NPROD/NPROD)*VPROD/2;
3908 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
3909 *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
3910 NPR=(NPROD/NPROD)*VPROD;NRATE= NPR/DAY;GPE=GP2+ NPR/2;
3911 MAXPROD= NPROD; MAXRATE= MAXPROD/DAY;
3912 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
3913 IF B2 LE GPE THEN QE=0;
3914 YECUM= YECUM + NPR;GP2= YECUM - GP1;
3915 END;
3916
3917 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
3918 NEXTM= MONTH + 1; DAYSN= 30;
3919 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
3920 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
3921 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
3922 END;
3923
3924 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
3925 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

3926      ((B3 - 1)*B1*(1-GP3/B2)**B3);
3927      TIME2=TIME1 + DAYSN;
3928      QE2= (B1*(1-(GP3/B2))**B3)*
3929      (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**(B3/(1-B3));
3930      GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
3931      NPRODM= GP2E - (YECUM - GP1) ;
3932      IF B2 LE 0 THEN NPRODM= 0;
3933
3934      *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QENNEW);
3935      *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
3936      QENNEW=QENNEW + NPRODM; TPR= VPROD; DPR= SPROD1;
3937
3938      OUTPUT;
3939
3940      *** INITIALIZATIONS FOR NEXT MONTH;
3941      *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
3942      IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPRODM= QENNEW;
3943      B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
3944      GP2= . ; GP3= . ; OUTPUT; END;### 1ST VINT YR ID#;
3945
3946      DELETE;
3947
3948      /*****
3949      * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR.      *
3950      *****/
3951      PROC SORT DATA=PYR3M05; BY YR DESCENDING VINTAGE;
3952
3953      /*****
3954      * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES,      *
3955      * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND      *
3956      * THE SCHEDULE PRODUCTION INFORMATION.      *
3957      * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 6TH MONTH OF 3RD      *
3958      * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK.      *
3959      *****/
3960      DATA PYR3M06;MERGE DYR3M06 PYR3M05;BY YR;CALC. DIST.  FACTORS*;
3961      RETAIN QENNEW 0 VPROD SPROD1 NPRODMT ;
3962      KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
3963      GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
3964
3965      MONTH=6;
3966
3967      *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
3968      IF VINTAGE EQ 999 THEN DO;
3969      NPRODMT= NPRODM; DELETE;
3970      END;
3971
3972      ***** 6TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
3973      *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
3974      IF VINTAGE EQ PY3 THEN DO;### NOTE: 1ST YEAR OF PROJECTION##;
3975      GP3=GP1-GPH;
3976      QE= 0;
3977      IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))**PWB3;
3978      ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
3979      NPRODM= QE*DAYN; HPROD=MAXWEL*ARATE*DAYN;
3980      NPRODMT=NPRODMT + NPRODM; VPROD=SPROD; SPROD1=SPROD;
3981      *** CAPACITY VS DEMAND CHECK;
3982      IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
3983      *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
3984      NPR= (NPRODM/NPRODMT) *VPROD;NRATE= NPR/DAYS;
3985      MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
3986      GPH=GPH + HPROD;PWELLS=PWELLS;
3987      QP= QE;
3988      YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
3989      OUTPUT; DELETE; END;
3990
3991      ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
3992      *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
3993      IF VINTAGE LT PY3 THEN DO;### NOTE: 1ST YEAR OF PROJECTION##;
3994      GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
3995      IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))**B3;IF B2 LE GP2 THEN QP= 0;
3996      *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
3997      NPR=(NPRODM/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
3998      MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
3999      IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))**B3;
4000      IF B2 LE GPE THEN QE=0;
4001      YECUM= YECUM + NPR;GP2= YECUM - GP1;
4002      END;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4003
4004 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
4005 NEXTM= MONTH + 1; DAYSN= 30;
4006 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
4007 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
4008 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
4009 END;
4010
4011 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
4012 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))*((1-B3)/B3)) - 1) /
4013 ((B3 - 1)*B1*(1-GP3/B2)**B3);
4014 TIME2=TIME1 + DAYSN;
4015 QE2= (B1*(1-(GP3/B2))**B3)*
4016 (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
4017 GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
4018 NPROD= GP2E - (YECUM - GP1) ;
4019 IF B2 LE 0 THEN NPROD= 0;
4020
4021 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QNEW);
4022 *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4023 QNEW=QNEW + NPROD; TPR= VPROD; DPR= SPROD1;
4024
4025 OUTPUT;
4026
4027 *** INITIALIZATIONS FOR NEXT MONTH;
4028 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4029 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QNEW;
4030 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
4031 GP2= . ; GP3= . ; OUTPUT; END;### 1ST VINT YR ID#;
4032
4033 DELETE;
4034
4035 /*****
4036 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
4037 *****/
4038 PROC SORT DATA=PYR3M06; BY YR DESCENDING VINTAGE;
4039
4040 /*****
4041 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
4042 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
4043 * THE SCHEDULE PRODUCTION INFORMATION. *
4044 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 7TH MONTH OF 3RD *
4045 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
4046 *****/
4047 DATA PYR3M07;MERGE DYR3M07 PYR3M06;BY YR; *CALC. DIST. FACTORS*;
4048 RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
4049 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
4050 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
4051
4052 MONTH=7;
4053
4054 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
4055 IF VINTAGE EQ 999 THEN DO;
4056 NPRODMT= NPROD; DELETE;
4057 END;
4058
4059 ***** 7TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
4060 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
4061 IF VINTAGE EQ PY3 THEN DO;### NOTE: 1ST YEAR OF PROJECTION###;
4062 GP3=GP1-GPH;
4063 QE= 0;
4064 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
4065 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
4066 NPROD= QE*DAYSN; HPROD=MAXWEL*ARATE*DAYSN;
4067 NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
4068 *** CAPACITY VS DEMAND CHECK;
4069 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
4070 *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
4071 NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYSN;
4072 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYSN;
4073 GPH=GPH + HPROD;PWELLS=PWELLS;
4074 QP= QE;
4075 YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
4076 OUTPUT; DELETE; END;
4077
4078 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
4079 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4080 IF VINTAGE LT PY3 THEN DO;*** NOTE: 1ST YEAR OF PROJECTION***;
4081 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
4082 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
4083 *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
4084 NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
4085 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
4086 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
4087 IF B2 LE GPE THEN QE=0;
4088 YECUM= YECUM + NPR;GP2= YECUM - GP1;
4089 END;
4090
4091 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
4092 NEXTM= MONTH + 1; DAYSN= 30;
4093 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
4094 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
4095 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
4096 END;
4097
4098 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
4099 TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
4100 ((B3 - 1)*B1*(1-GP3/B2))*B3);
4101 TIME2=TIME1 + DAYSN;
4102 QE2= (B1*(1-(GP3/B2))*B3)*
4103 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
4104 GP2E= B2*(1 - (QE2/B1))*B3/(1-B3) ;
4105 NPROD= GP2E - (YECUM - GP1) ;
4106 IF B2 LE 0 THEN NPROD= 0;
4107
4108 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QNEW);
4109 *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4110 QNEW=QNEW + NPROD; TPR= VPROD; DPR= SPROD1;
4111
4112 OUTPUT;
4113
4114 *** INITIALIZATIONS FOR NEXT MONTH;
4115 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4116 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QNEW;
4117 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
4118 GP2= . ; GP3= . ; OUTPUT; END;*** 1ST VINT YR ID#;
4119
4120 DELETE;
4121
4122 /*****
4123 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
4124 *****/
4125 PROC SORT DATA=PYR3M07; BY YR DESCENDING VINTAGE;
4126
4127 /*****
4128 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
4129 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
4130 * THE SCHEDULE PRODUCTION INFORMATION. *
4131 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 8TH MONTH OF 3RD *
4132 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
4133 *****/
4134 DATA PYR3M08;MERGE DYR3M08 PYR3M07;BY YR;*CALC. DIST. FACTORS*;
4135 RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
4136 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
4137 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
4138
4139 MONTH=8;
4140
4141 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
4142 IF VINTAGE EQ 999 THEN DO;
4143 NPRODMT= NPROD; DELETE;
4144 END;
4145
4146 ***** 8TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
4147 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
4148 IF VINTAGE EQ PY3 THEN DO;
4149 GP3=GP1-GPH;
4150 QE= 0;
4151 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
4152 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
4153 NPROD= QE*DAYS; HPROD=MAXWEL*ARATE*DAYS;
4154 NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
4155 *** CAPACITY VS DEMAND CHECK;
4156 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4157 *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
4158 NPR= (NPRODM/NPRODMT) *VPROD;NRATE= NPR/DAYS;
4159 MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
4160 GPH=GPH + HPROD;PWELLS=WELLS;
4161 QP= QE;
4162 YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
4163 OUTPUT; DELETE; END;
4164
4165 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
4166 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
4167 IF VINTAGE LT PY3 THEN DO;
4168 GP2=YECUM - GP1 + (NPRODM/NPRODMT)*VPROD/2;
4169 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))**B3;IF B2 LE GP2 THEN QP= 0;
4170 *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
4171 NPR=(NPRODM/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
4172 MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
4173 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))**B3;
4174 IF B2 LE GPE THEN QE=0;
4175 YECUM= YECUM + NPR;GP2= YECUM - GP1;
4176 END;
4177
4178 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
4179 NEXTM= MONTH + 1; DAYSN= 30;
4180 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
4181 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
4182 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
4183 END;
4184
4185 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
4186 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
4187 ((B3 - 1)*B1*(1-GP3/B2)**B3);
4188 TIME2=TIME1 + DAYSN;
4189 QE2= (B1*(1-(GP3/B2))**B3)*
4190 (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
4191 GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
4192 NPRODM= GP2E - (YECUM - GP1) ;
4193 IF B2 LE 0 THEN NPRODM= 0;
4194
4195 *** SUM OF MAX PRODUCTIC' FOR NEXT MONTH OVER ALL VINTAGES (QENEW);
4196 *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4197 QENEW=QENEW + NPRODM; TPR= VPROD; DPR= SPROD1;
4198
4199 OUTPUT;
4200
4201 *** INITIALIZATIONS FOR NEXT MONTH;
4202 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4203 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPRODM= QENEW;
4204 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
4205 GP2= . ; GP3= . ; OUTPUT; END;### 1ST VINT YR ID#;
4206
4207 DELETE;
4208
4209 /*****
4210 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
4211 *****/
4212 PROC SORT DATA=PYR3M08; BY YR DESCENDING VINTAGE;
4213
4214 /*****
4215 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
4216 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
4217 * THE SCHEDULE PRODUCTION INFORMATION. *
4218 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 9TH MONTH OF 3RD *
4219 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
4220 *****/
4221 DATA PYR3M09;MERGE DYR3M09 PYR3M08;BY YR;*CALC. DIST. FACTORS*;
4222 RETAIN QENEW 0 VPROD SPROD1 NPRODMT ;
4223 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
4224 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPRODM;
4225
4226 MONTH=9;
4227
4228 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
4229 IF VINTAGE EQ 999 THEN DO;
4230 NPRODMT= NPRODM; DELETE;
4231 END;
4232
4233 ***** 9TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4234 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
4235 IF VINTAGE EQ PY3 THEN DO;
4236   GP3=GP1-GPH;
4237   QE= 0;
4238 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
4239 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
4240   NPRODM= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
4241   NPRODMT=NPRODMT + NPRODM; VPROD=SPROD; SPROD1=SPROD;
4242 *** CAPACITY VS DEMAND CHECK;
4243   IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
4244 *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
4245   NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
4246   MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
4247   GPH=GPH + HPROD;PWELLS=WELLS;
4248   QP= QE;
4249   YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
4250 OUTPUT; DELETE; END;
4251
4252 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
4253 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
4254 IF VINTAGE LT PY3 THEN DO;
4255   GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
4256 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
4257 *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
4258   NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
4259   MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
4260 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
4261 IF B2 LE GPE THEN QE=0;
4262   YECUM= YECUM + NPR;GP2= YECUM - GP1;
4263 END;
4264
4265 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
4266   NEXTM= MONTH + 1; DAYSN= 30;
4267 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
4268 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
4269 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
4270 END;
4271
4272 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
4273 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
4274   ((B3 - 1)*B1*(1-GP3/B2))*B3);
4275   TIME2=TIME1 + DAYSN;
4276   QE2= (B1*(1-(GP3/B2))*B3)*
4277   (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
4278   GP2E= B2*(1 - (QE2/B1))*B3/(1-B3)) ;
4279   NPROD= GP2E - (YECUM - GP1) ;
4280 IF B2 LE 0 THEN NPROD= 0;
4281
4282 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QENW);
4283 *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4284 QENW=QENW + NPROD; TPR= VPROD; DPR= SPROD1;
4285
4286 OUTPUT;
4287
4288 *** INITIALIZATIONS FOR NEXT MONTH;
4289 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4290 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QENW;
4291 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
4292 GP2= . ; GP3= . ; OUTPUT; END;## 1ST VINT YR ID#;
4293
4294 DELETE;
4295
4296 /*****
4297 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
4298 *****/;
4299 PROC SORT DATA=PYR3M09; BY YR DESCENDING VINTAGE;
4300
4301 /*****
4302 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
4303 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
4304 * THE SCHEDULE PRODUCTION INFORMATION. *
4305 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 10TH MONTH OF 3RD *
4306 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
4307 *****/;
4308 DATA PYR3M10;MERGE DYR3M10 PYR3M09;BY YR;*CALC. DIST. FACTORS*;
4309 RETAIN QENW 0 VPROD SPROD1 NPRODMT ;
4310 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4311      GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
4312
4313      MONTH=10;
4314
4315      *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
4316      IF VINTAGE EQ 999 THEN DO;
4317          NPRODMT= NPROD; DELETE;
4318      END;
4319
4320      ***** 10TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
4321      *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
4322      IF VINTAGE EQ PY3 THEN DO;
4323          GP3=GP1-GPH;
4324          QE= 0;
4325          IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
4326          ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
4327          NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
4328          NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
4329          *** CAPACITY VS DEMAND CHECK;
4330          IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
4331          *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
4332          NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
4333          MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
4334          GPH=GPH + HPROD;PWELLS=WELLS;
4335          QP= QE;
4336          YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
4337          OUTPUT; DELETE; END;
4338
4339      ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
4340      *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
4341      IF VINTAGE LT PY3 THEN DO;
4342          GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
4343          IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
4344          *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
4345          NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
4346          MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
4347          IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
4348          IF B2 LE GPE THEN QE=0;
4349          YECUM= YECUM + NPR;GP2= YECUM - GP1;
4350      END;
4351
4352      *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
4353      NEXTM= MONTH + 1; DAYSN= 30;
4354      IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
4355      IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
4356      IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
4357      END;
4358
4359      *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
4360      TIME1=(B2-GP3)*((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3) - 1) /
4361      ((B3 - 1)*B1*(1-GP3/B2))*B3 ;
4362      TIME2=TIME1 + DAYSN;
4363      QE2= (B1*(1-(GP3/B2))*B3)*
4364      (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*((B3/(1-B3)));
4365      GP2E= B2*(1 - (QE2/B1))*((1/B3)) ;
4366      NPROD= GP2E - (YECUM - GP1) ;
4367      IF B2 LE 0 THEN NPROD= 0;
4368
4369      *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QENNEW);
4370      *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4371      QENNEW=QENNEW + NPROD; TPR= VPROD; DPR= SPROD1;
4372
4373      OUTPUT;
4374
4375      *** INITIALIZATIONS FOR NEXT MONTH;
4376      *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4377      IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QENNEW;
4378      B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
4379      GP2= . ; GP3= . ; OUTPUT; END;### 1ST VINT YR ID#;
4380
4381      DELETE;
4382
4383      /*****
4384      * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
4385      *****/
4386      PROC SORT DATA=PYP3M10; BY YR DESCENDING VINTAGE;
4387

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4388 /*****
4389 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
4390 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
4391 * THE SCHEDULE PRODUCTION INFORMATION. *
4392 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 11TH MONTH OF 3RD *
4393 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
4394 *****/;
4395 DATA PYR3M11;MERGE DYR3M11 PYR3M10;BY YR;*CALC. DIST. FACTORS*;
4396 RETAIN QENW 0 VPROD SPROD1 NPRODMT ;
4397 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
4398 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
4399
4400 MONTH=11;
4401
4402 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
4403 IF VINTAGE EQ 999 THEN DO;
4404 NPRODMT= NPROD; DELETE;
4405 END;
4406
4407 ***** 11TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
4408 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
4409 IF VINTAGE EQ PY3 THEN DO;
4410 GP3=GP1-GPH;
4411 QE= 0;
4412 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
4413 ** IF QE GT (MAXWEL*PWB1) THEN QE= MAXWEL*PWB1;
4414 NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
4415 NPRODMT=NPRODMT + NPROD; VPROD=SPROD; SPROD1=SPROD;
4416 *** CAPACITY VS DEMAND CHECK;
4417 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
4418 *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
4419 NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAY;
4420 MAXPROD= NPROD; MAXRATE= MAXPROD/DAY;
4421 GPH=GPH + HPROD;PWELLS=WELLS;
4422 QP= QE;
4423 YECUM= YECUM + NPR; GP1= YECUM; QE= 0;
4424 OUTPUT; DELETE; END;
4425
4426 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
4427 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
4428 IF VINTAGE LT PY3 THEN DO;
4429 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
4430 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
4431 *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
4432 NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAY;GPE=GP2+ NPR/2;
4433 MAXPROD= NPROD; MAXRATE= MAXPROD/DAY;
4434 IF B2 GT GPE THEN QE=B1*(1-GPE/(B2))*B3;
4435 IF B2 LE GPE THEN QE=0;
4436 YECUM= YECUM + NPR;GP2= YECUM - GP1;
4437 END;
4438
4439 *** CALCULATE NUMBER OF DAYS IN NEXT MONTH FOR PSEUDO TIME CALC;
4440 NEXTM= MONTH + 1; DAYSN= 30;
4441 IF NEXTM EQ 1 OR NEXTM EQ 3 OR NEXTM EQ 5 OR NEXTM EQ 7 THEN DAYSN=31;
4442 IF NEXTM EQ 8 OR NEXTM EQ 10 OR NEXTM EQ 12 THEN DAYSN=31;
4443 IF NEXTM EQ 2 THEN DO;DAYSN=28;IF (INT(YR/4) * 4) EQ YR THEN DAYSN=29;
4444 END;
4445
4446 *** CALCULATE MAX PRODUCTION (FROM OLD VINTAGES) FOR NEXT MONTH;
4447 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
4448 ((B3 - 1)*B1*(1-GP3/B2))*B3;
4449 TIME2=TIME1 + DAYSN;
4450 QE2= (B1*(1-(GP3/B2))*B3)*
4451 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
4452 GP2E= B2*(1 - (QE2/B1))*B3;
4453 NPROD= GP2E - (YECUM - GP1) ;
4454 IF B2 LE 0 THEN NPROD= 0;
4455
4456 *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QENW);
4457 *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4458 QENW=QENW + NPROD; TPR= VPROD; DPR= SPROD1;
4459
4460 OUTPUT;
4461
4462 *** INITIALIZATIONS FOR NEXT MONTH;
4463 *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4464 IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPROD= QENW;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4465 B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ; GPH= . ; NPR= . ; QP= . ;
4466 GP2= . ; GP3= . ; OUTPUT; END;### 1ST VINT YR ID#;
4467
4468 DELETE;
4469
4470 /*****
4471 * SORT DATA BY PRODUCTION YEAR AND DESCENDING VINTAGE YEAR. *
4472 *****/;
4473 PROC SORT DATA=PYR3M11; BY YR DESCENDING VINTAGE;
4474
4475 /*****
4476 * BRING IN YEAR-END PRODUCTION INFORMATION FROM OLD VINTAGES, *
4477 * MONTH-END PRODUCTION INFO FROM LAST MONTH'S PROJECTION, AND *
4478 * THE SCHEDULE PRODUCTION INFORMATION. *
4479 * CALCULATE PRODUCTION AND PRODUCTION CUMS FOR 12TH MONTH OF 3RD *
4480 * PROJECTION YEAR BASED ON THE CAPACITY VS. DEMAND CHECK. *
4481 *****/;
4482 DATA PYR3M12;MERGE DYR3M12 PYR3M11;BY YR;*CALC. DIST. FACTORS*;
4483 RETAIN QNEW 0 VPROD SPROD1 NPRODMT ;
4484 KEEP VINTAGE YR MONTH B1 B2 B3 YECUM PWELLS
4485 GP1 GP2 GP3 GPH NPR NRATE MAXPROD MAXRATE TPR DPR QE QP NPROD;
4486
4487 MONTH=12;
4488
4489 *** GET FIRST VALUE OF NPRODMT - CAPACITY OF ALL PREVIOUS VINTAGES;
4490 IF VINTAGE EQ 999 THEN DO;
4491 NPRODMT= NPROD; DELETE;
4492 END;
4493
4494 ***** 12TH MONTH OF 3RD YEAR OF PROJECTION FOR NEW VINTAGE *****;
4495 *** PERFORM PROJECTED PRODUCTION CHECK AND CALCULATIONS;
4496 IF VINTAGE EQ PY3 THEN DO;
4497 GP3=GP1-GPH;
4498 QE= 0;
4499 IF MAXWEL GT 0 THEN QE=(0.5*WLS+LWELL)*PWB1*(1-GP3/(PWB2*MAXWEL))*PWB3;
4500 NPROD= QE*DAY; HPROD=MAXWEL*ARATE*DAY;
4501 NPRODMT=NPROD + NPROD; VPROD=SPROD; SPROD1=SPROD;
4502 *** CAPACITY VS DEMAND CHECK;
4503 IF SPROD GT NPRODMT THEN VPROD= NPRODMT;
4504 *** PRODUCTION PRORATION (NPR) FOR NEW VINTAGE;
4505 NPR= (NPROD/NPRODMT) *VPROD;NRATE= NPR/DAYS;
4506 MAXPROD= NPROD; MAXRATE= MAXPROD/DAYS;
4507 GPH=GPH + HPROD;PWELLS=WELLS;
4508 QP= QE;
4509 YECUM= YECUM + NPR;GP1=YECUM; GP3=GP1-GPH;
4510 *** CALCULATE B1, B2, B3 PARAMETERS FOR 2ND PROJECTION YEAR;
4511 B1=PWB1*MAXWEL; B2=PWB2* MAXWEL; B3=PWB3;
4512 QE= B1*(1-GP3/(B2))*B3;
4513
4514 *** CONVERT NEW VINTAGE CAPACITY TO OLD VINTAGE CAPACITY;
4515 *** SINCE A NEW PROJECTION YEAR WILL BE STARTING NEXT MONTH;
4516 ***;
4517 *** GET NUMBER OF DAYS. PERFORM CAPACITY CALCULATIONS;
4518 DAYSN= 31;
4519 TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2))*B3))*((1-B3)/B3)) - 1) /
4520 ((B3 - 1)*B1*(1-GP3/B2))*B3);
4521 TIME2=TIME1 + DAYSN;
4522 QE2= (B1*(1-(GP3/B2))*B3)*
4523 (1 + B1*(B3-1)*(1-GP3/B2))*B3 *TIME2 / (B2-GP3))*B3/(1-B3));
4524 GP2E= B2*(1 - (QE2/B1))*B3 - GP3 ;
4525 NPROD= GP2E - (YECUM - GP1);
4526 IF B2 LE 0 THEN NPROD= 0;
4527
4528 *** SUM OF MAX PRODUCTION (QNEW);
4529 *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4530 QNEW=QNEW + NPROD; TPR= VPROD; DPR= SPROD1;
4531
4532 OUTPUT; DELETE;END;
4533
4534 ***** OLD VINTAGES - PRIOR TO 3RD YEAR OF PROJECTION *****;
4535 *** END-OF-MONTH CALCULATIONS FOR NEXT MONTH'S CAPACITY;
4536 IF VINTAGE LT PY3 THEN DO;
4537 GP2=YECUM - GP1 + (NPROD/NPRODMT)*VPROD/2;
4538 IF B2 GT GP2 THEN QP=B1*(1-GP2/(B2))*B3;IF B2 LE GP2 THEN QP= 0;
4539 *** PRODUCTION PRORATION (NPR) FOR OLD VINTAGES;
4540 NPR=(NPROD/NPRODMT)*VPROD;NRATE= NPR/DAYS;GPE=GP2+ NPR/2;
4541

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4542      MAXPROD= NPRODM; MAXRATE= MAXPROD/DAYS;
4543      IF B2 GT GPE THEN QE=B1*(1-GPE/B2)**B3;
4544      IF B2 LE GPE THEN QE=0;
4545      YECUM= YECUM + NPR;
4546      END;
4547
4548      *** GET NUMBER OF DAYS. PERFORM CAPACITY CALCULATIONS;
4549      DAYS= 31;
4550      TIME1=(B2-GP3)*(((QE/(B1*(1-GP3/B2)**B3))**((1-B3)/B3)) - 1) /
4551      ((B3 - 1)*B1*(1-GP3/B2)**B3);
4552      TIME2=TIME1 + DAYS;
4553      QE2= (B1*(1-(GP3/B2))**B3)*
4554      (1 + B1*(B3-1)*(1-GP3/B2)**B3 *TIME2 / (B2-GP3))**((B3/(1-B3)));
4555      GP2E= B2*(1 - (QE2/B1)**(1/B3)) ;
4556      NPRODM= GP2E - (YECUM - GP1);
4557      IF B2 LE 0 THEN NPRODM= 0;
4558
4559      *** SUM OF MAX PRODUCTION FOR NEXT MONTH OVER ALL VINTAGES (QENW);
4560      *** SAVE PROJECTED (TPR) AND SCHEDULED PRODUCTION (DPR) VALUES;
4561      QENW=QENW + NPRODM; TPR= VPROD; DPR= SPROD1;
4562
4563      OUTPUT;
4564
4565      *** INITIALIZATIONS FOR NEXT MONTH;
4566      *** VINTAGE=999 DENOTES SUM OF ALL VINTAGES' CAPACITY OF MONTH;
4567      IF VINTAGE EQ VY1 THEN DO;VINTAGE=999;QE= . ;NPRODM= QENW;
4568      B1= . ; B2= . ; B3= . ; YECUM= . ; GP1= . ;GPH= . ;NPR= . ;QP= . ;
4569      GP2= . ; GP3= . ; OUTPUT; END;### 1ST VINT YR ID#;
4570
4571      DELETE;
4572
4573      /*****
4574      * FOR DEBUG/CHECK PURPOSES
4575      *****/;
4576      *PROC PRINT; *TITLE 'MONTH 12 3RD YR'; *ID VINTAGE;
4577
4578      /*****
4579      * CONCATENATE PROJECTION INFORMATION FROM ALL YEARS AND MONTHS *
4580      *****/;
4581      DATA DAT2A;
4582      SET PYR1M01 PYR1M02 PYR1M03 PYR1M04 PYR1M05 PYR1M06
4583      PYR1M07 PYR1M08 PYR1M09 PYR1M10 PYR1M11 PYR1M12
4584      PYR2M01 PYR2M02 PYR2M03 PYR2M04 PYR2M05 PYR2M06
4585      PYR2M07 PYR2M08 PYR2M09 PYR2M10 PYR2M11 PYR2M12
4586      PYR3M01 PYR3M02 PYR3M03 PYR3M04 PYR3M05 PYR3M06
4587      PYR3M07 PYR3M08 PYR3M09 PYR3M10 PYR3M11 PYR3M12 ;
4588
4589      KEEP VINTAGE YR MONTH NRATE QP PERCN PERCQ PRATE ORATE MAXPROD MAXRATE
4590      YECUM GP1 GP2 GP3 B1 B2 B3 NPR TPR DPR PWELLS;
4591
4592      *** CALCULATE PRODUCTION PERCENTAGES;
4593      IF MAXPROD GT 0 THEN PERCN= 100*NPR/MAXPROD;
4594      IF MAXRATE GT 0 THEN PERCQ= 100*NRATE/MAXRATE;
4595      *** SAVE OLD PRODUCTION RATE AND CURRENT MAX PEAK RATE;
4596      ORATE= NRATE;
4597      PRATE= MAXRATE;
4598      *** ELLIMINATE VINTAGE SUMMATION (COMPOSITE) RECORDS;
4599      IF VINTAGE EQ 999 THEN DELETE;
4600      GP2= YECUM-GP1;
4601
4602      PROC DELETE DATA=
4603      PYR1M01 PYR1M02 PYR1M03 PYR1M04 PYR1M05 PYR1M06
4604      PYR1M07 PYR1M08 PYR1M09 PYR1M10 PYR1M11 PYR1M12
4605      PYR2M01 PYR2M02 PYR2M03 PYR2M04 PYR2M05 PYR2M06
4606      PYR2M07 PYR2M08 PYR2M09 PYR2M10 PYR2M11 PYR2M12
4607      PYR3M01 PYR3M02 PYR3M03 PYR3M04 PYR3M05 PYR3M06
4608      PYR3M07 PYR3M08 PYR3M09 PYR3M10 PYR3M11 PYR3M12
4609      DYR1M01 DYR1M02 DYR1M03 DYR1M04 DYR1M05 DYR1M06
4610      DYR1M07 DYR1M08 DYR1M09 DYR1M10 DYR1M11 DYR1M12
4611      DYR2M01 DYR2M02 DYR2M03 DYR2M04 DYR2M05 DYR2M06
4612      DYR2M07 DYR2M08 DYR2M09 DYR2M10 DYR2M11 DYR2M12
4613      DYR3M01 DYR3M02 DYR3M03 DYR3M04 DYR3M05 DYR3M06
4614      DYR3M07 DYR3M08 DYR3M09 DYR3M10 DYR3M11 DYR3M12
4615      DATN DATP1 DATV0 DATV1 DATV2 DATNEW;
4616
4617      /*****
4618      * SORT DATA BY PRODUCTION YEAR AND MONTH, AND VINTAGE YEAR.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4619 *****/;
4620 PROC SORT DATA=DAT2A; BY YR MONTH VINTAGE;
4621
4622
4623 /*****
4624  * FOR DEBUG/CHECK PURPOSES
4625  *****/;
4626 * PROC PRINT; * TITLE 'XXX PROJECTIONS';
4627 * BY YR MONTH; * ID VINTAGE;
4628 * VAR YECUM GP1 GP2 GP3 B1 B2 B3 PWELLS TPR DPR
4629     NPR MAXPROD PERCN NRATE MAXRATE PERCQ ;
4630 *FORMAT
4631 VINTAGE YR MONTH 4. GP1 GP2 GP3 YECUM B2 15. MAXPROD NPR DPR TPR 10.
4632     B1 MAXRATE NRATE 9.0 PWELLS 6.0 PERCQ PERCN 5.1 B3 8.5;
4633
4634
4635 /*****
4636  * INPUT THE HISTORICAL DATA FITS FOR EACH VINTAGE YEAR.
4637  * ELIMINATE UNNECESSARY DATA.
4638  *****/;
4639 DATA DAT1OLD;
4640     SET IN2.PRODDATA ;
4641
4642 ***## THIS IF STMT SHOULD BE CHANGED TO REFLECT FIRST VINTAGE YR##;
4643
4644 IF ST NE 'XXX' THEN DELETE;
4645
4646 *** KEEP VINTAGES AFTER THE FIRST VINTAGE YEAR AND BEFORE/WITHIN;
4647 *** THE FIRST PROJECTION YEAR;
4648 IF VINTAGE LT VY1 OR VINTAGE GE (PY1) THEN DELETE;
4649 *** LAST YEAR OF HISTORICAL PRODUCTION;
4650 IF YR GE 19PY1 THEN DELETE;
4651 IF PRATE LT 0 THEN DELETE;
4652 OUTPUT;
4653 DELETE;
4654
4655 /*****
4656  * SORT DATA BY VINTAGE YEAR.
4657  *****/;
4658 PROC SORT DATA= DAT1OLD; BY VINTAGE;
4659
4660 /*****
4661  * MERGE HISTORICAL DATA FITS WITH LOAD FACTOR.
4662  *****/;
4663 DATA DAT1X;
4664     MERGE DAT1OLD DATLFAC; BY VINTAGE;
4665
4666 /*****
4667  * MULTIPLY HISTORICAL DATA PEAK RATE BY LOAD FACTOR.
4668  *****/;
4669 DATA DAT1;
4670     SET DAT1X;
4671     PRATE=PRATE * PKFACTOR;
4672
4673 /*****
4674  * SORT DATA BY PRODUCTION YEAR AND MONTH, AND VINTAGE YEAR.
4675  *****/;
4676 PROC SORT DATA= DAT1; BY YR MONTH VINTAGE;
4677
4678 /*****
4679  * APPEND PROJECTION INFORMATION TO HISTORICAL DATA FITS WITH
4680  * ADJUSTED PEAK RATES.
4681  *****/;
4682 DATA DAT2;
4683     SET DAT1 DAT2A;
4684
4685 PROC DELETE DATA=DAT1 DAT2A;
4686
4687 /*****
4688  * SORT DATA BY PRODUCTION YEAR AND MONTH, AND VINTAGE YEAR.
4689  *****/;
4690 PROC SORT DATA= DAT2; BY YR MONTH VINTAGE;
4691
4692 /*****
4693  * INPUT DAILY GAS PRODUCTION RATES AND NUMBER OF PRODUCING GAS
4694  * WELLS. KEEP NUMBER OF PRODUCING GAS WELLS IN DECEMBER OF
4695  * VINTAGE YEAR.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4696      *****/;
4697 DATA DAT2B1;
4698     SET IN5.PROD;
4699     KEEP VINTAGE DECWEL;
4700
4701     IF ST NE 'XXX' THEN DELETE;
4702
4703     IF (VINTAGE + 1900) EQ YR AND MONTH EQ 12 THEN DO;
4704         DECWEL=GWELLS; OUTPUT;
4705     END;
4706 DELETE;
4707
4708 /*****
4709  * SORT DATA BY VINTAGE YEAR.
4710 *****/;
4711 PROC SORT DATA=DAT2B1; BY VINTAGE;
4712 PROC SORT DATA=DATV ; BY VINTAGE;
4713
4714 /*****
4715  * MERGE DECEMBER OF VINTAGE YEAR NUMBER OF PRODUCING GAS WELLS
4716  * WITH VINTAGE PARAMETERS. CALCULATE PER WELL B1 PARAMETER
4717  * FOR DECEMBER'S NUMBER OF WELLS.
4718 *****/;
4719 DATA DAT2B2;
4720     MERGE DAT2B1 DATV; BY VINTAGE;
4721     PWB1=B1/DECWEL;
4722     KEEP VINTAGE PWB1;
4723
4724 /*****
4725  * FOR DEBUG/CHECK PURPOSES
4726 *****/;
4727 PROC PRINT;TITLE'CAPACITY FACTOR FOR OLD VINTAGES';
4728
4729 PROC DELETE DATA= DAT2B1 DATV;
4730
4731 /*****
4732  * INPUT DAILY GAS PRODUCTION RATES AND NUMBER OF PRODUCING
4733  * WELLS. AFTER SELECTING RECORDS FOR THE APPROPRIATE STATE/AREA,
4734  * ELIMINATE STATE/AREA VARIABLE.
4735 *****/;
4736 DATA DAT2B3;
4737     SET IN5.PROD;
4738     IF ST NE 'XXX' THEN DELETE;
4739     DROP ST;
4740
4741 /*****
4742  * SORT DATA BY VINTAGE YEAR.
4743 *****/;
4744 PROC SORT DATA= DAT2B2; BY VINTAGE ;
4745 /*****
4746  * SORT DATA BY VINTAGE YEAR, AND PRODUCTION YEAR & MONTH.
4747 *****/;
4748 PROC SORT DATA= DAT2B3; BY VINTAGE YR MONTH ;
4749
4750 /*****
4751  * MERGE VINTAGE DECEMBER PER WELL B1 PARAMETER WITH THE DAILY
4752  * GAS PRODUCTION RATES AND NUMBER OF PRODUCING WELLS.
4753 *****/;
4754 DATA DAT2B;
4755     MERGE DAT2B3 DAT2B2; BY VINTAGE;
4756
4757 PROC DELETE DATA= DAT2B2 DAT2B3;
4758
4759 /*****
4760  * SORT DATA BY PRODUCTION YEAR AND MONTH, AND VINTAGE YEAR.
4761 *****/;
4762 PROC SORT DATA= DAT2B ; BY YR MONTH VINTAGE;
4763
4764 /*****
4765  * MERGE THE ADJUSTED HISTORICAL AND PROJECTED DATA WITH THE
4766  * DAILY GAS PRODUCTION RATES, NUMBER OF PRODUCING WELLS, AND
4767  * VINTAGE DECEMBER PER WELL B1 PARAMETERS.
4768  * ELIMINATE UNNEEDED RECORDS AND CALCULATE PEAK RATE.
4769 *****/;
4770 DATA DAT3;
4771     MERGE DAT2 DAT2B; BY YR MONTH VINTAGE;
4772 *** ELLIMINATE VINTAGES BEYOND THE 3RD PROJECTION YEAR;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4773 IF VINTAGE GT PY3 THEN DELETE;
4774 *** CALCULATE THE TOTAL MONTHLY PEAK RATE FOR OLD VINTAGES;
4775 *** FOR THE FIRST 12 MONTHS OF THE VINTAGE YEAR;
4776 IF VINTAGE LT PY1 THEN DO;
4777 IF (VINTAGE + 1900) EQ YR AND 0 LT MONTH LE 12 THEN DO;
4778 PRATE= GWELLS*PWB1;
4779 END;
4780 END;
4781
4782 PROC DELETE DATA= DAT2 DAT2B;
4783
4784 /*****
4785 * SORT DATA BY PRODUCTION YEAR AND MONTH, AND VINTAGE YEAR. *
4786 *****/;
4787 PROC SORT DATA= DAT3; BY YR MONTH VINTAGE;
4788
4789 /*****
4790 * GET THE SUMS OF THE CUM PRODUCTIONS, PEAK RATES AND THE OLD *
4791 * PRODUCTION RATES. *
4792 *****/;
4793 PROC SUMMARY;
4794 CLASS YR MONTH;
4795 OUTPUT OUT=DAT4 SUM(GP2)=GPT2 SUM(PRATE)= QPT SUM(ORATE)= NPT;
4796
4797 /*****
4798 * FOR DEBUG/CHECK PURPOSES *
4799 *****/;
4800 *PROC PRINT , * TITLE'OUTPUT FR PROC SUMMARY #1--HISTORICAL FIT';
4801
4802 /*****
4803 * KEEP THE PRODUCTION SUMS (COMPOSITES) FOR EACH MONTH OF *
4804 * EACH PRODUCTION YEAR. *
4805 *****/;
4806 DATA DAT5;
4807 SET DAT4;
4808 KEEP YR MONTH GPT2 QPT NPT;
4809 IF _TYPE_ EQ 3 THEN OUTPUT DAT5;
4810
4811 PROC DELETE DATA=DAT4;
4812
4813 /*****
4814 * REDEFINE THE SUMMARY VARIABLES FOR CONCATENATION LATER ON. *
4815 * SET VINTAGE=99 TO IDENTIFY SUMMARY VARIABLES. *
4816 *****/;
4817 DATA DAT6;
4818 SET DAT5;
4819 VINTAGE=99;
4820 GP2=GPT2;
4821 PRATE= QPT;
4822 ORATE= NPT;
4823 OUTPUT DAT6;
4824 KEEP VINTAGE YR MONTH GPT2 PRATE ORATE GP2;
4825 DELETE;
4826
4827 /*****
4828 * FOR DEBUG/CHECK PURPOSES *
4829 *****/;
4830 PROC PRINT , TITLE'OUTPUT OF TOTALS FR PROC SUMMARY #1--HIST. FIT';
4831
4832 /*****
4833 * SORT DATA BY PRODUCTION YEAR AND MONTH. *
4834 *****/;
4835 PROC SORT DATA= DAT5; BY YR MONTH;
4836
4837 /*****
4838 * MERGE PRODUCTION SUMS (WITH YEAR AND MONTH) WITH HISTORICAL *
4839 * AND PROJECTION DATA (BY VINTAGE). TAGS EACH VINTAGE'S *
4840 * PRODUCTION TO THE COMPOSITE CUMULATIVE PRODUCTION. OUT OF THE *
4841 * PRODUCTION SUMS, ONLY KEEP PRODUCTION CUM SUM. *
4842 *****/;
4843 DATA DAT1;
4844 MERGE DAT3 DAT5; BY YR MONTH;
4845 DROP QPT NPT;
4846 IF VINTAGE EQ 99 THEN DELETE;
4847
4848 PROC DELETE DATA=DAT3 DAT5;
4849

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4850 /*****
4851 * CONCATENATE REDEFINED PRODUCTION SUMMARIES WITH HISTORICAL *
4852 * AND PROJECTION DATA AND GPT2 TOTAL (PRODUCTION CUM). *
4853 *****/;
4854 DATA DAT2;
4855     SET DAT1 DAT6;
4856
4857 PROC DELETE DATA=DAT1 DAT6;
4858
4859 /*****
4860 * SORT DATA BY VINTAGE YEAR, AND PRODUCTION YEAR & MONTH. *
4861 *****/;
4862 PROC SORT DATA= DAT2; BY VINTAGE YR MONTH;
4863
4864 /*****
4865 * BRING IN DATASET WITH REDEFINED PRODUCTION SUMS, HISTORICAL *
4866 * DATA, PROJECTION DATA, AND PRODUCTION CUM SUM. *
4867 *****/;
4868 DATA DATF;
4869     SET DAT2;
4870
4871 *** CALCULATE CUMULATIVE NUMBER OF MONTHSAND PERCENT OF ACTUAL;
4872 *** RATE TO CAPACITY;
4873 ***# THIS STMT SHOULD BE CHANGED TO REFLECT FIRST VINTAGE YR -1 ##;
4874 CUMMONTH= MONTH + 12*(YR - 1969 - 1);
4875 IF CUMMONTH LE 0 THEN DELETE;
4876 IF PRATE GT 0 THEN PERCENT= 100*(ORATE/PRATE);
4877
4878 /*****
4879 * SORT DATA BY VINTAGE YEAR, AND PRODUCTION YEAR & MONTH. *
4880 *****/;
4881 PROC SORT DATA= DATF; BY VINTAGE YR MONTH;
4882
4883 PROC DELETE DATA=DAT2 ;
4884
4885 /*****
4886 * FOR DEBUG/CHECK PURPOSES *
4887 *****/;
4888 *PROC PRINT; *BY VINTAGE YR; *ID MONTH;
4889 * VAR GP2 ORATE PRATE PERCENT; *TITLE 'XXX TOTAL';
4890
4891 /*****
4892 * KEEP THE REDEFINED VARIABLES ONLY. *
4893 *****/;
4894 DATA DATP;
4895     SET DATF;
4896     IF VINTAGE EQ 99 THEN OUTPUT;
4897     DELETE;
4898
4899 /*****
4900 * SORT DATA BY PRODUCTION YEAR AND MONTH. *
4901 *****/;
4902 PROC SORT DATA= DATP; BY YR MONTH;
4903 PROC SORT DATA= DATSCH; BY YR MONTH;
4904
4905 /*****
4906 * MERGE REDEFINED PRODUCTION VARIABLES WITH PRODUCTION SCHEDULE. *
4907 * CONVERT MCF UNITS TO BCF UNITS FOR SCHEDULED PRODUCTION. *
4908 *****/;
4909 DATA DATP2;
4910     MERGE DATP DATSCH; BY YR MONTH;
4911     SPROD=0.000001* SPROD;
4912
4913 /*****
4914 * BRING IN PRODUCTION SUMMARIES (BY VINTAGE), HISTORICAL DATA, *
4915 * AND PROJECTION DATA. KEEP DECEMBER DATA. *
4916 *****/;
4917 DATA DATG;
4918     SET DATP2;
4919     IF MONTH EQ 12 THEN DO;
4920         AREA='ZZ'; CASE='LOW';
4921         OUTPUT;
4922         DELETE;
4923     END;
4924
4925
4926 /*****

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

4927      * DECEMBER VINTAGE PRODUCTION PERCENTS (WELL-AGE REPORT).          *
4928      *****/;
4929      DATA _NULL_;
4930          SET DATG ;
4931      FILE OUT3;
4932          PUT AREA $8-9 CASE $15-19 VINTAGE 21-22
4933              YR 25-28 MONTH 38-39 @40 ORATE F11.0 @52 PRATE F11.0;
4934
4935
4936      /*****
4937      * SORT DATA BY VINTAGE YEAR, AND PRODUCTION YEAR & MONTH.          *
4938      *****/;
4939      PROC SORT DATA= DATP2; BY VINTAGE YR MONTH; **SORT THE DATA;
4940
4941      /*****
4942      * FOR DEBUG/CHECK PURPOSES                                          *
4943      *****/;
4944      PROC PRINT; BY VINTAGE YR; ID MONTH;
4945      VAR GP2 ORATE PRATE PERCENT SRATE; TITLE 'XXX TOTAL';
4946
4947      /*****
4948      * HISTORICAL + PROJECTION TOTAL PRODUCTION REPORT.                *
4949      *****/;
4950      DATA _NULL_;
4951          SET DATP2 ;
4952      FILE OUT1;
4953          PUT AREA $8-9 CASE $15-19
4954              YR 25-28 MONTH 38-39 WLS 41-48 MAXWEL 51-57 SPROD 60-66
4955              @67 SRATE F11.0 @78 ORATE F11.0 @89 PRATE F11.0;
4956
4957      /*****
4958      * CALCULATE PRODUCTIVE CAPACITY FOR MONTH (CPROD) AND MONTHLY      *
4959      * PRODUCTION.                                                        *
4960      *****/;
4961      DATA DATPRO;
4962          SET DATP2;
4963          IF YR LT (1900 + PY1 - 1) THEN DELETE;
4964          ** ## SET TO 1ST YR OF PROJECTION NEEDED*;
4965          IF YR GT 19PY2 THEN DELETE; ** ## SET TO LAST YR OF PROJECTION NEEDED*;
4966          CPROD=0.000001*PRATE*DAY;
4967          MPROD=0.000001*ORATE*DAY;
4968
4969      /*****
4970      * REALLOCATION SCHEDULE                                              *
4971      *****/;
4972      DATA _NULL_;
4973          SET DATPRO ;
4974      FILE OUT2;
4975          PUT AREA $8-9 CASE $15-19
4976              YR 25-28 MONTH 38-39 WLS 41-48 MAXWEL 51-57 @60 SPROD F9.3
4977              @69 CPROD F9.3 @78 MPROD F9.3;
4978
4979
4980      PROC DELETE DATA= DATP2 DATSCH DATPRO;
4981
4982      /*****
4983      * HISTORICAL AND PROJECTION DATA, AND PRODUCTION SUMMARIES        *
4984      * VINTAGE, AND COMPOSITE CUM PRODUCTION.                          *
4985      * BREAK UP DATA BY YEARS TO PRODUCE PLOTS FOR GIVEN VINTAGES.    *
4986      *****/;
4987      DATA DATF1 DATF2 DATF3 DATF4 DATF5 DATF6 DATF7; SET DATF;
4988
4989      IF VINTAGE LT 72 THEN DO;
4990          IF PRATE LE 0 THEN PRATE= . ;
4991          IF ORATE LE 0 THEN ORATE= . ; OUTPUT DATF1; END;
4992
4993      IF VINTAGE GE 72 AND VINTAGE LE 75 THEN DO;
4994          IF PRATE LE 0 THEN PRATE= . ;
4995          IF ORATE LE 0 THEN ORATE= . ; OUTPUT DATF2;
4996      END;
4997
4998      IF VINTAGE GE 76 AND VINTAGE LE 79 THEN DO;
4999          IF PRATE LE 0 THEN PRATE= . ;
5000          IF ORATE LE 0 THEN ORATE= . ; OUTPUT DATF3;
5001      END;
5002
5003      IF VINTAGE GE 80 AND VINTAGE LE 83 THEN DO;

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5004     IF PRATE LE 0 THEN PRATE= . ;
5005     IF ORATE LE 0 THEN ORATE= . ;OUTPUT DATF4;
5006 END;
5007
5008     IF VINTAGE GE 84 AND VINTAGE LE 87 THEN DO;
5009     IF PRATE LE 0 THEN PRATE= . ;
5010     IF ORATE LE 0 THEN ORATE= . ;OUTPUT DATF5;
5011 END;
5012
5013     IF VINTAGE GE 88 AND VINTAGE LE PY3 THEN DO;
5014     IF PRATE LE 0 THEN PRATE= . ;
5015     IF ORATE LE 0 THEN ORATE= . ;OUTPUT DATF6;
5016 END;
5017
5018     IF VINTAGE EQ 99 THEN DO;
5019     IF PRATE LE 0 THEN PRATE= . ;
5020     IF ORATE LE 0 THEN ORATE= . ;OUTPUT DATF7;
5021 END;
5022
5023 /*
5024 /**
5025
5026 /******
5027 * THE FOLLOWING PLOTS ARE NOT NEEDED EXCEPT FOR DEBUGGING TOOLS. *
5028 ******
5029 /******
5030 * PLOT RATE CURVES FOR PEAK RATES AND PRODUCTION RATES VERSES *
5031 * TIME (IN MONTHS) FOR HISTORICAL + PROJECTION SUMMARIES. *
5032 ******
5033 PROC TAG
5034     DATA=DATF7;
5035     PARMCARDS4;
5036     GENERATE A PLOT.
5037     SAS DATA.
5038     USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5039     USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .
5040     END OF DATA.
5041
5042
5043
5044     X PAGE 22, Y PAGE 11.
5045
5046     PAGE BORDER IS 0.
5047
5048     FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5049
5050     CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5051     CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5052     CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5053     CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5054
5055     CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5056     CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5057     CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5058     CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.
5059
5060     X AXIS LENGTH IS 16.
5061     X AXIS HEIGHT IS .12.
5062     X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5063
5064     Y AXIS MIN 0.
5065     Y AXIS LENGTH IS 7.0.
5066     Y AXIS ORIGIN IS 1.5.
5067
5068     LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE ,
5069
5070
5071     X AXIS LABEL STYLE IS DUPLEX .
5072     Y AXIS LABEL STYLE IS DUPLEX.
5073     X AXIS STYLE IS DUPLEX.
5074     Y AXIS STYLE IS DUPLEX.
5075
5076     X GRID IS ON.
5077     Y GRID IS ON.
5078     GRID COLOR IS GREEN, TEXTURE IS 1.
5079
5080     X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5081 X LABEL HEIGHT IS 0.14.
5082 Y LABEL HEIGHT IS 0.14.
5083 Y LABEL 'PEAK RATE, MCF/D'.
5084
5085 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5086 TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)**B)'.
5087
5088 GO.
5089 ;;;;
5090
5091
5092 /*****
5093  * PLOT THE PEAK RATES VERSES THE CUM PRODUCTION FOR PRODUCTION  *
5094  * SUMMARIES.                                                    *
5095  *****/;
5096 PROC TAG
5097     DATA=DATP ;
5098     PARMCARDS4;
5099     GENERATE A PLOT.
5100     SAS DATA.
5101     USE X= GP2 Y= PRATE CLASS=VINTAGE .
5102     END OF DATA.
5103
5104
5105     PAGE BORDER IS 0.
5106     X PAGE 14, Y PAGE 11.
5107
5108     X AXIS LENGTH IS 11.0.
5109     X AXIS HEIGHT IS .12.
5110     X AXIS ORIGIN IS 1.5.
5111     X MIN 0.
5112
5113     Y AXIS MIN 0.
5114     Y AXIS LENGTH IS 8.5.
5115     Y AXIS ORIGIN IS 1.5.
5116
5117     FOR EVERY CURVE, SYMBOL SIZE IS 1,SYMBOL COUNT IS 9999.
5118
5119     LEGEND X ORIGIN IS 12.6, Y ORIGIN IS 1.75, HEIGHT IS .09.
5120
5121
5122     X AXIS LABEL STYLE IS DUPLEX .
5123     Y AXIS LABEL STYLE IS DUPLEX.
5124     X AXIS STYLE IS DUPLEX.
5125     Y AXIS STYLE IS DUPLEX.
5126
5127     X GRID IS ON.
5128     Y GRID IS ON.
5129     GRID COLOR IS GREEN, TEXTURE IS 1.
5130
5131     X LABEL 'CUMULATIVE PRODUCTION, MCF'.
5132     X LABEL HEIGHT IS 0.14.
5133     Y LABEL HEIGHT IS 0.14.
5134     Y LABEL 'PEAK RATE, MCF/D'.
5135
5136     TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5137     TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)**B)'.
5138
5139     GO.
5140     ;;;;
5141
5142
5143 /*****
5144  * PLOT THE PEAK RATES AND PRODUCTION RATES VERSES TIME (IN      *
5145  * CUM MONTHS) FROM THE HISTORICAL & PROJECTION DATA WHERE      *
5146  * THE VINTAGES ARE PRIOR TO 1972.                                *
5147  *****/;
5148 PROC TAG
5149     DATA=DATF1;
5150     PARMCARDS4;
5151     GENERATE A PLOT.
5152     SAS DATA.
5153     USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5154     USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .
5155     END OF DATA.
5156
5157

```


Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5158 X PAGE 22, Y PAGE 11.
5159
5160 PAGE BORDER IS 0.
5161
5162 FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5163
5164 CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5165 CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5166 CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5167 CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5168
5169 CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5170 CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5171 CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5172 CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.
5173
5174 X AXIS LENGTH IS 16.
5175 X AXIS HEIGHT IS .12.
5176 X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5177
5178 Y AXIS MIN 0.
5179 Y AXIS LENGTH IS 7.0.
5180 Y AXIS ORIGIN IS 1.5.
5181
5182 LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE '
5183
5184
5185 X AXIS LABEL STYLE IS DUPLEX .
5186 Y AXIS LABEL STYLE IS DUPLEX.
5187 X AXIS STYLE IS DUPLEX.
5188 Y AXIS STYLE IS DUPLEX.
5189
5190 X GRID IS ON.
5191 Y GRID IS ON.
5192 GRID COLOR IS GREEN, TEXTURE IS 1.
5193
5194 X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.
5195 X LABEL HEIGHT IS 0.14.
5196 Y LABEL HEIGHT IS 0.14.
5197 Y LABEL 'PEAK RATE, MCF/D'.
5198
5199 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5200 TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)**B)'.
5201
5202 GO.
5203
5204
5205
5206 /*****
5207 * PLOT THE PEAK RATES AND PRODUCTION RATES VERSES TIME (IN
5208 * CUM MONTHS) FROM THE HISTORICAL & PROJECTION DATA WHERE
5209 * THE VINTAGES AFTER 1972 AND BEFORE 1975, INCLUSIVELY.
5210 *****/;
5211 PROC TAG
5212 DATA=DATF2;
5213 PARMCARDS4;
5214 GENERATE A PLOT.
5215 SAS DATA.
5216 USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5217 USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .
5218 END OF DATA.
5219
5220 X PAGE 22, Y PAGE 11.
5221
5222 PAGE BORDER IS 0.
5223
5224 FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5225
5226 CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5227 CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5228 CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5229 CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5230
5231 CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5232 CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5233 CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5234 CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5235
5236 X AXIS LENGTH IS 16.
5237 X AXIS HEIGHT IS .12.
5238 X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5239
5240 Y AXIS MIN 0.
5241 Y AXIS LENGTH IS 7.0.
5242 Y AXIS ORIGIN IS 1.5.
5243
5244 LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE ' '.
5245
5246
5247 X AXIS LABEL STYLE IS DUPLEX .
5248 Y AXIS LABEL STYLE IS DUPLEX.
5249 X AXIS STYLE IS DUPLEX.
5250 Y AXIS STYLE IS DUPLEX.
5251
5252 X GRID IS ON.
5253 Y GRID IS ON.
5254 GRID COLOR IS GREEN, TEXTURE IS 1.
5255
5256 X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.
5257 X LABEL HEIGHT IS 0.14.
5258 Y LABEL HEIGHT IS 0.14.
5259 Y LABEL 'PEAK RATE, MCF/D'.
5260
5261 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5262 TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)**B)'.
5263
5264 GO.
5265 ****
5266
5267 /*****
5268 * PLOT THE PEAK RATES AND PRODUCTION RATES VERSES TIME (IN *
5269 * CUM MONTHS) FROM THE HISTORICAL & PROJECTION DATA WHERE *
5270 * THE VINTAGES AFTER 1976 AND BEFORE 1979, INCLUSIVELY. *
5271 *****/
5272 PROC TAG
5273 DATA=DATEF3;
5274 PARMCARDS4;
5275 GENERATE A PLOT.
5276 SAS DATA.
5277 USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5278 USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .
5279 END OF DATA.
5280
5281
5282 X PAGE 22, Y PAGE 11.
5283
5284 PAGE BORDER IS 0.
5285
5286 FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5287
5288 CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5289 CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5290 CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5291 CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5292
5293 CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5294 CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5295 CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5296 CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.
5297
5298 X AXIS LENGTH IS 16.
5299 X AXIS HEIGHT IS .12.
5300 X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5301
5302 Y AXIS MIN 0.
5303 Y AXIS LENGTH IS 7.0.
5304 Y AXIS ORIGIN IS 1.5.
5305
5306 LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE ' '.
5307
5308
5309 X AXIS LABEL STYLE IS DUPLEX .
5310 Y AXIS LABEL STYLE IS DUPLEX.
5311 X AXIS STYLE IS DUPLEX.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5312 Y AXIS STYLE IS DUPLEX.
5313
5314 X GRID IS ON.
5315 Y GRID IS ON.
5316 GRID COLOR IS GREEN, TEXTURE IS 1.
5317
5318 X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.
5319 X LABEL HEIGHT IS 0.14.
5320 Y LABEL HEIGHT IS 0.14.
5321 Y LABEL 'PEAK RATE, MCF/D'.
5322
5323 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5324 TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)**B)'.
5325
5326 GO.
5327 ;;;;
5328
5329 /*****
5330 * PLOT THE PEAK RATES AND PRODUCTION RATES VERSES TIME (IN
5331 * CUM MONTHS) FROM THE HISTORICAL & PROJECTION DATA WHERE
5332 * THE VINTAGES AFTER 1980 AND BEFORE 1983, INCLUSIVELY.
5333 *****/
5334 PROC TAG
5335 DATA=DATF4;
5336 PARMCARDS4;
5337 GENERATE A PLOT.
5338 SAS DATA.
5339 USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5340 USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .
5341 END OF DATA.
5342
5343
5344 X PAGE 22, Y PAGE 11.
5345
5346 PAGE BORDER IS 0.
5347
5348 FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5349
5350 CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5351 CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5352 CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5353 CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5354
5355 CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5356 CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5357 CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5358 CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.
5359
5360 X AXIS LENGTH IS 16.
5361 X AXIS HEIGHT IS .12.
5362 X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5363
5364 Y AXIS MIN 0.
5365 Y AXIS LENGTH IS 7.0.
5366 Y AXIS ORIGIN IS 1.5.
5367
5368 LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE ' '.
5369
5370
5371 X AXIS LABEL STYLE IS DUPLEX .
5372 Y AXIS LABEL STYLE IS DUPLEX.
5373 X AXIS STYLE IS DUPLEX.
5374 Y AXIS STYLE IS DUPLEX.
5375
5376 X GRID IS ON.
5377 Y GRID IS ON.
5378 GRID COLOR IS GREEN, TEXTURE IS 1.
5379
5380 X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.
5381 X LABEL HEIGHT IS 0.14.
5382 Y LABEL HEIGHT IS 0.14.
5383 Y LABEL 'PEAK RATE, MCF/D'.
5384
5385 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5386 TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)**B)'.
5387
5388 GO.

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5389      ;;;;;
5390
5391      /*****
5392      * PLOT THE PEAK RATES AND PRODUCTION RATES VERSES TIME (IN
5393      * CUM MONTHS) FROM THE HISTORICAL & PROJECTION DATA WHERE
5394      * THE VINTAGES AFTER 1984 AND BEFORE 1987, INCLUSIVELY.
5395      *****/;
5396  PROC TAG
5397      DATA=DATE5;
5398      PARMCARDS4;
5399      GENERATE A PLOT.
5400      SAS DATA.
5401      USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5402      USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .
5403      END OF DATA.
5404
5405
5406      X PAGE 22, Y PAGE 11.
5407
5408      PAGE BORDER IS 0.
5409
5410      FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5411
5412      CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5413      CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5414      CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5415      CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5416
5417      CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5418      CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5419      CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5420      CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.
5421
5422      X AXIS LENGTH IS 16.
5423      X AXIS HEIGHT IS .12.
5424      X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5425
5426      Y AXIS MIN 0.
5427      Y AXIS LENGTH IS 7.0.
5428      Y AXIS ORIGIN IS 1.5.
5429
5430      LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE '
5431
5432
5433      X AXIS LABEL STYLE IS DUPLEX .
5434      Y AXIS LABEL STYLE IS DUPLEX.
5435      X AXIS STYLE IS DUPLEX.
5436      Y AXIS STYLE IS DUPLEX.
5437
5438      X GRID IS ON.
5439      Y GRID IS ON.
5440      GRID COLOR IS GREEN, TEXTURE IS 1.
5441
5442      X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.
5443      X LABEL HEIGHT IS 0.14.
5444      Y LABEL HEIGHT IS 0.14.
5445      Y LABEL 'PEAK RATE, MCF/D'.
5446
5447      TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5448      TITLE 'LOW CASE RATE CURVES FOR XXX, (QP(1-GP/U)*B)'.
5449
5450      GO.
5451      ;;;;;
5452
5453      /*****
5454      * PLOT THE PEAK RATES AND PRODUCTION RATES VERSES TIME (IN
5455      * CUM MONTHS) FROM THE HISTORICAL & PROJECTION DATA WHERE
5456      * THE VINTAGES AFTER 1984 AND BEFORE PROJECTION YEAR 3,
5457      * INCLUSIVELY.
5458      *****/;
5459  PROC TAG
5460      DATA=DATE6;
5461      PARMCARDS4;
5462      GENERATE A PLOT.
5463      SAS DATA.
5464      USE X= CUMMONTH Y= PRATE CLASS=VINTAGE .
5465      USE X= CUMMONTH Y= ORATE CLASS=VINTAGE .

```

Table E2. SAS Program Listing for EPROJZZ (Continued)

```

5466 END OF DATA.
5467
5468
5469 X PAGE 22, Y PAGE 11.
5470
5471 PAGE BORDER IS 0.
5472
5473 FOR EVERY CURVE THICKNESS IS 1,SYMBOL COUNT IS 9999 .
5474
5475 CURVE 1 TEXTURE IS 1,COLOR IS RED,SYMBOL TYPE IS 16.
5476 CURVE 2 TEXTURE IS 1,COLOR IS BLUE,SYMBOL TYPE IS 16.
5477 CURVE 3 TEXTURE IS 1,COLOR IS GREEN,SYMBOL TYPE IS 16.
5478 CURVE 4 TEXTURE IS 1,COLOR IS BLACK,SYMBOL TYPE IS 16.
5479
5480 CURVE 5 TEXTURE IS 2,COLOR IS RED,SYMBOL TYPE IS 15.
5481 CURVE 6 TEXTURE IS 2,COLOR IS BLUE,SYMBOL TYPE IS 15.
5482 CURVE 7 TEXTURE IS 2,COLOR IS GREEN,SYMBOL TYPE IS 15.
5483 CURVE 8 TEXTURE IS 2,COLOR IS BLACK,SYMBOL TYPE IS 15.
5484
5485 X AXIS LENGTH IS 16.
5486 X AXIS HEIGHT IS .12.
5487 X AXIS ORIGIN IS 1.5, MIN 0, STEP 12, MAX 276.
5488
5489 Y AXIS MIN 0.
5490 Y AXIS LENGTH IS 7.0.
5491 Y AXIS ORIGIN IS 1.5.
5492
5493 LEGEND HEIGHT 0.1, X ORIGIN 18.5, Y ORIGIN 1.6, TITLE '
5494
5495
5496 X AXIS LABEL STYLE IS DUPLEX .
5497 Y AXIS LABEL STYLE IS DUPLEX.
5498 X AXIS STYLE IS DUPLEX.
5499 Y AXIS STYLE IS DUPLEX.
5500
5501 X GRID IS ON.
5502 Y GRID IS ON.
5503 GRID COLOR IS GREEN, TEXTURE IS 1.
5504
5505 X LABEL 'CUMULATIVE MONTHS, 19VY1-19PY3'.
5506 X LABEL HEIGHT IS 0.14.
5507 Y LABEL HEIGHT IS 0.14.
5508 Y LABEL 'PEAK RATE, MCF/D'.
5509
5510 TITLE HEIGHT IS 0.17, STYLE IS DUPLEX,X IS 1.2, Y IS 10.1 .
5511 TITLE 'LOW CASE RATE CURVES FOR KXX, (QP(1-GP/U)**B)'.
5512
5513 GO.
5514 ;;;;

```

Table E3. SAS Program Listing for PROJ17ST

```

1 //VF1UPR17 JOB (6972,DAL,,999),FUNKOUT,REGION=1200K,TIME=(0,07),
2 // MSGCLASS=A
3 //*****
4 /** PROJ17ST BY VELTON FUNK - UNITS ARE MMCF, MCF/DAY, ***
5 /** AND BCF/MONTH ***
6 /** INSTRUCTIONS: RUN THE FIRST PROC NLIN AND PROC GLM BEFORE ***
7 /** DOING THE PROJECTION-- THE SCHEDULE IS NOT NEEDED. COMMENT IT.***
8 /** CH'91' TO THE FIRST PROJECTION YEAR EG. 92,93,.... ***
9 /** CH'LOW' TO THE CORRECT CASE AND RUN THE PROJECTION PART. ***
10 //*****
11 /** LINES 180, 206, 234 & 265 CONTAIN MORE DETAILED INSTRUCTIONS ***
12 //*****
13 /**STEP1 EXEC SAS,TAGDSN='CN6972.PRJ.P17TST',
14 /**STEP1 EXEC SAS,
15 /** TIME=(0,31),REGION=1200K
16 /**IN1 DD DSN=CN6972.PRJ.GASCAP92.RAWDATA(PROD17ST),UNIT=DASD,DISP=SHR
17 /**IN2 DD DSN=CN6972.PRJ.GASCAP92.RAWDATA(WELL17ST),DISP=SHR
18 /**IN4 DD DSN=CN6972.PRJ.SCHED,DISP=SHR
19 /**OUT1 DD DSN=CN6972.PRJ.PROD.ST17LOW,
20 /** DCB=(RECFM=FB,LRECL=100,BLKSIZE=1000),
21 /** UNIT=DASD,DISP=(NEW,CATLG,DELETE),SPACE=(TRK,(75,5),RLSE)
22 /**OUT2 DD DSN=CN6972.PRJ.PROD.SCHED.ST17LOW,

```

Table E3. SAS Program Listing for PROJ17ST (Continued)

```

23 //      DCB=(RECFM=FB,LRECL=100,BLKSIZE=1000),
24 //      UNIT=DASD,DISP=(NEW,CATLG,DELETE),SPACE=(TRK,(75,5),RLSE)
25 //FT20F001 DD SYSOUT=A
26 //SYSIN      DD *
27 ***** PROJ17ST *****;
28 * THIS PROGRAM MAKES PROJECTIONS FOR A GROUP OF 18 STATES: AZ, ;
29 * FL, IL, IN, KY, MD, MI, MO, NE, NV, NY, OH, OR, PA, SD, TN, VA, ;
30 * AND WV. ;
31 * THIS IS A MULTI-STEP RUN PROCESS: ;
32 * 1. RUN PROGRAM TO GET INITIAL GUESSES FOR PROJECTION, ;
33 * COMMENTING OUT STEPS 2 THROUGH 5. ;
34 * ;
35 * 2. RUN PROGRAM TO DETERMINE INITIAL FLOW RATE (Q0) USING ;
36 * FIXED DECLINE RATE (D) GOTTEN FROM 1ST RUN AND CALCULATE ;
37 * AN R-SQR, COMMENTING OUT STEPS 1, & 3 THROUGH 5. ;
38 * ;
39 * 3. RUN PROGRAM TO USE DECLINE RATE (D) FROM 1ST RUN TO ;
40 * RECALCULATE Q0, COMMENTING OUT STEPS 1 & 2, 4 & 5. ;
41 * ;
42 * 4. RUN PROGRAM MULTIPLE TIMES TO NORMALIZE DATA, COMMENTING ;
43 * OUT STEPS 1 THROUGH 3, & 5. ;
44 * ;
45 * 5. RUN PROGRAM TO MAKE PROJECTIONS, COMMENTING OUT STEPS ;
46 * 1 THROUGH 3 (STEP 5 INCLUDES CODE FROM STEP 4). ;
47 *****;
48 * INPUT DATA FOR IN1 (EIA PRODUCTION DATA FOR 18 STATES) ;
49 *VARIABLE*      DESCRIPTION ;
50 *      YR      YEAR ;
51 *      MONTH   MONTH ;
52 *      PROD    MONTHLY PROD, MMCF ;
53 *      PPROD   LARGEST MONTHLY PROD, MMCF ;
54 *      GP      CUMULATIVE PROD, MMCF ;
55 *      Q       DAILY RATE, MCF/DAY ;
56 *      WELLS   WELLS PRODUCING AT YEAR END ;
57 *****;
58 * INPUT DATA FOR IN2 (API WELL COMPLETIONS FOR 18 STATES) ;
59 *VARIABLE*      DESCRIPTION ;
60 *      YR      YEAR ;
61 *      MONTH   MONTH ;
62 *      OILWELLS NUMBER OF OIL WELLS COMPLETED DURING MONTH ;
63 *      GASWELLS NUMBER OF GAS WELLS COMPLETED DURING MONTH ;
64 *      DRYHOLES NUMBER OF DRY HOLES COMPLETED DURING MONTH ;
65 *      TOTWELLS TOTAL NUMBER OF WELLS COMPLETED DURING MONTH ;
66 *****;
67 * INPUT DATA FOR IN4 (DEMAND SCHEDULE) ;
68 *VARIABLE*      DESCRIPTION ;
69 *      YR      YEAR ;
70 *      MONTH   MONTH ;
71 *      NWELLS  NUMBER OF GASWELLS COMPLETED DURING MONTH ;
72 *      MAXWEL  TOTAL NUMBER OF GAS WELLS COMPLETED DURING YEAR ;
73 *      SPROD   SCHEDULED PRODUCTION BASED ON STEO DEMAND FORECAST ;
74 *****;
75 * OUTPUT DATA FOR OUT1 HISTORICAL DATA FOR REPORT ;
76 *VARIABLE*      DESCRIPTION ;
77 *      YR      YEAR ;
78 *      MONTH   MONTH ;
79 *      ORATE   REPORTED PRODUCTION RATE FOR MONTH, MCF/DAY ;
80 *      PRATE   PREDICTED PRODUCTIVE CAPACITY FOR MONTH, MCF/DAY ;
81 *****;
82 * OUTPUT DATA FOR OUT2/ PROJECTED DATA FOR REALLOCATION AND REPORT ;
83 *VARIABLE*      DESCRIPTION ;
84 *      AREA    AREA NAME ;
85 *      CASE    LOW, BASE OR HIGH WELL COUNT ;
86 *      YR      YEAR ;
87 *      MONTH   MONTH ;
88 *      NWELLS  NEW WELL COMPLETIONS FROM SCHEDULE, MONTHLY ;
89 *      MAXWEL  TOTAL NEW WELLS FOR THE YEAR ;
90 *      SPROD   SCHEDULED PRODUCTION (DEMAND), BCF/MONTH ;
91 *      CPROD   PROJECTED PRODUCTIVE CAPACITY, BCF/MONTH ;
92 *      MPROD   PROJECTED MONTHLY PRODUCTION, BCF/MONTH. IT WILL EQUAL ;
93 *      EITHER SPROD OR CPROD, WHICHEVER IS SMALLER; ;
94 *****;
95 * OTHER INTERIM VARIABLES ;
96 *VARIABLE*      DESCRIPTION ;
97 *      PPROD   ALIAS PRATE--PEAK MONTHLY PRODUCTION RATE, MCF/DAY ;
98 *      LPPROD  PREVIOUS PPROD, MCF/DAY ;
99 *      LWELLS  DECEMBER PRODUCING WELL COUNT ;

```

Table E3. SAS Program Listing for PROJ17ST (Continued)

```

100 *   SPWLS   SUM OF CURRENT MONTH AND 11 PREVIOUS MONTHS NEW GAS WELL ;
101 *           COMPLETIONS ;
102 *   NWELLS  NEW MONTHLY WELL COMPLETIONS ;
103 *   Q0      INITIAL FLOW RATE, A DERIVED PARAMETER, MCF/DAY ;
104 *   JRATE   A'IAS PRATE-- A PREDICTED PRODUCTIVE CAPACITY, MCF/DAY ;
105 *   JPROD   PRODUCTION RATE THAT IS DECLINED, MCF/DAY ;
106 *   LPPROD  PREVIOUS REPORTED PEAK PRODUCTION RATE, MCF/DAY ;
107 *   LNWELLS 1 MONTH LAGGED NEW WELL COMPLETIONS ;
108 *****;
109
110 ***** INPUT 18 STATES PROD FR NAT GAS ANN(EIA) ***;
111 DATA DAT1 ;RETAIN LGP LPPROD LWELLS PEAK;
112   KEEP YR MONTH DAYS PROD PPROD PEAK LPPROD WELLS LWELLS GP LGP Q;
113   INFILE IN1;
114   INPUT @1 TEST $4. @;
115   IF TEST LT '1970' THEN DO;INPUT;DELETE;END;
116
117   INPUT @1 YR 4.0 MONTH 6-7 DAYS 11-12 PROD 14-20
118   GP 21-31 Q 45-55 PPROD 56-67 WELLS 68-78;
119   IF MONTH EQ . THEN MONTH= 12;
120   PEAK=PPROD; ** OMIT PPROD FOR EXCESSIVELY LOW DEMAND YEARS**;
121   IF YR EQ 1990 OR YR EQ 1988 OR YR EQ 1983 THEN PPROD= . ;
122   OUTPUT;
123
124   IF PEAK GT 0 THEN LGP= GP;
125   IF PPROD GT 0 THEN LPPROD= PPROD;
126   IF MONTH EQ 12 THEN LWELLS= WELLS;
127
128 PROC SORT;BY YR MONTH;
129
130 **PROC PRINT;**TITLE' PRODUCTION HISTORY';**BY YR;**ID MONTH;
131 *VAR DAYS PROD GP LGP Q PPROD LPPROD WELLS;
132
133 *** INPUT WELL COMPLETION HISTORY FR EIA'S 'BEST GUESS' FILE-- ***;
134 *** REGION DESCRIBED AS OTHER STATES FOR DATA PUBLISHED IN MBR. ***;
135 *** (MONTHLY ENERGY REVIEW). ***;
136 DATA DAT2; ** INPUT THE HISTORICAL COMPLETION RECORD *****;
137 INFILE IN2; RETAIN LNWELLS SUMNWLS 0 LSUMNWLS ;
138 INPUT @1 TYPE $1. @;
139 IF TYPE NE 'A' THEN DO;INPUT;DELETE;END; ** A=ALL, EXP & DEV **;
140
141 INPUT YR 3-4 MONTH 6-7 OILWELLS 17-21 GASWELLS 22-26
142 DRYHOLES 27-31 TOTWELLS 32-36;
143 YR= YR + 1900;
144 NWELLS= GASWELLS;
145 LNWELLS= LAG1(NWELLS); SUMNWLS=SUMNWLS + NWELLS;
146 LSUMNWLS= NWELLS
147 + LAG1(NWELLS) + LAG2(NWELLS) + LAG3(NWELLS) + LAG4(NWELLS)
148 + LAG5(NWELLS) + LAG6(NWELLS) + LAG7(NWELLS) + LAG8(NWELLS)
149 + LAG9(NWELLS) + LAG10(NWELLS) + LAG11(NWELLS);
150 OUTPUT;
151 IF MONTH EQ 12 THEN DO;
152 *ANWELLS= SUMNWLS; SUMNWLS=0;LSUMNWLS= SUMNWLS; DELETE;
153 END;
154 *****NOTE: ANWELLS NOT USED IN THIS VERSION*****;
155 PROC SORT ;BY YR MONTH;
156 ***** MERGE WELL HISTORY AND PROD FILES *****;
157 DATA DAT2A;
158 MERGE DAT1 DAT2;
159 BY YR MONTH;
160
161 ** SUM NEW COMPLETIONS FROM DATE OF LAST USED PEAK. OLD PRODUCTION*;
162 ** WILL BE DECLINED FROM HERE AND NEW PRODUCTION WILL START THERE***;
163 DATA DAT2B;SET DAT2A;RETAIN SPWLS 0;
164 SPWLS= LSUMNWLS;
165 OUTPUT;
166 IF PEAK GT 0 THEN DO; ** RE INITIALIZE NEW COMPLETIONS ***;
167 SPWLS= 0;
168 END;
169
170 *PROC PRINT;*BY YR;*ID MONTH;
171 *VAR NWELLS SPWLS LSUMNWLS PROD LGP PPROD LPPROD LWELLS;
172
173 *PROC PRINT;
174 *BY YR;
175 *ID MONTH;
176 *TITLE' WELL COMPLETION HISTORY';

```

Table E3. SAS Program Listing for PROJ17ST (Continued)

```

177 *VAR OILWELLS GASWELLS DRYHOLES TOTWELLS;
178 *SUM OILWELLS GASWELLS DRYHOLES TOTWELLS;
179 ***** FURTHER INSTRUCTIONS *****;
180 **** 1. CHANGE COL 1 TO ' ' IN NEXT 22 LINES AND RUN PROGRAM *****;
181 **** GET INITIAL GUESSES FOR Q0--INITIAL RATE AND D--DECLINE RATE**
182 **** GO TO 206 FOR FURTHER INSTRUCTIONS **
183 *****;
184 *DATA DAT3;
185 * SET DAT2B;
186 * IF YR LT 1984 THEN PPROD= . ;
187 * IF YR EQ 1984 THEN LPPROD= . ;
188 * PROC NLIN BEST=10 NOHALVE;
189 * BOUNDS 0<Q0<200, -0.00009<=D<-0.00001;
190 * PARMS Q0= 20 TO 100 BY 10
191 * D= -0.00005 TO -0.00001 BY 0.00001;
192 * MODEL PPROD= (LPPROD*EXP(D*LGP/LWELLS) + SPWLS*Q0) ;
193 * OUTPUT OUT=TEMP PREDICTED=YHAT RESIDUAL=RESID PARMS= Q0 D;
194 * DATA DAT4;
195 * SET TEMP;
196 * IF PPROD GT 0 THEN DIFF= 100*(YHAT/PPROD - 1);
197 * IF YHAT EQ . AND PPROD EQ . THEN DELETE;
198 *
199 * PROC PRINT;
200 * BY YR;
201 * ID MONTH;
202 * VAR PPROD NWELLS SPWLS PEAK PPROD YHAT DIFF Q0 D;
203 **/
204 **/
205 *****;
206 **** 2. CHANGE COL 1 TO ' ' IN NEXT 24 LINES AND MODIFY D= AND ****;
207 **** RUN PROC. THEN GO TO 234 FOR NEXT STEP *****;
208 ****DETERMINE Q0 WITH DECLINE RATE FROM ABOVE AND CALC AN R-SQR ****;
209 *****;
210 * DATA DAT3;
211 * SET DAT2B;
212 * IF YR LT 1984 THEN PPROD= . ;
213 * IF YR EQ 1984 THEN LPPROD= . ;
214 *
215 * D= -0.000010000;
216 * A= LPPROD*EXP(D*LGP/LWELLS);
217 *
218 * PROC GLM;
219 * MODEL PPROD = SPWLS A/NOINT ;
220 * OUTPUT OUT=TEMP PREDICTED=YHAT RESIDUAL=RESID;
221 *
222 * DATA DAT4;
223 * SET TEMP;
224 * IF PPROD GT 0 THEN DIFF= 100*(YHAT/PPROD - 1);
225 * IF YHAT EQ . AND PPROD EQ . THEN DELETE;
226 *
227 * PROC PRINT;
228 * BY YR;
229 * ID MONTH;
230 * VAR PPROD YHAT DIFF;
231 **/
232 **/
233 *****;
234 **** 3. MODIFY D= AND RUN PROGRAM ** NEXT STEP IS THE PROJECTION **;
235 **** MORE INSTRUCTIONS-LINE 265 CHECK INPUT AND OUTPUT DSNS **;
236 *****;
237 ****PUT IN THE D--DECLINE RATE FR ABOVE &RECALC Q0 FOR PROJECTIONS****;
238 *****;
239 * DATA DAT3;
240 * SET DAT2B;
241 * IF YR LT 1984 THEN PPROD= . ;
242 * IF YR EQ 1984 THEN LPPROD= . ;
243 *
244 * PROC NLIN BEST=10;
245 * BOUNDS 0<Q0<200;
246 * PARMS Q0= 0 TO 50 BY 5;
247 * D= -0.000010000;
248 * MODEL PPROD= (LPPROD*EXP(D*LGP/LWELLS) + SPWLS*Q0) ;
249 * OUTPUT OUT=TEMP PREDICTED=YHAT RESIDUAL=RESID PARMS= Q0 ;
250 * DATA DAT4;
251 * SET TEMP;
252 * D= -0.000047138;
253 * IF PPROD GT 0 THEN DIFF= 100*(YHAT/PPROD - 1);

```


Table E3. SAS Program Listing for PROJ17ST (Continued)

```

254 *****IF YHAT EQ . AND PPROD EQ . THEN DELETE;
255 *
256 * PROC PRINT;
257 * BY YR;
258 * ID MONTH;
259 * TITLE'HISTORICAL FIT OF DATA';
260 * VAR PROD SPWLS LGP LWELLS LPPROD PPROD DIFF YHAT Q0 D;
261 **PROC PLOT;*PLOT YHAT*DATE='Y' PPROD*DATE='P' Q*DATE='Q'/OVERLAY;
262 /*
263 */
264 *****;
265 ** 4. CHANGE COL 1 TO ' ' FOR PRINT AND FOLLOWING 2 LINES. INPUT **;
266 ** THE FINALIZED D AND Q0 IN LINE 279. EXECUTE PROGRAM MULTIPLE **;
267 ** TIMES TO NORMALIZE TO THE BIGGEST POINT BY ADJUSTING THE **;
268 ** JPROD VALUE UNTIL THE PREDICTED = BIGGEST POINT. **;
269 *****;
270 ** 5. COMMENT THE PRINT STATEMENT AND FOLLOWING 2 LINES AND MAKE **;
271 ** SURE OUTPUT FILES ARE OK. INPUT THE FINALIZED JPROD VALUE **;
272 ** AND MAKE THE PROJECTIONS. **;
273 *****;
274 DATA DAT4;
275 KEEP YR MONTH GP WELLS LWELLS DATE JRATE JPROD NWELLS D Q Q0 PROD
276 PPROD SPWLS DAYS PEAK;
277 SET DAT2B;RETAIN JPROD;
278 IF YR GT (1992 - 1) THEN DELETE;
279 D= -0.000010000; Q0=10.526 ;** FINALIZED PARAMETERS **;
280 DATE= YR + MONTH/12;** FOR PLOTTING PURPOSES **;
281 MGP=LAG1(GP); ** ONE MONTH LAG ON CUMULATIVE PRODUCTION**;
282 ***** DECLINE THE OLD WELLS AND BRING ON THE NEW *****;
283 JRATE= (JPROD*EXP(D*MGP/LWELLS) + LNWELLS*Q0) ;
284 IF YR EQ 1977 AND MONTH EQ 2 THEN DO;JPROD=1854137;JRATE=JPROD;END;
285 OUTPUT;*** JPROD (ABOVE) VARIABLE ALTERED TO NORMALIZE THE DATA***;
286 JPROD=JRATE;
287 * PROC PRINT;*BY YR;*ID MONTH;
288 * TITLE'HISTORICAL FIT OF DATA';
289 * VAR PEAK PPROD Q JRATE NWELLS SPWLS Q0 D;
290 /*
291 */
292 *****;
293 ** MAKE THE PROJECTIONS FOR THE 18-STATES **;
294 *****;
295 DATA DATSCH4;INFILE IN4; *** INPUT THE SCHEDULED PROD AND WELLS***;
296 INPUT AREA $13-14 CASE $20-23 @;
297 IF AREA NE '17' OR CASE NE 'LOW' THEN DO;INPUT;DELETE;END;
298 INPUT YR 29-32 MONTH 40-41 NWELLS 45-50 MAXWEL 54-59 SPROD 61-68;
299
300 **PROC PRINT;**TITLE'SCHEDULE DATA';
301
302 DATA DATSCH;SET DATSCH4;
303 KEEP YR MONTH NWELLS SPROD SRATE CASE AREA;
304
305 IF YR LT 1992 THEN DELETE;
306 DAYS=30;
307 IF MONTH EQ 1 OR MONTH EQ 3 OR MONTH EQ 5 OR MONTH EQ 7 THEN DAYS=31;
308 IF MONTH EQ 8 OR MONTH EQ 10 OR MONTH EQ 12 THEN DAYS=31;
309 IF MONTH EQ 2 THEN DO;DAYS=28;IF (INT(YR/4) * 4) EQ YR THEN DAYS=29;
310 END;
311
312 *** CONVERT FROM BCF/MONTH TO MCF/DAY *****;
313 SPROD= 1000000*SPROD;
314 SRATE= SPROD/DAYS;
315
316 IF YR GE 1992 THEN OUTPUT;
317 DELETE;
318
319 PROC SORT DATA=DAT4;BY YR MONTH;
320 PROC SORT DATA=DAT5;BY YR MONTH;
321
322 *** COMBINE HISTORY AND SCHEDULED PRODUCTION DATA *****;
323 DATA DAT5;SET DAT4 DATSCH;
324 KEEP YR MONTH WELLS LWELLS JRATE NWELLS D Q Q0 GP PROD
325 SPROD SRATE CASE AREA;
326 PROC SORT DATA=DAT5;BY YR MONTH;
327
328 PROC DELETE DATA= DAT1 DAT4 DATSCH;
329
330 *PROC PRINT;*TITLE'COMBINED DATA';
331

```

Table E3. SAS Program Listing for PROJ17ST (Continued)

```

332 DATA DATPRO;SET DAT5;***** PROJECT 1ST YRS CAPACITY *****;
333 KEEP AREA CASE YR MONTH DAYS ORATE PRATE D Q0
334 NPROD NPROD2 NPROD3 PROD ;
335 RETAIN GPP DP QP LWELLSP JPRODP ANWELLS 0
336 NGP 0 SNWELLS 0 RRATE RWELLS
337 NGP2 0 RRATE2 RWELLS2;
338
339 DAYS=30;***** ACCOUNT FOR NUMBER OF DAYS IN A MONTH *****;
340 IF MONTH EQ 1 OR MONTH EQ 3 OR MONTH EQ 5 OR MONTH EQ 7 THEN DAYS=31;
341 IF MONTH EQ 8 OR MONTH EQ 10 OR MONTH EQ 12 THEN DAYS=31;
342 IF MONTH EQ 2 THEN DO;DAYS=28;IF (INT(YR/4) * 4) EQ YR THEN DAYS=29;
343 END;
344
345 IF YR EQ (1992 - 1) THEN ANWELLS= ANWELLS + NWELLS; **SUM WELLS**;
346 **** INITIALIZE LAGGED WELLS AND RATE FOR 1ST PROJECTION YEAR *****;
347 IF YR EQ (1992 - 1) AND MONTH EQ 12 THEN DO;
348 DP=D; QP=Q0; GPP= GP; JPRODP=JRATE; * INITIALIZE RATE FOR 1ST YR;
349 LWELLSP= LWELLS + ANWELLS;
350 END;
351
352 LNWELLS=LAG1(NWELLS);
353
354 IF YR LT 1992 THEN DO;PRATE=JRATE;ORATE= Q;OUTPUT;DELETE;END;
355 ***** ESTIMATE 1ST PROJECTION YEARS PRODUCTION RATES *****;
356 IF YR EQ 1992 THEN DO;D=DP;Q0=QP;MGP=GPP;LWELLS=LWELLSP;JPROD=JPRODP;
357
358 SNWELLS= SNWELLS + LNWELLS;
359 JRATE= (JPROD*EXP(D*MGP/LWELLS) + SNWELLS*Q0) ;
360
361 PRATE=JRATE;
362 PROD=JRATE*DAYS; IF PROD GT SPROD THEN PROD= SPROD;
363 NPROD=SNWELLS*Q0*DAYS;
364 GPP=GPP + PROD - NPROD;
365 NGP=NGP + NPROD;
366 NRATE= NPROD/DAYS;
367
368 IF MONTH EQ 12 THEN DO; **JPRODP= JPROD*EXP(D*GPP/LWELLS);
369 ** INITIALIZE RATE FOR 2ND YRS CAPACITY OF 1ST YRS NEW WELLS**;
370 RRATE= NRATE ;
371 RWELLS= SNWELLS; **NUMBER OF NEW WELLS COMPLETED IN 1ST PROJ YR;
372 SNWELLS= 0;
373 END;
374 END;
375 ***** PROJECT 2ND PROJ YRS CAPACITY *****;
376 IF YR EQ (1992 + 1) THEN DO;
377 D=DP;Q0=QP;MGP=GPP;LWELLS=LWELLSP;JPROD=JPRODP;
378 SNWELLS= SNWELLS + LNWELLS;
379
380 **CAPACITY = OLD VINT CAPACITY + NEW VINT CAPACITY + CAPACITY FROM**;
381 ** LAST YEARS COMPLETIONS *****;
382 JRATE= (JPROD*EXP(D*MGP/LWELLS)) + (SNWELLS*Q0) +
383 (RRATE*EXP(D*NGP/RWELLS));
384
385 PRATE=JRATE;
386 PROD=JRATE*DAYS; IF PROD GT SPROD THEN PROD= SPROD;
387 NPROD= RRATE*EXP(D*NGP/RWELLS)*DAYS ;
388 NPROD2=SNWELLS*Q0*DAYS;
389 GPP=GPP + PROD - NPROD - NPROD2 ;
390 NGP=NGP + NPROD ;
391 NGP2=NGP2 + NPROD2 ;
392
393 IF MONTH EQ 12 THEN DO; **JPRODP= JPROD*EXP(D*MGP/LWELLS);
394 RRATE2= NPROD2/DAYS ;
395 AWELLS2= SNWELLS; ** 2ND YRS WELL COMPLETIONS **;
396 SNWELLS= 0;
397 END;
398 END;
399 ***** PROJECT 3RD YEARS CAPACITY *****;
400 IF YR EQ (1992 + 2) THEN DO;
401 D=DP;Q0=QP;MGP=GPP;LWELLS=LWELLSP;JPROD=JPRODP;
402 SNWELLS= SNWELLS + LNWELLS;
403
404 JRATE= (JPROD*EXP(D*MGP/LWELLS)) + (SNWELLS*Q0) +
405 (RRATE*EXP(D*NGP/RWELLS)) + (RRATE2*EXP(D*NGP2/RWELLS2));
406
407 PRATE=JRATE;
408 PROD=JRATE*DAYS; IF PROD GT SPROD THEN PROD= SPROD;
409 NPROD= RRATE*EXP(D*NGP/RWELLS)*DAYS ;

```

Table E3. SAS Program Listing for PROJ17ST (Continued)

```

410   NPROD2= RRATE2*EXP(D*NGP2/RWELLS2)*DAYS ;
411   NPROD3=SNWELLS*Q0*DAYS;
412   GPP=GPP + PROD - NPROD - NPROD2 - NPROD3;
413   NGP=NGP + NPROD ; NGP2=NGP2 + NPROD2;
414   END;
415
416   ORATE= PROD/DAYS;SPROD= 0.000001 * SPROD;MPROD=0.000001 * PROD;
417   PERC= 100*(ORATE/PRATE); CPROD= 0.000001*PRATE*DAYS;
418
419   OUTPUT;
420   *****;
421   *** THE FOLLOWING STMTS ARE USED FOR DEBUGGING ONLY****;
422   *** AND SHOULD BE LEFT COMMENTED UNLESS DEBUGGING ****;
423   *****;
424   *DATA DATPRNT;*SET DATPRO;*
425   *KEEP AREA CASE YR MONTH NRATE PRATE N2RATE NPROD NPROD2 OLDPROD
426   *   PROD RRATE OLDRATE OLDPEAK;*
427   * IF YR LT 1990 THEN DELETE;*
428   * IF NPROD EQ . THEN NPROD=NPROD;*
429   * IF NPROD2 LT 0 THEN NPROD2=0;*
430   * NRATE=NPROD/DAYS;* N2RATE=NPROD2/DAYS;*
431   * OLDPROD=PROD - NPROD - NPROD2;*
432   * OLDRATE=OLDPROD/DAYS;* OLDPEAK=PRATE;*
433   *PROC PRINT;*BY YR;*ID MONTH;*
434   *VAR AREA CASE OLDPEAK OLDRATE NRATE N2RATE PROD OLDPROD
435   *NPROD NPROD2 RRATE MONTH;*****/*
436   *****;
437
438   DATA DATPRO1;SET DATPRO;***** CALC PROD AS PERCENT OF CAPACITY *****;
439   ***** CONVERT FROM DAILY RATES TO MONTHLY PRODUCTION, BCF/MONTH *****;
440   PERC= 100*(ORATE/PRATE); CPROD= 0.000001*PRATE*DAYS;
441   MPROD= 0.000001*ORATE*DAYS;
442
443   PROC SORT DATA=DATPRO1;BY YR MONTH;
444   PROC SORT DATA=DATSC4;BY YR MONTH;
445
446   DATA DATPRO2;MERGE DATPRO1 DATSC4; BY YR MONTH;
447   SRATE=SPROD/DAYS;
448
449   PROC SORT DATA=DATPRO2; BY YR MONTH;
450
451   PROC PRINT DATA=DATPF12;BY YR;ID MONTH;TITLE'17-STATES PROJECTION';
452   VAR CASE SPROD MPROD CPROD PERC SRATE PRATE ORATE MONTH;
453   **VAR Q0 D GP GPP MGP JRATE JPRODP JPROD PRATE ORATE SPROD
454   PROD LWELLS WELLS LWELLSP NWELLS LNWELLS MONTH;
455   **/*
456   **/*;
457   DATA _NULL_;** OUTPUT THE HISTORICAL DATA--FOR PLOTTING ETC**;
458   SET DATPRO ;
459   FILE OUT1;
460   PUT AREA $8-9 CASE $15-19
461   YR 27-30 MONTH 38-39 @78 ORATE F11.0 @89 PRATE F11.0;
462
463   ** KEEP PROJECTED YEARS' DATA ***;
464   DATA DATO2;SET DATPRO2;
465   IF YR LT (1992 - 1) THEN DELETE;
466
467   DATA _NULL_;** OUTPUT THE PROJECTED DATA--FOR REALLOCATION ETC**;
468   SET DATO2;
469   FILE OUT2;
470   PUT AREA $8-9 CASE $15-19
471   YR 25-28 MONTH 38-39 NWELLS 41-48 MAXWEL 51-57 @60 SPROD F9.3
472   @69 CPROD F9.3 @78 MPROD F9.3;
473
474   ** MAKE A PRINTER PLOT OF HISTORY AND PROJECTIONS *****;
475   DATA DATPLOT;SET DATPRO2;
476
477   DATE= YR + MONTH/12;
478   PRATE= PRATE/1000000;
479   ORATE= ORATE/1000000;
480   NRATE= (NPROD/DAYS)/1000000;
481   NRATE2=(NPROD2/DAYS)/1000000;
482   NRATE3=(NPROD3/DAYS)/1000000;
483
484   PROC PLOT DATA=DATPLOT;
485   PLOT SRATE*DATE='S' ORATE*DATE='O' PRATE*DATE='C'/OVERLAY;
486   /*
487   /**;

```

Appendix F

Reallocation Routine

The reallocation routines are executed after each of the mainframe projection runs. The function of the reallocations is to redistribute projected demand from areas which cannot meet scheduled demand to areas with surplus productive capacity (Figure F1). All reallocations of projections are made on a dry EIA total gas basis which requires several conversions of the data as downloaded from the mainframe. Oil-well gas is not reallocated since it is explicitly assumed that all oil-well gas production is at full capacity. Oil-well gas is added to gas-well gas to reallocate demand on a total gas basis.

Special processing is required after the first pass of the mainframe projection routines to create historical gas-well gas production and capacity files which are included in other parts of the reallocation processing. The historical data are not reallocated but are required for proper file processing. Subsequent reallocations simply use the files created during the initial processing of the historical data.

Historical Data

A concatenated data file is downloaded from the first pass of the mainframe projection routines which contains historical data for all States/areas. This file also contains the results of the first projections, but the projections contained in the history download are ignored and not reallocated. The mainframe file is parsed and processed by the macro-driven spreadsheet **PRSHIST2**. Ten individual State/area history files (**ZZHIST** where ZZ is the State/area abbreviation) are created. These 10 files contain gross historical Dwight's-basis gas-well gas production and productive capacity data.

Projected Data

Each complete run of the mainframe projection routines is followed by processing of mainframe downloads through the PC reallocation routines. The reallocations begin with three separate mainframe downloads of concatenated files which contain all the States/areas for each of the three cases. The downloads are first converted into individual case State/area spreadsheet files (30 files total) through the macro-driven spreadsheet **PARSER1**. Each of the three case downloads is processed through **PARSER1**.

The reallocation process continues with conversions of the mainframe projections from Dwight's-basis gross gas-well gas into EIA-basis total dry gas. The 30 individual gross Dwight-basis, State/area, and case-specific projection files are first converted to individual State/area and case-specific dry total EIA-basis files using the macro-driven spreadsheet **PRE_ALL6**. **PRE_ALL6** calls in data from the run identifier (**ID**), the dry/gross conversion file (**SHRINKA**), the EIA/Dwight's conversion (**EIAFACT**), the gross EIA oil-well gas production for the appropriate case (**MONBAA**, **MONHIA**, or **MONLOA**), the State/area historical data file (**ZZHIST**), and the thirty gross Dwight's-basis State/area by case files. Thirty individual State/area and case-specific files of EIA-basis dry total gas data are output from **PRE_ALL6**. The macros complete operation within **PRE_ALL6** by retrieving the next spreadsheet in the processing sequence.

The 30 EIA-basis dry total gas data files are automatically processed by the spreadsheet **STEP5D** into a single file which is specifically formatted for use in the reallocation spreadsheet **STEP6A**.

Figure F1. Demand Reallocation Module

The reallocation of EIA-basis total dry gas takes place in the macro-driven spreadsheet **STEP6A**. The reallocation redistributes scheduled demand which exceeds the State/area productive capacity to States/areas which have a surplus capacity in that particular month. The demand deficits are distributed to the surplus capacity States/areas based on the proportion of demand the State with surplus capacity contributes to the total demand. Parts of the new demand schedule are output which are recombined in further processing. The new demand schedule is a combination of: 1) old demand for States with demand less than capacity and no need to make up deficits, 2) capacities in States which had capacity less than or equal to demand, and 3) new demands in States which have a surplus while other States have a deficit in the same month.

Once demand is reallocated on a dry total EIA basis, it must be converted back to a gross gas-well gas Dwight's basis to be used properly in the mainframe projection routines. These conversions are executed in the macro-driven spreadsheet **POST_ALL1**. Data from the run identifier (**ID**), the dry/gross conversion file (**SHRINKA**), the EIA/Dwight's conversion (**EIAFACT**), the gross EIA oil-well gas production for the appropriate case (**MONBAA**, **MONHIA**, or **MONLOA**), the new gas-well completion forecast, and the new total demand by State/area and case are incorporated during processing. An ASCII file (**RVSCA#** where # is the iteration number) of new demand and the unchanged forecast of new gas-well completions is created to upload these data to the mainframe projection routines. The macros present the user with the option to load a spreadsheet which compares one demand schedule with another to determine if an additional run through the mainframe projections is warranted using the new demand schedule.

The macro-driven spreadsheet **TEST** compares one demand schedule to another and recommends whether an additional run through the mainframe projections is warranted based on the differences in the two schedules. A difference threshold of 1 billion cubic feet per month, or greater, has been set as the lower limit which requires an additional projection run. It is possible that several projection/reallocation cycles may be necessary to reconcile demand with capacity.

Table F1. Reference Table of PC File Names, Software, and Functions

File Name	Software	Function
PARSER1	LOTUS 123	Parse concatenated mainframe projection downloads into spreadsheet format
POSTALL1	LOTUS 123	Convert reallocated dry EIA-basis total demand to gross Dwight-basis gas well gas and combine with the gas well completions forecast for the mainframe projection routines
PRE_ALL6	LOTUS 123	Convert parsed mainframe downloads of demand, production, and capacity from gross Dwight-basis gas well gas into dry EIA-basis total gas for reallocation
PRSHIST2	LOTUS 123	Parse mainframe download of concatenated historic production and capacities into spreadsheet format (preliminary projections are also included in the downloaded files but are not utilized by subsequent spreadsheets)
SHRINKA	LOTUS 123	Table of DRY/GROSS conversion factors used by other spreadsheets
STEP5D	LOTUS 123	Aggregate 30 dry EIA-basis total gas files into specific format for the reallocation program
STEP6A	LOTUS 123	Satisfy national total gas demand by reallocating demand from areas with a production short-fall to areas with excess capacity
TEST	LOTUS 123	OPTIONALLY compare one gross Dwight's-basis demand schedule to a subsequent gross Dwight's-basis demand schedule

Table F2. Spreadsheet Structure Table for PARSER1.WK1

Coefficients, Variables, etc	Location	Description
Download	Col C	Download of States/areas concatenated file of production and capacity for a single case on Dwight's gross gas-well gas basis
Active parse area	D1..D37	Single State/area extraction for parse input
Name	D53	Concatenated State/area abbreviation and case which is used as the name of each extracted State/area file
Area	D55..D90	State/area abbreviation
Case	E55..E90	Case designator
Year	F55..F90	Year designator
Month	G55..G90	Month designator (1-12)
Monthly completions	H55..H90	Monthly projected new gas-well completions
Annual completions	I55..I90	Annual projected new gas-well completions
Scheduled Production	J55..J90	Scheduled monthly production projection as uploaded from the PC (Bcf) on Dwight's gross gas-well gas basis
Capacity	K55..K90	Calculated capacity based on projections of historical data and evaluation of the scheduled monthly production projection (Bcf) and new gas-well completions
Production	L55..L90	Calculated production based on projections of historical data and evaluation of the scheduled monthly production projection (Bcf) and new gas-well completions
Extract	D54..L91	Range of parsed data which is extracted to output files

Table F3. Macros Listing for PARSER1.WK1

Macro Name: \0

{home}/wgpe{beep}

Macro Name: \R

```
{windowsoff}{goto}ID~/wgpd/fccelD~{windowson}{goto}C1~
{if @length(ID)>2#or#@length(ID)<1}ERROR in ID code, can not continue!!!~{beep}{quit}
{onerror DOUBLE}
/fit
{esc}A:.*~{?}~
{for COUNT,1,10,1,DOWN}
```


Table F3. Macros Listing for PARSER1.WK1 (Continued)

```
{for COUNT,1,10,1,GARBAGE}
{if @left(@trim(CELL),2)<>@left(@trim(CHECK),2))/reA1..H20~{goto}A9~    Data Wrap Error
in Download!!! DATA NOT PARSED~{d 2}    <Enter> will exit.~{beep}{?}/wey
{for COUNT,1,10,1,BIGPARSE}
{beep}
/frPARSER1~
```

Subroutine Name: BIGPARSE

```
/m.{d 35}~D1~
{goto}D1~
/dpfc1.{end}{d}~
oD55~g
{if D55=1}/wdcD1~
{if D55=17}{goto}D55~'17~/cD55~D55..D90~
{goto}D53~+D55&E55~
{d}^AREA{r}^CASE{r}^YEAR{r}^MONTH{r}^MTLYCOMP{r}^YRLYCOMP{r}^SCHEDPROD{r}
^CAPACITY{r}PRODUCTION~
/rncNAME~D53~{goto}NAME~
/rff3~J55..N90~
/rncPROD~L67..L90~/rncCAP~K67..K90~/rncDATA~K55..L90~/rncDEM~J67..J90~
/rncDEMAND~J55..J90~
/fxv
$ABB&+$ID
~EXTRACT~r~
/reEXTRACT~
/reD1..D37~
{home}/wdr~
{goto}C2~
{end}{d}
{return}
```

Subroutine Name: DOUBLE

```
{esc}/fit{esc 2}A:.*~{?}~
{branch MORE}
```

Subroutine Name: DOWN

```
/rndCELL~/rncCELL~~
{if CELL=""}{down}{return}
{if CELL="?"}{down}{return}
{if @upper(@left(@trim(CELL),1))="L"}{down}{return}
{forbreak}
```

Subroutine Name: GARBAGE

```
/rndCELL~/rncCELL~~
{if @left(@trim(CELL),1)="1"}{r}/rndCELL~/rncCELL~{d}/rncCHECK~~{u}{forbreak}
{if @left(@trim(CELL),2)="CA"}{d}/rncCHECK~~{u}{forbreak}
{down}{return}
```

Table F4. Spreadsheet Structure Table for POSTALL1.WK1

Coefficients, Variables, etc	Location	Description
Abbreviation	Col A	Two-digit State/area abbreviation
Case	Col B	Case designator, Low case in rows 9-368, Base case in rows 369-728, and High case in rows 729-1088
Year	Col C	Year
Month	Col D	Month
New completions	Col E	Monthly new gas-well completions
Yearly completions	Col F	Annual summation of monthly new gas-well completions
Demand	Col G	Monthly scheduled Dwight's-basis gas-well gas demand (Bcf)
Total Dry Demand	Col H	Reallocated monthly EIA-basis total dry demand (Bcf)
Dry/Gross	Col J	Lookup function of Dry/Gross gas-well gas conversions from table derived from SHRINKA.WK1
EIA/DWT	Col K	Lookup function of EIA/Dwight's gross gas-well gas conversions from table derived from EIAFACT.WK1
Oil-well gas	Col L	Lookup function of oil-well gas from tables derived from MONLOA.WK1, MONBAA.WK1, and MONHIA.WK1
Revised Schedule	A1..G1088	Extracted range which is the revised (reallocated) demand schedule which is sent to the mainframe as basis for projections
Oil-well gas table, low case	P141..AA177	Table of low case oil-well gas projections
Oil-well gas table, base case	P182..AA218	Table of base case oil-well gas projections
Oil-well gas table, high case	P223..AA259	Table of high case oil-well gas projections
Dry/Gross table	P117..Z137	Table of Dry/Gross conversions from SHRINKA.WK1
EIA/DWT table	P91..Z111	Table of EIA/DWT conversions from EIAFACT.WK1

Table F5. Macros Listing for POSTALL1.WK1

Macro Name: \O

```
{goto}SERIES~/wgpdp/fccnSERIES~
STEP5D~{home}{blank A9..L1088}~
{recalc NAME_UPDATE}
{branch \Q}{quit}
```

Macro Name: \Q

```
{goto}A5~/fcceS5~
{blank H7..L1088}
{goto}H5~/fcceS6~
/cDWT_GROSS_FORM~G9..G1088~
{goto}CA~/fccnCA~EIAFACT~
{goto}FO~/fccnFO~EIAFACT~
{goto}KS~/fccnKS~EIAFACT~
{goto}LA~/fccnLA~EIAFACT~
{goto}NM~/fccnNM~EIAFACT~
{goto}OK~/fccnOK~EIAFACT~
{goto}TX~/fccnTX~EIAFACT~
{goto}RM~/fccnRM~EIAFACT~
{goto}SE~/fccnSE~EIAFACT~
/rvFACT_TABLE~FACT_TABLE~
{blank OWG_LOW}
{blank OWG_BASE}
{blank OWG_HIGH}~
{goto}LOW~{d}/fccnA136..L171~
MONLO&+$ID~
{goto}BASE~{d}/fccnA136..L171~
MONBA&+$ID~
{goto}HIGH~{d}/fccnA136..L171~
MONHI&+$ID~
{goto}SHRINK_TABLE~{d}/fccnA5..K18~SHRINKA~
{let A3,"PC FILENAME ."}{blank A4}{let C3,+"RVSC"&$ID&@string($COUNTER,0)&\O
{let A1,"REALLOCATED SCHEDULED DWT-BASIS GWG & FORECAST GAS WELL
COMPL."}
{let A2,@now}{let C2,@now}{let B2,@STRING(-1*@YEAR(@NOW),0)}
~{calc}/rvJ9..L1088~J9~
/fxfRVSC
+$ID&+&$SERIES
~REVISED_SCHED~r{esc}{onerror CONTINUE}
/fep
RVSC&+$ID&+&$SERIES
~y
{onerror}{indicate ASCII}/pf (CONTINUE)
RVSC&+$ID&+&$SERIES
~rA1..G1088~oouml6~mr135~qagq
{goto}P49~{indicate DONE}{beep}{get O40}
~{indicate}{if @upper(O40)="T"/frTEST~
/wey
```

Table F5. Macros Listing for POSTALL1.WK1 (Continued)

Subroutine Name: CONTINUE

```
{onerror}{indicate ASCII}/pf
RVSC&+$ID&+&$SERIES
~rA1..G1088~oouml6~mr135~qagq
{goto}P49~{indicate DONE}{beep}{get O40}
~{indicate}{if @upper(O40)="T"/frTEST~
/wey
```

Table F6. Spreadsheet Structure Table for PRE_ALL6.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Date value of last day of month
Gross EIA gas-well gas production	B25..B192	Monthly gross EIA gas-well gas production derived by converting Dwight's-basis production to an EIA basis (mmcf/d)
Gross EIA gas-well gas capacity	C25..C192	Monthly gross EIA gas-well gas capacity derived by converting Dwight's-basis capacity to an EIA basis (mmcf/d)
Gross EIA oil-well gas production	D25..D192	Monthly gross EIA oil-well gas production (mmcf/d)
Gross EIA total gas production	E25..E192	Monthly gross EIA total gas production derived by summing EIA-basis gas-well gas and oil-well gas (mmcf/d)
Gross EIA total gas capacity	F25..F192	Monthly gross EIA total gas capacity derived by summing EIA-basis gas-well gas and oil-well gas capacity (mmcf/d)
Dry EIA total gas forecast schedule	G157..G192	Monthly demand schedule converted to total EIA basis(Bcf)
Dry EIA total gas capacity	H25..H192	Dry EIA total gas capacity from converted Dwight's-basis gas-well gas capacity and oil-well gas production (mcf/d)
Dry EIA total gas production	I25..I192	Dry EIA total gas production from converted Dwight's-basis gas-well gas production (mcf/d)
Oil-well gas	J25..J192	Monthly oil-well gas production (mmcf)
Gross Dwight's basis scheduled gas-well gas production forecast	K157..K192	Monthly gross Dwight's basis scheduled gas-well gas production forecast from parsed mainframe download (Bcf)
Gross Dwight's basis gas-well gas capacity	L25..L192	Monthly gross Dwight's basis gas-well gas capacity from parsed mainframe download (mcf/d)

Table F6. Spreadsheet Structure Table for PRE_ALL6.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Gross Dwight's basis gas-well gas production	M25..M192	Monthly gross Dwight's basis gas-well gas production from parsed mainframe download (mcf/d)
Dwight's capacity place holder	N25..N192	Place holder for monthly gross Dwight's capacity (mcf/d)
Gross EIA gas-well gas production	O25..O192	Monthly gross EIA gas-well gas production from converted Dwight's parsed mainframe download (mmcf)
Gross EIA gas-well gas capacity	P25..P192	Monthly gross EIA gas-well gas capacity from converted Dwight's parsed mainframe download (mmcf)
Oil-well gas production	Q25..Q192	Monthly oil-well gas production (mmcf)
Gross EIA total gas production	R25..R192	Monthly gross EIA total gas production derived from summation of EIA gas-well gas production and oil-well gas production (mmcf)
Gross EIA total gas capacity	S25..S192	Monthly gross EIA total gas capacity derived from summation of EIA gas-well gas capacity and oil-well gas production (mmcf)
Dry EIA total gas production	T25..T192	Dry EIA total gas production from summation of EIA gas-well gas and oil-well gas production (mmcf)
Dry EIA total gas capacity	U25..U192	Dry EIA total gas capacity
EIA/DWT factor	V25..V192	EIA/DWT factor table from EIAFACT.WK1
Dry/gross factor	W25..W192	Dry/gross factor table from SHRINKA.WK1
Extract	A19..W192	Extracted data range

Table F7. Macros Listing for PRE_ALL6.WK1

Macro Name: \O

/FDC:\123\JAMES~{goto}ID~/fccID~{SCHEDULE}{calc}{branch ALL}

Macro Name: \Q

```
{goto}TABLE~
{goto}AREAS~{?}/wgpD
{if @CELLPOINTER("col")<32#or#@cellpointer("col")>32}{beep}{branch \Q}
{if @CELLPOINTER("row")=13}{branch ALL}
{if @CELLPOINTER("row")=2}{let ABB,CA}{goto}CA~/fccnCA~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=3}{let ABB,FO}{goto}FO~/fccnFO~EIAFACT~{branch INCORP}
```

Table F7. Macros Listing for PRE_ALL6.WK1 (Continued)

```
{if @CELL.POINTER("row")=4}{let ABB,KS}{goto}KS~/fccnKS~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=5}{let ABB,LA}{goto}LA~/fccnLA~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=6}{let ABB,NM}{goto}NM~/fccnNM~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=7}{let ABB,OK}{goto}OK~/fccnOK~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=8}{let ABB,TX}{goto}TX~/fccnTX~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=9}{let ABB,RM}{goto}RM~/fccnRM~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=10}{let ABB,SE}{goto}SE~/fccnSE~EIAFACT~{branch INCORP}
{if @CELL.POINTER("row")=11}{let ABB,@string(17,0)}{branch INCORP}
{if @CELL.POINTER("row")=15}{home}{quit}
{branch \Q}
```

Subroutine Name: INCORP

```
/rvFACT_TABLE~FACT_TABLE~{calc}{let NAME,+$ABB&"BASE"&$ID}~
{let DATE,@now}{let TIME,@now}~{if ABB="KS"/cKS_FORMULA~B25..B168~
/cKS_PROJ~B169..B192~
{goto}HIST~/fccnHISTORY~
$ABB&"HIST~"
{let CASE,"BASE"}{goto}BASE~/fccnDEMAND~ (CONTINUE)
+$ABB&+$CASE&+$ID~
/cBASE~SCHED~
{goto}OWG~/fccn
$ABB~MONBA+$ID
~/rvOWG~OWG~
{goto}PROJ~{onerror NOBASE}/fccnPROD~
+$ABB&+$CASE&+$ID~
{r}/fccnCAP~
$ABB&+"BASE"+$ID
~{calc}{onerror}/fxvED_
$ABB&"B"&+$ID
~DATA~r{esc}
{let NAME,+$ABB&"LOW"&$ID}{let CASE,"LOW"}~ (NOBASE)
{goto}LOW~/fccnDEMAND~
$ABB&+"LOW"&+$ID~
/cLOW~SCHED~
{goto}OWG~/fccn
$ABB~MONLO&+$ID~
~/rvOWG~OWG~
{goto}PROJ~{onerror NOLOW}/fccnPROD~
$ABB&+"LOW"&+$ID~
{r}/fccnCAP~
$ABB&+"LOW"&+$ID
~{calc}{onerror}/fxvED_
$ABB&"L"&+$ID
~DATA~r{esc}
{let NAME,+$ABB&"HIGH"&$ID}{let CASE,HIGH}~ (NOLOW)
{goto}HIGH~/fccnDEMAND~
$ABB&"HIGH"&+$ID~
/cHIGH~SCHED~
{goto}OWG~/fccn
$ABB~MONHI&+$ID~
~/rvOWG~OWG~
```

Table F7. Macros Listing for PRE_ALL6.WK1 (Continued)

```
{goto}PROJ~{onerror NOHIGH}/fccnPROD~
$ABB&"HIGH"&+$ID~
{r}/fccnCAP~
$ABB&"HIGH"&+$ID
~{calc}{onerror}/fxvED_
$ABB&"H"&+$ID
~DATA~r{esc}
{home}{beep} (NOHIGH)
{if ABB="KS"}/cNOT_KS~B25..B168~/cNOT_KS_PROJ~B169..B192~
```

Subroutine Name: ALL

```
{indicate ALL}
{blank CA}{blank FO}{blank LA}{blank KS}{blank LA}{blank NM}{blank OK}{blank TX}
{blank RM}{blank SE}
{goto}CA~/fccnCA~EIAFACT~{goto}FO~/fccnFO~EIAFACT~{goto}KS~/fccnKS~EIAFACT~
{goto}LA~
/fccnLA~EIAFACT~{goto}NM~/fccnNM~EIAFACT~{goto}OK~/fccnOK
/rvFACT_TABLE~FACT_TABLE~{for COUNT,0,9,1,SEQUENCE}{indicate}/frSTEP5D~
```

Subroutine Name: SEQUENCE

```
{let ABB,@index(XX,0,COUNT)}
{recalc INDICATOR}
{indicate $ABB}
{INCORP}
```

Subroutine Name: SCHEDULE

```
{onerror}
{blank DEMAND_SCHEDULE}
{goto}SHRINK_FACTOR~/fccnB5..K24~SHRINKA~
{home}
```

Table F8. Spreadsheet Structure Table for PRSHIST2.WK1

Coefficients, Variables, etc	Location	Description
Download	Col C	Download of States/areas concatenated file of capacity by vintage and year on Dwight's gross gas-well gas basis
Active parse area	D1..D320	Single State/area extraction for parse input
Name	E4	Concatenated State/area abbreviation and "HIST" which is used as the name of each extracted State/area file
Area	Col E	State/area abbreviation
Case	Col F	Case designator

Table F8. Spreadsheet Structure Table for PRSHIST2.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Year	Col G	Year designator
Month	Col H	Month designator (1-12)
Placeholder	Col I - K	Placeholder for unneeded data elements from the download
Scheduled Production	Col L	Scheduled monthly production projection as uploaded from the PC (mcf/d) on Dwight's gross gas-well gas basis
Production	Col M	Monthly historical gas-well gas production data on Dwight's basis (mcf/d)
Capacity	K55..K90	Monthly historical gas-well gas capacity data on Dwight's basis (mcf/d)
Extract	E4..N310	Range of parsed data which are extracted to output files

Table F9. Macros Listing for PRSHIST2.WK1

Macro Name: \0

{home}/vgpe{beep}/fdC:\123\JAMES~

Macro Name: \R

```
{windowsoff}{goto}ID~/wgpd/fccelD~{windowson}{goto}C1~
{if @length(ID)>2#or#@length(ID)<1}ERROR in ID code, can not continue!!!~{beep}{quit}
{onerror DOUBLE}
/fit
{esc}A:.*~{?}~
{onerror}
{BIGPARSE} (MORE)
{FOPARSE}
{for COUNT,1,7,1,BIGPARSE}
{PARSE17}
{beep}/wey
```

Subroutine Name: MORE

```
{BIGPARSE}
{FOPARSE}
{for COUNT,1,7,1,BIGPARSE}
{PARSE17}
{beep}/wey
```

Subroutine Name: BIGPARSE

```
/m.{d 299}~D2~
{let D1,D266}~{goto}D1~
/dpfc{end}{d}~
```


Table F9. Macros Listing for PRSHIST2.WK1 (Continued)

```

oE5~g
{if E6=1}/wdcE1~
{if E6=17}{let E5,'17}~/cE5..F5~E5..E261~
{goto}E5~/cE5..F5~.{end}{d}~
{let E4,+E6&"HIST"}{blank F4..K4}~
^AREA{r}^CASE{r}^YEAR{r}^MONTH{r 4}SCHEDULE{r}PRODUCTION{r}CAPACITY~
/rncNAME~E4~{goto}NAME~
{blank I5..K5}~
/rncPROD~M126..M269~/rncCAP~N126..N269~/rncHISTORY~M126..N269~
/fxv
$ABB&"HIST"
~E4..N310~r~
{blank D1..N310}~
{home)/wdr~
{goto}C2~
{end}{d}
{return}

```

Subroutine Name: DOUBLE

```

{esc)/fit{esc 2}A:.*~{?}~
{branch MORE}

```

Subroutine Name: PARSE17

```

/m.{d 299}~D2~
{let D1,D266}~{goto}D1~
/dpfci.{end}{d}~
oE5~g
~
{if E6=17}{let E5,'17}~/cE5..F5~E5..E261~
{goto}E5~/cE5..F5~.{end}{d}~
{let E4,"17HIST"}{blank F4..K4}~
^AREA{r}^CASE{r}^YEAR{r}^MONTH{r}PRODUCTION{r}CAPACITY~
/rncNAME~E4~{goto}NAME~
/rncPROD~I126..I269~/rncCAP~J126..J269~/rncHISTORY~I126..J269~
/fxv
17HIST
~E4..N310~r~
/reD1..N310~
{home)/wdr~

```

Subroutine Name: FOPARSE

```

/m.{d 287}~D2~
{let D1,D266}~{goto}D1~
/dpfci.{end}{d}~
oE5~g
{if E6=1}/wdcE1~
{if E6=17}{let E5,'17}~/cE5..F5~E5..E261~
{goto}E5~/cE5..F5~.{end}{d}~
{let E4,+E6&"HIST"}{blank F4..K4}~
^AREA{r}^CASE{r}^YEAR{r}^MONTH{r 4}SCHEDULE{r}PRODUCTION{r}CAPACITY~

```

Table F9. Macros Listing for PRSHIST2.WK1 (Continued)

```

/rncNAME~E4~{goto}NAME~
{blank I5..K5}~
/rncPROD~M114..M257~/rncCAP~N114..N257~/rncHISTORY~M114..N257~
/fxv
$ABB&"HIST"
~E4..N310~r~
{blank D1..N310}~
{home}/wdr~
{goto}C2~
{end}{d}
{return}

```

Table F10. Spreadsheet Structure Table for SHRINKA.WK1

Coefficients, Variables, etc	Location	Description
Year	Col A	Year designator
CA	Col B	California (including Pacific OCS) ratio of dry to gross annual volumes of gas-well gas
FO	Col C	Gulf of Mexico OCS ratio of dry (MMS) to gross annual volumes of gas-well gas
KS	Col D	Kansas ratio of dry to gross annual volumes of total gas
LA	Col E	Louisiana (excluding Gulf of Mexico OCS) ratio of dry to gross annual volumes of gas-well gas
NM	Col F	New Mexico ratio of dry to gross annual volumes of gas-well gas
OK	Col G	Oklahoma ratio of dry to gross annual volumes of gas-well gas
TX	Col H	Texas (excluding Gulf of Mexico OCS) ratio of dry to gross annual volumes of gas-well gas
RM	Col I	Rocky Mountain States group ratio of dry to gross annual volumes of gas-well gas
SE	Col J	Southeastern States group ratio of dry to gross annual volumes of gas-well gas
17	Col K	Eighteen States group ratio of dry to gross annual volumes of gas-well gas

Table F11. Spreadsheet Structure Table for STEP5D.WK1

Coefficients, Variables, etc	Location	Description
ID	N2	Run series identifier assigned in START.WK1
COUNTER	P2	Iteration counter used to assign sequential file names to allow each reallocation series to be distinguished
OLD_ID	P3	Check of ID when last used to enable reinitialization of the COUNTER when the run series identifier has changed
Abbreviation	Col A	Two-digit State/area abbreviation
Case	Col B	Case designator, Low case in rows 9 - 368, Base case in rows 369 - 728, and High case in rows 729 - 1088
Year	Col C	Year
Month	Col D	Month
New completions	Col E	Monthly new gas-well completions
Yearly completions	Col F	Annual summation of monthly new gas-well completions
Demand	Col G	Monthly scheduled Dwight's-basis gas-well gas demand
Extract	A1..G1088	Range output to file

Table F12. Macros Listing for STEP5D.WK1

Macro Name: \0

```
/fdC:\123\JAMES~{goto}ID~/fcceID~{home}{calc}{if ID<>OLD_ID}{let COUNTER,0}
{branch \A}~
```

Macro Name: \A

```
{goto}A9~{blank A9..I1088}~/fcceINIT
+$ID
~{onerror 1}
{goto}G9~/fcceED_FOL&+$ID~
{onerror 2} (1)
{goto}G45~/fcceED_TXL&+$ID~
{onerror 3} (2)
{goto}G81~/fcceED_LAL&+$ID~
{onerror 4} (3)
{goto}G117~/fcceED_CAL&+$ID~
{onerror 5} (4)
{goto}G153~/fcceED_KSL&+$ID~
{onerror 6} (5)
{goto}G189~/fcceED_NML&+$ID~
```

Table F12. Macros Listing for STEP5D.WK1 (Continued)

```

{onerror 7} (6)
{goto}G225~/fcceED_OKL&+$ID~
{onerror 8} (7)
{goto}G261~/fcceED_SEL&+$ID~
{onerror 9} (8)
{goto}G297~/fcceED_RML&+$ID~
{onerror 10} (9)
{goto}G333~/fcceED_17L&+$ID~
{onerror 11} (10)
{goto}G369~/fcceED_FOB&+$ID~
{onerror 12} (11)
{goto}G405~/fcceED_TXB&+$ID~
{onerror 13} (12)
{goto}G441~/fcceED_LAB&+$ID~
{onerror 14} (13)
{goto}G477~/fcceED_CAB&+$ID~
{onerror 15} (14)
{goto}G513~/fcceED_KSB&+$ID~
{onerror 16} (15)
{goto}G549~/fcceED_NMB&+$ID~
{onerror 17} (16)
{goto}G585~/fcceED_OKB&+$ID~
{onerror 18} (17)
{goto}G621~/fcceED_SEB&+$ID~
{onerror 19} (18)
{goto}G657~/fcceED_RMB&+$ID~
{onerror 20} (19)
{goto}G693~/fcceED_17B&+$ID~
{onerror 21} (20)
{goto}G729~/fcceED_FOH&+$ID~
{onerror 22} (21)
{goto}G765~/fcceED_TXH&+$ID~
{onerror 23} (22)
{goto}G801~/fcceED_LAH&+$ID~
{onerror 24} (23)
{goto}G837~/fcceED_CAH&+$ID~
{onerror 25} (24)
{goto}G873~/fcceED_KSH&+$ID~
{onerror 26} (25)
{goto}G909~/fcceED_NMH&+$ID~
{onerror 27} (26)
{goto}G945~/fcceED_OKH&+$ID~
{onerror 28} (27)
{goto}G981~/fcceED_SEH&+$ID~
{onerror 29} (28)
{goto}G1017~/fcceED_RMH&+$ID~
{onerror QUIT} (29)
{goto}G1053~/fcceED_17H&+$ID~
{let COUNTER,COUNTER+1} (QUIT)
{CALC}{home}{onerror}
/fxvSCH

```

Table F12. Macros Listing for STEP5D.WK1 (Continued)

```
+$ID&+$SERIES
~A9..I1088~r{esc}
{let OLD_ID,ID}~
/fs~r
/frSTEP6A~
```

Table F13. Spreadsheet Structure Table for STEP6A.WK1

Coefficients, Variables, etc	Location	Description
Year, L48	Col A	Year designator for Lower-48 summary
Month, L48	Col B	Month designator for Lower-48 summary
Case, L48	Col C	Case designator for Lower-48 summary
Demand, L48	Col D	Lower-48 Sum of monthly Demand for case (Bcf)
Capacity, L48	Col E	Lower-48 Sum of monthly Capacity for case
Production, L48	Col F	Lower-48 Sum of monthly Production for case
Surplus Cap, L48	Col G	Lower-48 Sum of monthly Surplus Capacity for case
Dem with Surplus, L48	Col H	Lower-48 Sum of monthly Demand with Surplus Capacity for case
Deficit, L48	Col I	Lower-48 Sum of monthly Deficit for case
Added Deficit, L48	Col J	Lower-48 Sum of monthly Added Deficit for case
Prod / Dem, L48	Col K	Production / Demand, Lower-48
Deficit / Dem, L48	Col L	Deficit / Demand, Lower-48
Cap / Dem, L48	Col M	Capacity / Demand, Lower-48
Tot Dem with Sur / Tot Dem, L48	Col N	Total Demand with Surplus / Total demand, Lower-48
New Dem, L48	Col O	Lower-48 New Dry Gas Total Demand after reallocation (Bcf)
Projection Download	Cols Q - Y	Dry EIA-basis total gas projection (converted downloads) for each State/area and case by month (Bcf)
Area	Col Q	State/area designator
Case	Col R	State/area case designator
Year	Col S	State/area year designator
Month	Col T	State/area month designator

Table F13. Spreadsheet Structure Table for STEP6A.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Monthly New Gas-Well Completions	Col U	State/area projected monthly new gas-well completions
Annual New Gas-Well Completions	Col V	State/area projected annual new gas-well completions
Scheduled Demand	Col W	Projected monthly demand schedule converted to EIA total dry gas based on Dwight's-basis gas-well gas schedule sent to the mainframe
Capacity	Col X	Projected monthly capacity converted to EIA total dry gas from Dwight's-basis gas-well gas capacity downloaded from the mainframe
Production	Col Y	Monthly production projection converted to EIA total dry gas from Dwight's-basis gas-well gas production downloaded from the mainframe
Surplus Capacity	Col Z	Monthly surplus projected capacity on EIA total dry gas basis
Deficit	Col AA	Absolute value of monthly deficit projected demand on EIA total dry gas basis
Demand with Surplus	Col AB	Monthly demand with surplus on EIA total dry gas basis
Cap / Prod	Col AC	Ratio of Capacity to Production on EIA total dry gas basis
Dem / Tot Dem	Col AD	State/area monthly demand divided by total Lower-48 demand
Demand with Surplus >0	Col AE	State/area monthly demand with surplus capacity
New Fraction	Col AF	New fraction, Col AD/Col N
Deficit Added	Col AG	Deficit Added to the State/area, = New Fraction * Total Deficit
New Demand	Col AH	New Demand (basis for new Dwight's-basis gross gas-well gas forecast for mainframe projections) = Production + Deficit Added
Cap / New Dem	Col AI	Capacity / New Demand on EIA dry total gas basis

Table F14. Macros Listing for STEP6A.WK1

Macro Name: \0

```
/fdC:\123\JAMES~{home}{windowsoff}{indicate ID}{goto}SERIES~/fccnSERIES~STEP5D~
{home}{windowson}{indicate}{branch \A}~
```

Macro Name: \A

```
{blank INCOMING}{calc}
{goto}Q9~/fceeSCH
+ $ID&+$SERIES
~{CALC}~{onerror}
/fixvS5~DATA_S5~r{esc}
/fixvS6~DATA_S6~r{esc}
{blank B1}
{HOME}DETAIL RESULT OF SCH
+ $ID&+$SERIES
~/rvA9..A11088~A9~/rnd\0~
/fsDSCH
+ $ID&+$SERIES
~r{esc}
/frPOSTALL1~
```

Table F15. Spreadsheet Structure Table for TEST.WK1

Coefficients, Variables, etc	Location	Description
SERIES	L2..O2	Run series identifier and iteration counter from STEP5D.WK1
Abbreviation	Col A	Two-digit State/area abbreviation
Case	Col B	Case designator, Low case in rows 9-368, Base case in rows 369-728, and High case in rows 729-1088
Year	Col C	Year
Month	Col D	Month
Old schedule	Col E	Monthly demand schedule used in a prior run (Bcf)
New schedule	Col F	Proposed reallocated demand schedule (Bcf)
Difference	Col G	Arithmetic difference of old and new schedules (Bcf)
Action prompt	E4..F4	Prompt to upload new schedule and run mainframe projection routine if differences exceed 1 BCF in any of the projection months for any case, otherwise to process final data

Table F16. Macros Listing for TEST.WK1

Macro Name: \0

```
/fdC:\123\JAMES~{home}{windowsoff}{indicate ID}{goto}SERIES~  
/fccnSERIES~STEP5D~{home}{windowson}{indicate}/rfhE4..F4~
```

Macro Name: \A

```
{menubranched SELECT}
```

Subroutine Name: AUTO_NAME

```
{calc}{goto}E9~/fccnG9..G1088~  
@IF(COUNTER>1,+"RVSC"&$ID&@STRING($COUNTER-1,0)&"~",+"INIT"&$ID&"~")  
{goto}F9~/fccnG9..G1088~  
+"RVSC"&$ID&@STRING($COUNTER,0)&"~"  
/rvE9..F1088~E9~  
/rfgE4..F4~{calc}
```

Subroutine Name: MANUAL

```
{goto}E9~{blank B1..C1}{let B1,Select OLD schedule}/ruB1~/fccnG9..G1088~  
RVSC*~{?}~  
{goto}F9~{blank B1..C1}{let B1,Select NEW schedule}/ruB1~/fccnG9..G1088~  
RVSC*~{?}~  
/rvE9..F1088~E9~  
/rfgE4..F4~{calc}
```

Subroutine Name: NO_AUTO

```
{onerror}  
{goto}K30~{get B1}  
{home}{let A3,NO NOT RESAVE THIS FILE !!!!!}~{branch MANUAL}
```

Menu Name: SELECT

Auto

Automatically process STEP6 data, auto name resultant file w/ STEP5A labels.
{onerror NO_AUTO}{branch AUTO_NAME}

Manual

Manually assign file name to STEP6 data.
{branch MANUAL}

Quit

Do not process or save anything.
{home}{quit}

Appendix G

Table and Figure Generating Routines

Final data processing begins after all projection runs are completed. The tables and figures which are presented in the *Natural Gas Productive Capacity for the Lower 48 States* report (Capacity Report) are created using graphic, word processing, and desk top publishing software on personal computers. Much of the data used in the Capacity Report are prepared as part of the demand reallocation process described in Appendix F. Additional PC programs are run over downloaded mainframe data specifically for several graphic presentations (Figure G1).

Table Generation

Generating the summary table data for each of the States/areas is performed by the spreadsheet **SUMMARY** spreadsheet. **SUMMARY** pulls together various data and outputs a summary table for each of the 10 State/areas. Inputs to **SUMMARY** are: the run identifier (**ID**), the EIA/Dwight's conversion factor (**EIAFACT**), the historical and projected oil-well gas for three cases (**MONLOA**, **MONBAA**, and **MONLOA**), the **DRY/GROSS** conversions (**SHRINKA**), the State/area historical gas-well gas production and capacity (**ZZHIST**), and three cases of State/area gas-well gas production and capacity. All 10 States/areas may be sequentially processed by a single macro.

Monthly summary table data are output in 10 individual State/area files (**AZZSUM**). These output files contain all months throughout the historical and projection years. The **AZZSUM** files are processed through another macro-driven spreadsheet (**SUM_L48**) which sums the State/area data into a lower 48 States aggregate data file (**AL48SUM**). Final publication tables are prepared by manually reducing the data to the appropriate months and years prior to incorporating them into a series of WordPerfect files which support Ventura desk top publishing.

Figure Generation

In addition to the summary table data files output by **SUMMARY**, 10 individual State/area data files for graph generation are also output. The data files for the graphics contain historical and projected data series for the capacities for all three cases. The historical and projected base case production data are also included. Lotus 123 spreadsheet named ranges are imported into Harvard Graphics to prepare the publication graphics.

The lower 48 States production and capacity graph data are prepared by the spreadsheet **CHT_L48**. This macro-driven spreadsheet sums the 10 individual chart data files output by **SUMMARY**. The data output by the macro are saved into a data file named **L48_CHT** which is the source for Harvard Graphic named range importation.

Graphical data for the percentage productive capacity by well age plots are developed independent of the reallocation processing. A concatenated data file (**AVBASE**) is downloaded from the mainframe and incorporated into the macro-driven spreadsheet **PRS12CAP**. The spreadsheet uses data table functions to evaluate the percentage of gross productive capacity wells in the one to five years old age brackets contribute to total capacity for the specific area or State. This evaluation is made for only nine States/areas since the Eighteen States do not have data which allow this type of evaluation. The lower States, excluding the Eighteen States, are also evaluated. The data in the output files (**ZZD_A** and **L48D_A**) are imported as named ranges into Harvard Graphics charts for publication.

Figure G1. Data Presentation Routines

Table G1. Reference Table of PC File Names, Software, and Functions

File Name	Software	Function
CHT_L48	LOTUS 123	Aggregate 10 individual area chart data files into a L48 data set for importation into Harvard Graphics
PRS12CAP	LOTUS 123	Prepare evaluation of December capacity by completion age (year - vintage)
SUM_L48	LOTUS 123	Prepare production and capacity summary tables of the lower 48 States
SUMMARY	LOTUS 123	Prepare production and capacity summary tables and extracts of production and capacity data for charts

Table G2. Spreadsheet Structure Table for CHT_L48.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Month and year
Dry monthly production	Col B	Historical and projected base case monthly dry total gas production (mmcf/d)
Dry low case capacity	Col C	Historical total dry capacity and projected low case total dry capacity (mmcf/d)
Dry base case capacity	Col D	Historical total dry capacity and projected base case total dry capacity (mmcf/d)
Dry high case capacity	Col E	Historical total dry capacity and projected high case total dry capacity (mmcf/d)

Table G3. Macros Listing for CHT_L48.WK1

Macro Name: \L

```
{blank A6..E149}
{home}
{let A1,L48_CHT.wk1}
/fsL48_CHT~r{esc}
/fcce17_CHT~
/cA6..A149~F6~
{let A1,L48_CHT.wk1}
{indicate CA}
/fcaeCA_CHT~
{indicate FO}
/fcaeFO_CHT~
{indicate KS}
/fcaeKS_CHT~
{indicate LA}
/fcaeLA_CHT~
{indicate NM}
/fcaeNM_CHT~
{indicate OK}
/fcaeOK_CHT~
{indicate RM}
/fcaeRM_CHT~
{indicate SE}
/fcaeSE_CHT~
{indicate TX}
/fcaeTX_CHT~
{indicate SAVE}
/cF6..F149~A6~
{indicate}
{blank F6..F149}
```

Table G3. Macros Listing for CHT_L48.WK1 (continued)

```
{let C1,@now}
{goto}E1~/fcelID~
/fs~r
/wey
```

Table G4. Spreadsheet Structure Table for PRS12CAP.WK1

Coefficients, Variables, etc	Location	Description
Download	Col C	Mainframe download of AVBASE file
Area	Col E	Area designator
Case	Col F	Case designator
Vintage	Col G	Vintage year
Year	Col H	Year
Month	Col I	Month
Production	Col J	Gross Dwight's annual production (mcf)
Capacity	Col K	Gross Dwight's capacity (mcf)
Criteria	N2..P3	Data table criteria
Function	M5	Data lookup function
Data Table	M5..Z25	Two-way data table of vintage and year
Database	E4..K8192	Parsed database of December data
Capacity by age	M28..Z33	Percentage capacity by well age table for charts
Extract	M4..Y33	Data file extract for charts

Table G5. Macros Listing for PRS12CAP.WK1

Macro Name: \0

```
{home)/wgpe{beep}
```

Macro Name: \R

```
{windowsoff}{goto}ID~/wgpd/fcelID~{windowson}{goto}C2~
{if @length(ID)>2#or#@length(ID)<1}ERROR in ID code, can not continue!!!~{beep}{quit}
{onerror DOUBLE}
/fit
{esc}A:*.~{?}~
{let C1,C3220}~{onerror} (MORE)
```

Table G5. Macros Listing for PRS12CAP.WK1 (continued)

```

(goto)C1~
/dpfc{i.{end}}{d}~
oE5~g
(goto)E5~
AREA{r}^CASE{r}^VINT{r}^YEAR{r}^MONTH{r}PRODUCTION{r}CAPACITY~
(goto)M6~{edit}{home}{del}~
(for COUNT,0,8,1,STEP)
(blank AREA)~
/dt2
M6..Z26~
O4~P4~
{let AREA,"L48"}
{calc}/fxv
+$AREA&"D_"&$ID
~VINT~r{esc}
{beep}/wey

```

Subroutine Name: STEP

```

{let AREA,@index($size,0,$count)}
/dt2
M6..Z26~
O4~P4~
{calc}/fxv
+$AREA&"D_"&$ID
~VINT~r{esc}
{return}

```

Subroutine Name: DOUBLE

```

{esc}/fit{esc 2}A:.*~{?}~
(branch MORE)

```

Subroutine Name: MORE

```

{let C1,C3220}~{onerror}
(goto)C1~
/dpfc{i.{end}}{d}~
oE5~g
(goto)E5~
AREA{r}^CASE{r}^VINT{r}^YEAR{r}^MONTH{r}PRODUCTION{r}CAPACITY~
(goto)M6~{edit}{home}{del}~
(for COUNT,0,8,1,STEP)
(blank AREA)~
/dt2
M6..Z26~
O4~P4~
{let AREA,"L48"}
{calc}/fxv
+$AREA&"D_"&$ID
~VINT~r{esc}
{beep}/wey

```

Table G6. Spreadsheet Structure Table for SUM_L48.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Date value of last day of month
Dry EIA total gas production	B7..B150	Dry historical EIA total gas production from converted Dwight's-basis gas-well gas production (mmcf/d)
Dry EIA gas-well gas capacity	C7..C150	Dry historical EIA gas-well gas capacity calculated as the difference of dry total EIA capacity and dry oil-well gas production (mmcf/d)
Dry oil-well gas	D7..D150	Monthly historical oil-well gas production converted to dry using DRY/GROSS ratio (mmcf/d)
Dry EIA total gas capacity	E7..E150	Dry historical EIA total gas capacity from converted Dwight's-basis gas-well gas capacity and oil-well gas production (mmcf/d)
Dry surplus	F7..F150	Historical surplus dry total capacity (mmcf/d)
Utilization	G7..G228	Percentage total dry capacity utilization
Gross EIA gas-well gas production	H7..H150	Historical monthly gross EIA gas-well gas production derived by converting Dwight's-basis production to an EIA basis (mmcf/d)
Gross EIA gas-well gas capacity	I7..I150	Historical monthly gross EIA gas-well gas capacity derived by converting Dwight's-basis capacity to EIA basis (mmcf/d)
Gross EIA oil-well gas production	J7..J150	Monthly gross EIA oil-well gas production (mmcf/d)
Gross EIA total production	K7..K150	Historical monthly gross EIA total gas production (mmcf/d)
Gross EIA total capacity	L7..L150	Historical monthly gross EIA total capacity (mmcf/d)
EIA oil-well gas production	M7..M150	Historical monthly EIA oil-well gas (mmcf)
Dwight's-basis capacity	N7..N150	Historical monthly gross Dwight's capacity (mcf/d)
Dwight's gas-well gas production	O7..O150	Historical monthly gross Dwight's gas-well gas production (mcf/d)
Place holder	P7..P228	Place holder for incorporation of monthly gross Dwight's capacity (mcf/d)
EIA/DWT factor	Q7..Q228	EIA/DWT factor table from EIAFACT.wk1

Table G6. Spreadsheet Structure Table for SUM_L48.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Dry/gross factor	R7..R228	Dry/gross factor table from SHRINKA.wk1
Extract	A10..R228	Extracted data range for interim summary tables
Projected Dry EIA total gas production	B153..B228	Dry projected EIA total gas production from converted Dwight's-basis gas-well gas production (mmcf/d)
Projected Dry EIA gas-well gas capacity	C153..C228	Dry projected EIA gas-well gas capacity calculated as the difference of dry total EIA capacity and dry oil-well gas production (mmcf/d)
Projected Dry oil- well gas	D153..D228	Monthly projected oil-well gas production converted to dry using DRY/GROSS ratio (mmcf/d)
Projected Dry EIA total gas capacity	E153..E228	Dry projected EIA total gas capacity from converted Dwight's-basis gas-well gas capacity and oil-well gas production (mmcf/d)
Projected Dry surplus	F153..F228	Projected surplus dry total capacity (mmcf/d)
Projected Gross EIA gas-well gas production	H153..H228	Projected monthly gross EIA gas-well gas production derived by converting Dwight's-basis production to an EIA basis (mmcf/d)
Projected Gross EIA gas-well gas capacity	I153..I228	Projected monthly gross EIA gas-well gas capacity derived by converting Dwight's-basis capacity to an EIA basis (mmcf/d)
Projected Gross EIA oil-well gas production	J153..J228	Monthly gross EIA oil-well gas production (mmcf/d)
Projected Gross EIA total production	K153..K228	Projected monthly gross EIA total gas production (mmcf/d)
Projected Gross EIA total capacity	L153..L228	Projected monthly gross EIA total capacity (mmcf/d)
Projected EIA oil- well gas production	M153..M228	Projected monthly EIA oil-well gas (mmcf)
Projected Dwight's capacity	N153..N228	Projected monthly gross Dwight's capacity (mcf/d)

Table G6. Spreadsheet Structure Table for SUM_L48.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Projected Dwight's gas-well gas production	O153..O228	Projected monthly gross Dwight's gas-well gas production (mcf/d)
L-48 extract	A1..R228	L-48 Summary table data extract

Table G7. Macros Listing for SUM_L48.WK1

Macro Name: \0

{windowsoff}/wgpd{goto}ID~/fccelD~
{home}{windowson}/wgpe{quit}

Macro Name: \A

{home}/fcseSUM_L48~{recalc \A}
/fcae
+\$ID
CASUM~
/wgpd/cDATES~HOLD_DATES~
/fcae
+\$ID
FOSUM~
/fcae
+\$ID
KSSUM~
/fcae
+\$ID
LASUM~
/fcae
+\$ID
NMSUM~
/fcae
+\$ID
OKSUM~
/fcae
+\$ID
RMSUM~
/fcae
+\$ID
SESUM~
/fcae
+\$ID
TXSUM~
/fcae
+\$ID

Table G7. Macros Listing for SUM_L48.WK1 (continued)

```

17SUM~
{let DATE,@now}
{let TIME,@now}
{let A1,+$T$2&"L48SUM"}~
/cHOLD_DATES~DATES~
{calc}
/xf
+$ID&"L48SUM"
~EXTRACT~r{esc}
/wey

```

Table G8. Spreadsheet Structure Table for SUMMARY.WK1

Coefficients, Variables, etc	Location	Description
Time	Col A	Date value of last day of month
Dry EIA total gas production	B16..B159	Dry historical EIA total gas production from converted Dwight's-basis gas-well gas production (mmcf/d)
Dry EIA gas-well gas capacity	C16..C159	Dry historical EIA gas-well gas capacity calculated as the difference of dry total EIA capacity and dry oil-well gas production (mmcf/d)
Dry oil-well gas	D16..D159	Monthly historical oil-well gas production converted to dry using DRY/GROSS ratio (mmcf/d)
Dry EIA total gas capacity	E16..E159	Dry historical EIA total gas capacity from converted Dwight's-basis gas-well gas capacity and oil-well gas production (mmcf/d)
Dry surplus	F16..F159	Historical surplus dry total capacity (mmcf/d)
Utilization	G16..G237	Percentage total dry capacity utilization
Gross EIA gas-well gas production	H16..H159	Historical monthly gross EIA gas-well gas production derived by converting Dwight's-basis production to an EIA basis (mmcf/d)
Gross EIA gas-well gas capacity	I16..I159	Historical monthly gross EIA gas-well gas capacity derived by converting Dwight's-basis capacity to an EIA basis (mmcf/d)
Gross EIA oil-well gas production	J16..J159	Monthly gross EIA oil-well gas production (mmcf/d)
Gross EIA total production	K16..K159	Historical monthly gross EIA total gas production (mmcf/d)
Gross EIA total capacity	L16..L159	Historical monthly gross EIA total capacity (mmcf/d)

Table G8. Spreadsheet Structure Table for SUMMARY.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
EIA oil-well gas production	M16..M159	Historical monthly EIA oil-well gas (mmcf)
Dwight's-basis capacity	N16..N159	Historical monthly gross Dwight's capacity (mcf/d)
Dwight's gas-well gas production	O16..O159	Historical monthly gross Dwight's gas-well gas production (mcf/d)
Place holder	P16..P237	Place holder for incorporation of monthly gross Dwight's capacity (mcf/d)
EIA/DWT factor	Q16..Q237	EIA/DWT factor table from EIAFACT.wk1
Dry/gross factor	R16..R237	Dry/gross factor table from SHRINKA.wk1
Extract	A10..R237	Extracted data range for interim summary tables
Projected Dry EIA total gas production	B162..B237	Dry projected EIA total gas production from converted Dwight's-basis gas-well gas production (mmcf/d)
Projected Dry EIA gas-well gas capacity	C162..C237	Dry projected EIA gas-well gas capacity calculated as the difference of dry total EIA capacity and dry oil-well gas production (mmcf/d)
Projected Dry oil-well gas	D162..D237	Monthly projected oil-well gas production converted to dry using DRY/GROSS ratio (mmcf/d)
Projected Dry EIA total gas capacity	E162..E237	Dry projected EIA total gas capacity from converted Dwight's-basis gas-well gas capacity and oil-well gas production (mmcf/d)
Projected Dry surplus	F162..F237	Projected surplus dry total capacity (mmcf/d)
Projected Gross EIA gas-well gas production	H162..H237	Projected monthly gross EIA gas-well gas production derived by converting Dwight's-basis production to an EIA basis (mmcf/d)
Projected Gross EIA gas-well gas capacity	I162..I237	Projected monthly gross EIA gas-well gas capacity derived by converting Dwight's-basis capacity to an EIA basis (mmcf/d)
Projected Gross EIA oil-well gas production	J162..J237	Monthly gross EIA oil-well gas production (mmcf/d)
Projected Gross EIA total production	K162..K237	Projected monthly gross EIA total gas production (mmcf/d)

Table G8. Spreadsheet Structure Table for SUMMARY.WK1 (Continued)

Coefficients, Variables, etc	Location	Description
Projected Gross EIA total capacity	L162..L237	Projected monthly gross EIA total capacity (mmcf/d)
Projected EIA oil- well gas production	M162..M237	Projected monthly EIA oil-well gas (mmcf)
Projected Dwight's capacity	N162..N237	Projected monthly gross Dwight's capacity (mcf/d)
Projected Dwight's gas-well gas production	O162..O237	Projected monthly gross Dwight's gas-well gas production (mcf/d)
Chart extract	S11..W159	Chart data extract

Table G9. Macros Listing for SUMMARY.WK1

Macro Name: \O

/FDC:\123\JAMES~{goto}SERIES~/fccnM2..P3~STEP5C~{goto}ID~/fccelID~{SCHEDULE}{calc}

Macro Name: \Q

```
{goto}TABLE~
{goto}AREAS~{?}/wgpdp
{if @CELLPOINTER("col")<29#or#@cellpointer("col")>40}{beep}{branch \Q}
{if @CELLPOINTER("row")=13}{branch ALL}
{if @CELLPOINTER("row")=2}{let ABB,CA}{goto}CA~/fccnCA~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=3}{let ABB,FO}{goto}FO~/fccnFO~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=4}{let ABB,KS}{goto}KS~/fccnKS~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=5}{let ABB,LA}{goto}LA~/fccnLA~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=6}{let ABB,NM}{goto}NM~/fccnNM~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=7}{let ABB,OK}{goto}OK~/fccnOK~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=8}{let ABB,TX}{goto}TX~/fccnTX~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=9}{let ABB,RM}{goto}RM~/fccnRM~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=10}{let ABB,SE}{goto}SE~/fccnSE~EIAFACT~{branch INCORP}
{if @CELLPOINTER("row")=11}{let ABB,@string(17,0)}{branch INCORP}
{if @CELLPOINTER("row")=15}{home}{quit}
{branch \Q}
```

Subroutine Name: INCORP

```
/rvFACT_TABLE~FACT_TABLE~{calc}{let NAME,+$ID&$ABB&"SUM"}~
{let DATE,@now}{let TIME,@now}~
{goto}HIST~/fccnHISTORY~
+$ABB&"HIST~"
```

Table G9. Macros Listing for SUMMARY.WK1 (continued)

```
{goto}BASE_PROD~/fccnPROD~ (CONTINUE)
+$ABB&"BASE"&$ID&"~"
{goto}BASE_CAP~/fccnCAP~
+$ABB&"BASE"&$ID&"~"
{goto}LOW_PROD~/fccnPROD~ (NOBASE)
+$ABB&"LOW"&$ID&"~"
{goto}LOW_CAP~/fccnCAP~
+$ABB&"LOW"&$ID&"~"
{goto}HIGH_PROD~/fccnPROD~ (NOLOW)
+$ABB&"HIGH"&$ID&"~"
{goto}HIGH_CAP~/fccnCAP~
+$ABB&"HIGH"&$ID&"~"
{calc}/fxv (NOHIGH)
+$NAME
~EXTRACT~r{esc}
/fxv
+$ABB&"_CHT"
~CHART_DATA~r{esc}
{home}{beep}
```

Subroutine Name: ALL

```
{indicate ALL}
{blank CA}{blank FO}{blank LA}{blank KS}{blank LA}{blank NM}{blank OK}{blank TX}
{blank RM}{blank SE}
{goto}CA~/fccnCA~EIAFACT~{goto}FO~/fccnFO~EIAFACT~{goto}KS~/fccnKS~
EIAFACT~{goto}LA~/fccnLA~EIAFACT~{goto}NM~/fccnNM~EIAFACT~
{goto}OK~/fccnOK~EIAFACT~{goto}TX~/fccnTX~EIAFACT~{goto}RM~
/fccnRM~EIAFACT~{goto}SE~/fccnSE~EIAFACT~
/rvFACT_TABLE~FACT_TABLE~{for COUNT,0,9,1,SEQUENCE}{indicate}
```

Subroutine Name: SEQUENCE

```
{let ABB,@index(XX,0,COUNT)}
{recalc INDICATOR}
+{"indicate "&ABB&"}"
{INCORP}
```

Subroutine Name: PAUSE

```
{goto}V110~/bbbb{esc}{get V110}{home}{return}
```

Subroutine Name: SCHEDULE

```
{recalc SCHEDULE}{onerror}
{goto}BASE_OWG~{d}/fccnA4..L171~
+"MONBA"&$ID&"~"
{goto}SHRINK_FACTOR~/fccnB5..K24~SHRINKA~
{goto}HIGH_OWG~{d}/fccnA136..L171~
+"MONHI"&$ID&"~"
{goto}LOW_OWG~{d}/fccnA136..L171~
+"MONLO"&$ID&"~"
{home}
```

Appendix H

Model Cross-Reference Tables

Table H1. GASCAP Variable Cross-Reference

Name/Equation in Document		Program Name	Name/Place in Program	Definition and Units
q	(6) (6) (9)	VINTPEAK CHYP9TMP EPROJZZ EPROJZZ	PEAK PRATE QE QE2	Gas flow rate at capacity, Mcf per day
q _i	(6) (6) (11) (10) (9)	CHYP9TMP EPROJZZ EPROJZZ EPROJZZ EPROJZZ	B1 B1 B1 B1 B1	Initial gas flow rate at capacity, Mcf per day B1 multiplied by (1-GP3/B2)**(B3) to adjust for irregular initial production
G _p	(6) (6) (10)	VINTPEAK EPROJZZ EPROJZZ EPROJZZ	GPM GP2 GPE GP2E	Cumulative gas produced, Mcf
G _{ul} /v	(11)	EPROJZZ	PWB2	Ultimate recovery per well, Mcf
G _{ul}	(6) (6) (9) (10) (11)	CHYP9TMP EPROJZZ EPROJZZ EPROJZZ EPROJZZ	B2 B2 B2-GP3 B2 B2	Ultimate recoverable gas, Mcf
B	(6) (9) (10) (11)	CHYP9TMP EPROJZZ EPROJZZ EPROJZZ	B3 B3 B3 PWB3	Transformation of the hyperbolic decline exponent (b) which is equal to 1/(1-b)
G _{ulv}	(7)	CHYP9TMP	PWB2	Average ultimate recovery per well, Mcf
G _{pv}	(7)	CHYP9TMP	MGP2WELL	Average recovery through December of the second year of production, Mcf
q _v	(7)	CHYP9TMP	MMODWELL	Average capacity per well, Mcf per day
q _{iv}	(7)	CHYP9TMP	MPWB1	Average initial capacity per well, Mcf per well
t	(9)	EPROJZZ	TIME1	Time, days
q _i /v	(11)	EPROJZZ	PWB1	Productive capacity per well, Mcf per day
q _k	(11)	EPROJZZ	QE	Productive capacity in month k, Mcf per day

Table H1. GASCAP Variable Cross-Reference (Continued)

Name/Equation in Document		Program Name	Name/Place in Program	Definition and Units
v_k	(11)	EPROJZZ	NWELLS & WLS	Number of new gas-well completions for month k
v_j	(11)	EPROJZZ	LWELL	Summation of monthly well completions for the previous months of the vintage year
v_{m-1}	(12)	PROJ17ST	SPWLS	Total number new gas-well completions for year
ΔG_p	(11)	EPROJZZ	GP3	Difference between the gas produced during the month and the amount of gas that would have been produced under normal or average conditions, Mcf
k	(11)	EPROJZZ	MONTH	Month 1,2,...12
j	(11)	EPROJZZ	Observation	jth term in the series
m	(12,13)	PROJ17ST	YR	Year
q_{pk}	(12)	PROJ17ST	PPROD	Peak production rate for year m, Mcf per day
D	(12,13)	PROJ17ST	D	Decline rate of old production, wells per Bcf
G_{pvm-1}	(12)	PROJ17ST	LGP/LWELLS	Cumulative production per well, Bcf per well
q_{gi}	(12,13)	PROJ17ST	Q0	Initial gas production rate for new wells, Mcf per day
n	(13)	PROJ17ST	MONTH	Month
$q_{pk(m,n)}$	(13)	PROJ17ST	JRATE	Peak production rate for year (m) and month (n), Mcf per day
$q_{pk(m,1)}$	(13)	PROJ17ST	JPROD	Calculated January peak production rate for year (m) used as the starting point to cumulate new well completions for monthly projections, Mcf per day
$G_{pv(m,n-1)}$	(13)	PROJ17ST	MGP/LWELLS	Cumulative production per well, to month n-1 for year (m), Bcf per well
$v_{m,n-1}$	(13)	PROJ17ST	SNWELLS	New well completions to month (n-1) for year (m)
Rigs	(14) (19)	Rigs.xls	Col Z	Predicted total number of rigs drilling for oil and gas
SOI	(14)	Rigs.xls	Col O	Smoothed oil income, constant \$, using equation (15) for α_{SOI}

Table H1. GASCAP Variable Cross-Reference (Continued)

Name/Equation in Document		Program Name	Name/Place in Program	Definition and Units
SGI	(14)	Rigs.xls	Col U	Smoothed gas income, constant \$, using the generic equation (14) and a constant α_{SGI} of 0.324548
GI	(14)	Rigs.xls	Col R	Lower-48 gas income, constant \$
Sn	(14) (17)	Rigs.xls	Col X AD19:AD30	The 12 different seasonality factors for January through December
i	(14-16) (18)	Rigs.xls Gasrigs.xls	Col A Col A	Time, month and year
a	(14)	Rigs.xls	AC1	0.640402 (constant)
d	(14)	Rigs.xls	AC4	1.206404 (constant)
b	(14)	Rigs.xls	AC2	2.039463 (constant)
α_{SGI}	(15)	Rigs.xls	AD2	0.324548 (constant exponential smoothing coefficient for smoothed gas income)
α_{SOI}	(16)	Rigs.xls	Col N	Variable exponential smoothing coefficient for smoothed oil income
h	(16)	Rigs.xls	AD3	11.15438 (constant)
c	(16)	Rigs.xls	AC3	0.04 (constant)
SOI6	(16)	Rigs.xls	Col P	Smoothed oil income with a constant exponential smoothing coefficient of 0.2857 (equivalent to a 6 month smoothing)
i	(17)	Rigs.xls	AC19:AC30	1 - 12 for January - December
l	(17)	Rigs.xls	AD6	-0.19825 (constant)
j	(17)	Rigs.xls	AD5	0.026165 (constant)
f	(17)	Rigs.xls	AD4	1.073709 (constant)
GRR	(18,19)	Gasrigs.xls	Col AA	Predicted gas rig ratio as a percent
GI3	(18)	Gasrigs.xls	Col H	3-month running average of gas income, constant
α_{SGI}	(18)	Gasrigs.xls	AD3	0.08 (constant exponential smoothing coefficient for gas income)
α_{SOI}	(18)	Gasrigs.xls	AE3	0.139771 (constant exponential smoothing coefficient for oil income)
SOI	(18)	Gasrigs.xls	Col M	Smoothed oil income, constant \$, using the constant α_{SOI} of 0.139771

Table H1. GASCAP Variable Cross-Reference (Continued)

Name/Equation in Document		Program Name	Name/Place in Program	Definition and Units
SGI	(18)	Gasrigs.xls	Col G	Smoothed gas income, constant \$, using the constant α_{SGI} of 0.08
b	(18)	Gasrigs.xls	AD2	0.517667 (constant coalbed methane and tight gas sand drilling factor (1+b))
a	(18)	Gasrigs.xls	AD1	0.262762 (constant)
d	(18)	Gasrigs.xls	AD4	0.002974 (constant)
e	(18)	Gasrigs.xls	AD5	-0.0018 (constant)
f	(18)	Gasrigs.xls	AE1	0.085367 (constant)

Table H2. GASCAP Equation Cross-Reference

Document Equation Number	Program Names	Line Numbers in Program	Purpose of Equation
(6)	CHYP9TMP EPROJZZ	736, 1030, 1362, 1790 and 2255 538, 640, 760, 881 and 33 more times	Calculate cumulative production, Mcf
(7)	CHYP9TMP	2838 and 3189	Calculate ultimate recovery per well for projection years, Mcf
(9)	EPROJZZ	653, 777, 899, 1017, and 35 more times	Calculate time corresponding to vintage productive capacity at beginning of month, days
(10)	EPROJZZ	549, 658, 782, 904 and 36 more times	Calculate cumulative production through end of month if production is at capacity, Mcf
(11)	EPROJZZ	621, 724, 845, 962 and 30 more times	Calculate productive capacity for month k, Mcf
(12)	PROJ17ST	192, 219, and 248	Calculate peak rates from annual data, Mcf/day
(13)	PROJ17ST	283, 359, 382 and 404	Project productive capacity for year-m and month-n, Mcf/day
(14)	RIGS.XLS	Col Z	Predicted total number of rigs drilling for oil and gas
(16)	RIGS.XLS	Col N	Variable exponential smoothing coefficient for oil income
(17)	RIGS.XLS	AD19:AD30	Seasonality factors January through December
(18)	GASRIGS.XLS	Col AA	Predicted gas rig ratio as a percent
(19)	GASCMPL.WK1	B50..K141	Calculate projected new gas-well completions

Appendix I

Regression Coefficients for Capacity Equations

This series of tables consists of variables contained in equation (6) and their values through the most recent complete production data year. A dot under the asymptotic standard error headings mean that the value is missing. This occurs in the cases where the associated parameter value has been fixed. It also occurs for the last two vintage years where there was not enough data to perform a fit. There is a more detailed discussion on the fixed parameter values in Chapter 4 of this document.

The first vintage year varies by state but is usually the first year of reported production data. For expediency, the earliest that a vintage year can be is 1969. All wells that began producing in or prior to the first vintage year are included in the first vintage year. For example, the first vintage year for California is 1978. However, the production for wells that began producing in 1950 are included in the 1978 vintage. Also, the cumulative production prior to the first vintage year is included in the cumulative production for the first vintage year when available. Note that in areas containing more than one State (Rocky Mountain and Southeast), the State with the fewest reported years determines the first vintage year for the area.

These criteria cause the cumulative production (G_p), for the first vintage year, to be larger than the G_p for any of the later vintage years.

Table I1. Parameters and Coefficients for California (Including Pacific OCS)

Vintage Year	$G_{p,b}$ (Mcf) ^b	q_i (Mcf/day) ^b	$G_{ul,b}$ (Mcf) ^b	B	Asymptotic Standard Error ^a		
					q_i	G_{ul}	B
1978	1131865124	885494	2.655E+09	3.000	18469	6.587213E+07	
1979	114388444	190401	1.539830E+08	1.959	23078	1.359679E+07	
1980	98486819	117496	1.242180E+08	1.569	1017	9.314631E+05	2.262
1981	95937167	134836	1.297300E+08	1.776	1521	1.222624E+06	0.121
1982	76626283	130386	3.246770E+07	1.142	2497	1.325206E+06	0.274
1983	141337482	285021	1.518530E+08	1.188	7315	2.222996E+06	0.137
1984	151854902	254380	1.647360E+08	1.057	446	1.953551E+05	0.194
1985	76713562	153699	1.075640E+08	1.728	335	2.610150E+05	0.012
1986	50515286	108034	7.248850E+07	1.581	4908	1.777920E+07	0.062
1987	30201308	64592	5.246390E+07	1.667		4.203425E+06	0.637
1988	31822527	86920	5.573230E+07	1.667			
1989	34161581	83219	1.708100E+08	1.667			
1990	16937278	87082	6.895410E+07	1.667			
1991	0	80345	8.259340E+07	1.667			

^aA dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.

^bMcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table I2. Parameters and Coefficients for Gulf of Mexico OCS

Vintage Year	G_p^b (Mcf)	q_i (Mcf/day) ^b	G_{ul}^b (Mcf) ^b	B	Asymptotic Standard Error ^a	
					q_i	G_{ul}
1971	13397742643	10085368	1.392090E+10	1.001	74748	5.228486E+07
1972	2276344655	2133686	2.342890E+09	1.001	54275	3.725443E+07
1973	3499483108	5338591	3.710090E+09	1.437	66253	1.018870E+07
1974	1729469846	2063273	1.756580E+09	1.005	31722	6.625308E+06
1975	2462064475	2813859	2.602600E+09	1.165	33464	1.163794E+07
1976	3460378307	3441461	3.660240E+09	1.096	24475	1.048062E+07
1977	3875035839	4021185	4.037020E+09	1.003	23096	1.317267E+07
1978	5892778122	5651836	6.487820E+09	1.057	23946	2.107755E+07
1979	4399880320	5411174	4.650670E+09	1.017	8780	5.012091E+06
1980	3474858680	4602555	4.545770E+09	1.705	58879	4.857327E+07
1981	3220661979	4156886	3.855460E+09	1.319	35563	2.482343E+07
1982	4570131454	5013766	5.664320E+09	1.071	35242	3.793794E+07
1983	2050577929	3027195	2.950500E+09	1.691	32743	2.874046E+07
1984	2874385612	4079940	3.388420E+09	1.001	67198	5.156045E+07
1985	2761901346	4385302	3.415840E+09	1.001	137463	3.594526E+08
1986	2051409317	3490332	2.598080E+09	1.032	20928	2.009328E+07
1987	1564906487	3025252	2.299750E+09	1.171	56765	5.833054E+07
1988	1545464084	3492739	2.425750E+09	1.171	.	6.826806E+07
1989	1760631358	5515643	3.457250E+09	1.171	.	1.411983E+08
1990	969769060	5045144	4.140930E+09	1.171	.	.
1991	0	4548472	3.212000E+09	1.171	.	.

^a A dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.^b Mcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table I3. Parameters and Coefficients for Kansas

Vintage Year	G_{pb} (Mcf) ^b	q_i (Mcf/day) ^b	G_{ulb} (Mcf) ^b	B	Asymptotic Standard Error ^a	
					q_i	G_{ul}
1969	11440565705	4260563	1.821730E+10	1.001	63849	4.665608E+08
1970	208482361	158496	4.579390E+08	3.000	3117	1.063408E+07
1971	46766432	46979	8.576910E+07	3.000	962	1.545419E+06
1972	300044754	225925	7.273760E+08	2.626	1554	6.601019E+06
1973	266487146	191206	9.043430E+08	3.000	3210	2.943504E+07
1974	218327612	164069	7.076050E+08	3.000	3204	2.512149E+07
1975	212532430	166453	6.575670E+08	3.000	7458	6.313677E+07
1976	253421748	211907	6.968460E+08	3.000	5464	2.763698E+07
1977	273157754	244870	7.518520E+08	3.000	8359	3.701679E+07
1978	270833669	275478	7.391830E+08	3.000	10982	4.228042E+07
1979	192554302	196604	5.376720E+08	3.000	13562	5.883607E+07
1980	150442832	159662	4.192940E+08	3.000	3926	1.432426E+07
1981	136010326	159715	4.093160E+08	3.000	3740	1.417149E+07
1982	113289687	170087	1.306150E+08	1.001	3621	2.600568E+06
1983	87845988	114717	1.143540E+08	1.001	4770	2.159734E+07
1984	72814948	140994	1.152340E+08	1.868	813	7.133823E+05
1985	83914854	182910	1.974980E+08	3.000	3153	4.977934E+06
1986	65090430	160356	1.207990E+08	2.018	5713	6.337510E+06
1987	65294818	222957	1.356590E+08	2.559	9326	8.125518E+06
1988	107050377	241387	9.281260E+08	2.559	5928	1.412385E+08
1989	74870947	295082	4.378560E+08	2.559	.	5.259699E+07
1990	31630746	226827	3.016540E+08	2.559	.	.
1991	0	225647	4.181310E+08	2.559	.	.

^aA dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.^bMcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table 14. Parameters and Coefficients for Louisiana (Excluding Gulf of Mexico OCS)

Vintage Year	G_p^b (Mcf)	q_i (Mcf/day) ^b	G_{ul}^b (Mcf)	B	Asymptotic Standard Error ^a	
					q_i	G_{ul}
1969	24325628147	24887980	2.596910E+10	1.442	174393	5.413398E+07
1970	3474775918	3188595	3.587610E+09	1.209	15757	8.812662E+06
1971	2447174599	2739297	2.658070E+09	1.514	16773	8.243518E+06
1972	4668134469	4238816	4.924810E+09	1.231	42401	2.496692E+07
1973	2384106342	2497588	2.540550E+09	1.301	17543	1.009219E+07
1974	1692710624	1578261	1.811280E+09	1.221	22438	1.217655E+07
1975	1476472472	1590092	1.601970E+09	1.328	8688	5.544156E+06
1976	1304889674	1712153	1.485440E+09	1.586	10207	5.279200E+06
1977	1570085647	1972965	1.712720E+09	1.316	12021	7.260418E+06
1978	2131223834	2264399	2.542950E+09	1.496	12700	1.190270E+07
1979	1419531081	1849578	1.616740E+09	1.400	13469	8.410351E+06
1980	1404644973	1767886	1.740910E+09	1.596	17621	1.185942E+07
1981	1133892859	1582985	2.062790E+09	3.000	28755	3.496791E+07
1982	1307215896	1573280	1.731710E+09	1.442	15902	1.666276E+07
1983	928844043	1368984	1.483550E+09	2.049	4853	6.297828E+06
1984	870047529	1449993	1.770210E+09	3.000	33976	4.871818E+07
1985	1061405361	1587188	1.890900E+09	2.017	14835	2.295304E+07
1986	531196084	1064484	1.151740E+09	3.000	12083	1.772260E+07
1987	621910634	983258	1.318040E+09	1.656	8378	2.042851E+07
1988	451047814	1066877	8.469850E+08	1.656	.	4.462343E+07
1989	433886909	1397594	9.948300E+08	1.656	.	5.754355E+07
1990	267219141	1444351	1.169040E+09	1.656	.	.
1991	0	974727	7.513120E+08	1.656	.	.

^a A dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.

^b Mcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table 15. Parameters and Coefficients for New Mexico

Vintage Year	G_P^b (Mcf) ^b	q_i (Mcf/day) ^b	G_{ul}^b (Mcf) ^b	B	Asymptotic Standard Error ^a	
					q_i	G_{ul}
1970	8054812668	3514499	1.257410E+10	1.404	18798	9.731713E+07
1971	265239470	197449	4.024510E+08	2.138	2706	5.750486E+06
1972	353669478	348267	5.972580E+08	3.000	5167	7.265298E+06
1973	489812578	505083	8.299130E+08	3.000	5345	8.140749E+06
1974	317912933	362819	5.254970E+08	3.000	7111	8.862710E+06
1975	507636151	415774	1.024800E+09	3.000	13148	3.677992E+07
1976	454764299	370812	9.926230E+08	3.000	15502	4.683039E+07
1977	557498088	430920	1.384850E+09	3.000	15949	6.616415E+07
1978	633001580	516971	1.660350E+09	3.000	21081	9.818790E+07
1979	618980526	548423	1.638490E+09	3.000	19814	8.143517E+07
1980	542430078	529628	1.477160E+09	3.000	13109	4.726427E+07
1981	604662196	622144	1.719160E+09	3.000	7658	2.893360E+07
1982	419487909	452435	1.321390E+09	3.000	9150	4.509327E+07
1983	294062976	311116	9.843010E+08	3.000	9138	5.004326E+07
1984	182007831	214864	5.879670E+08	3.000	4436	2.211614E+07
1985	156917019	222426	3.612420E+08	1.608	5583	1.592172E+07
1986	136008365	208303	5.334970E+08	3.000	3153	1.630529E+07
1987	100204225	170266	4.480880E+08	2.836	3371	2.369501E+07
1988	112803442	228432	5.639080E+08	2.836	.	2.158231E+07
1989	174296239	396417	2.092320E+09	2.836	.	6.260161E+07
1990	121491025	577281	2.758190E+09	2.836	.	.
1991	0	558172	2.322850E+09	2.836	.	.

^a A dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.^b Mcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table 16. Parameters and Coefficients for Oklahoma

Vintage Year	G _p (Mcf) ^b	q _i (Mcf/day) ^b	G _{ul} ^b (Mcf)	B	Asymptotic Standard Error ^a		
					q _i	G _{ul}	B
1969	13006699297	6071234	1.655430E+10	1.116	31583	9.377293E+07	0.078
1970	677520065	519096	9.076250E+08	1.832	3109	3.880499E+06	0.081
1971	573217102	483540	9.400040E+08	2.617	3287	5.856492E+06	0.223
1972	468814427	419086	6.848740E+08	2.117	4457	6.070901E+06	0.232
1973	628387798	507412	1.223380E+09	3.000	5189	1.187241E+07	.
1974	901520192	682425	1.204620E+09	1.581	6402	8.512577E+06	0.126
1975	929509514	748520	1.128870E+09	1.332	3363	3.828720E+06	0.040
1976	1049913927	957972	1.587250E+09	1.944	5836	8.859276E+06	0.150
1977	1193642071	991221	1.677960E+09	1.513	5214	9.543315E+06	0.100
1978	1062275705	967782	2.403350E+09	3.000	17987	5.102133E+07	.
1979	899940699	1002585	1.863060E+09	3.000	19317	3.455915E+07	.
1980	1192631124	1159357	2.922090E+09	3.000	22192	7.197284E+07	.
1981	1366948171	1328831	3.624560E+09	3.000	36858	1.455217E+08	.
1982	1282051938	1393307	3.451560E+09	3.000	19348	7.280744E+07	.
1983	940315518	1166326	2.470650E+09	3.000	9501	3.155806E+07	.
1984	996458542	1327414	2.629350E+09	3.000	19463	5.344144E+07	.
1985	883814358	1252891	1.212940E+09	1.160	793	9.837008E+05	0.083
1986	626848932	1012483	1.797550E+09	3.000	36575	1.155576E+08	.
1987	662705838	1151857	1.920470E+09	2.307	4193	1.645805E+07	.
1988	458134572	967752	1.441040E+09	2.307	.	7.840318E+07	.
1989	363957298	1031275	1.385570E+09	2.307	.	5.167740E+07	.
1990	213854112	1095481	1.852600E+09	2.307	.	.	.
1991	0	895567	1.345510E+09	2.307	.	.	.

^aA dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.^bMcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table 17. Parameters and Coefficients for Rocky Mountain States

Vintage Year	G_b (Mcf) ^b	q_i (Mcf/day) ^b	G_{ul} (Mcf) ^b	B	Asymptotic Standard Error ^a	
					q_i	G_{ul}
1979	3456768951	2270524	1.345080E+10	3.000	54021	7.285066E+08
1980	819467744	539055	3.154080E+09	3.000	10706	1.243867E+08
1981	440926273	427849	1.295210E+09	3.000	14820	6.878055E+07
1982	834501834	671106	3.137940E+09	3.000	17871	1.590848E+08
1983	557392721	492389	1.398580E+09	1.706	6535	3.745004E+07
1984	304557529	402433	1.031930E+09	3.000	15929	7.688214E+07
1985	299754452	323405	1.362030E+09	3.000	6851	7.829868E+07
1986	979136535	796175	1.625210E+10	2.815	39005	7.704830E+09
1987	186989841	271882	9.378230E+08	2.815	258	2.564831E+06
1988	183907614	322015	9.606620E+08	2.815	.	9.965050E+07
1989	118770532	319190	7.695880E+08	2.815	.	1.218090E+08
1990	105558586	492005	3.122100E+09	2.815	.	.
1991	0	450051	1.492050E+09	2.815	.	.

^aA dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.

^bMcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table I8. Parameters and Coefficients for Southeastern States

Vintage Year	$G_{p,b}$ (Mcf) ^b	q_i (Mcf/day) ^b	$G_{ul,b}$ (Mcf) ^b	B	Asymptotic Standard Error ^a		
					q_i	G_{ul}	B
1977	2067056411	1277310	2.867860E+09	1.179	10609	2.913822E+07	0.135
1978	395200211	287793	6.440020E+08	1.875	6271	1.460046E+07	0.564
1979	281408438	260569	3.115650E+08	1.001	4334	3.245380E+06	0.082
1980	292823798	294563	3.790770E+08	1.494	2337	3.045718E+06	0.142
1981	448071226	394473	1.081710E+09	3.000	13565	5.166565E+07	.
1982	353763922	385481	8.754160E+08	3.000	13172	4.327561E+07	.
1983	244593238	296907	4.996060E+08	2.352	2191	5.454345E+06	0.589
1984	242707792	358411	5.790980E+08	3.000	5144	1.058176E+07	.
1985	437980119	444527	7.818480E+08	1.001	7207	2.713224E+07	0.634
1986	313371462	444529	4.764440E+08	1.212	8211	1.289555E+07	0.487
1987	128927712	266739	2.493380E+08	1.912	3668	6.030235E+06	.
1988	148134044	330613	4.484150E+08	1.912	.	1.168533E+07	.
1989	113007373	309155	6.760010E+08	1.912	.	1.676911E+07	.
1990	93341862	468752	1.141540E+09	1.912	.	.	.
1991	0	625743	1.176510E+09	1.912	.	.	.

^a A dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.^b Mcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Table I9. Parameters and Coefficients for Texas (Excluding Gulf of Mexico OCS)

Vintage Year	G_p^b (Mcf)	q_i (Mcf/day) ^b	G_{ul}^b (Mcf) ^b	B	Asymptotic Standard Error ^a	
					q_i	G_{ul}
1969	50073141681	28012787	5.756120E+10	1.260	92025	1.455973E+08
1970	4878609711	4026073	5.431670E+09	1.428	18737	1.799283E+07
1971	4214492935	4012806	4.545510E+09	1.338	11275	8.397107E+06
1972	3659086198	3907372	4.146320E+09	1.617	15434	1.036604E+07
1973	3702183105	3910562	4.321600E+09	1.645	12224	8.484972E+06
1974	3508013575	3534006	3.940340E+09	1.432	22111	1.692597E+07
1975	3638490730	3910398	3.996670E+09	1.325	31129	1.725948E+07
1976	3675789551	4204762	4.709100E+09	1.884	7970	7.395080E+06
1977	3646356029	4275137	4.398120E+09	1.628	63908	5.255739E+07
1978	3719897473	4230986	6.848090E+09	3.000	17117	2.497797E+07
1979	3334166015	4192300	5.483690E+09	2.571	12046	1.740636E+07
1980	2823550423	3754130	5.199950E+09	3.000	35084	4.436247E+07
1981	3013845849	3720540	6.169580E+09	3.000	36580	6.236670E+07
1982	3081302628	3573302	4.987150E+09	1.828	10396	1.955026E+07
1983	2365050796	3354919	5.027170E+09	3.000	29548	5.501061E+07
1984	2485427762	3782719	5.446520E+09	2.963	6793	1.288627E+07
1985	2383039556	3720401	5.316690E+09	2.893	14808	2.620195E+07
1986	1314833524	2271953	3.266140E+09	3.000	38557	7.681144E+07
1987	1159819731	2406936	2.322840E+09	2.156	18899	2.656384E+07
1988	1094726141	2537477	2.715630E+09	2.156	.	5.937219E+06
1989	1231693104	3285352	4.502270E+09	2.156	.	1.913993E+08
1990	557246043	2690444	2.865150E+09	2.156	.	.
1991	0	2558339	3.000720E+09	2.156	.	.

^aA dot indicates values which cannot be calculated. See the first page of Appendix I for a discussion of the circumstances which prevent calculation.

^bMcf = Thousand cubic feet.

Source: Energy Information Administration, Office of Oil and Gas and Model GASCAP92 C012993.

Bibliography

Arps, J.J. *Estimation of Primary Oil Reserves*. Transactions of the American Institute of Mining, Metallurgical, and Petroleum Engineers. Volume 207 (Dallas, TX, 1956).

Cutler, W.W., Jr. *Estimation of Underground Oil Reserves by Well Production Curves*. USBM Bull. 228, 1924.

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Gas Fields in Kansas, New Mexico, and Arkansas*. DOE/EIA-0416(83). (Washington, DC, September 1983).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Fields in Louisiana*. DOE/EIA-0506. (Washington, DC, December 2, 1987).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Fields in Louisiana and Texas Federal Offshore Areas*. DOE/EIA-0471. (Washington, DC, January 23, 1986).

Energy Information Administration. *Natural Gas Annual*. DOE/EIA-0131. (Washington, DC, 1982 - 1991).

Energy Information Administration. *Natural Gas Monthly*. DOE/EIA-0130. (Washington, DC, January 1982 - December 1992).

Energy Information Administration. *Natural Gas Productive Capacity for the Lower 48 States 1980 through 1991*. DOE/EIA-0542. (Washington, DC, January 24, 1991).

Energy Information Administration. *Petroleum Supply Annual*. DOE/EIA-0340. (Washington, DC, 1980 through 1991).

Energy Information Administration. *Short-Term Energy Outlook Quarterly Projections*. DOE/EIA-0202. (Washington, DC, December 1992 Fourth Quarter).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Gas Fields in Texas*. DOE/EIA-0342(82). (Washington, DC, October 1982).

Energy Information Administration. *Gas Deliverability and Flow Capacity of Surveillance Gas Fields in Texas Railroad Commission District 8*. DOE/EIA-0342. (Washington, DC, April 1982).

Energy Information Administration, *U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Reserves 1991 Annual Report*. DOE/EIA-0216(91). (Washington, DC, November 1992).

Hurst, William. *A Study of Transient or Unsteady State of Flow in the Hugoton Field and its Effect Upon Deliverability*. Testimony and Exhibit before Federal Power Commission, Docket No. G-20570, June 1960.

Natural Gas Supply Association. *Natural Gas Supply Association Survey Natural Gas Field Deliveries and Productive Capacity as of January 1, 1992*. (Washington, DC, September 1992).

National Petroleum Council. *Petroleum Storage and Information*. (Washington, DC, April 1989).

Rawlins, E.L., and Schellhardt, M.A. *Back-Pressure Natural Gas Wells and Their Application to Production Practices*. U.S. Bureau of Mines Monograph 7, 1936.

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