THE DESIGN OF A NATURAL GAS FORECASTING MODEL

by

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ABSTRACT

The aim of this work was to design an analytical natural gas forecasting model. A gas supplier is confronted with opposing penalty costs for excessive and deficient gas supplies. Natural gas consumption is primarily related to variations in the weather. The objective was to develop a model to forecast demand with an error not to exceed 5 percent of the actual demand for 95 percent of all forecasts.

The basis of the model is a modified multiple stepwise regression program. The procedure consists of gathering 25 independent and 1 dependent variable. A combination of variable and observation weighting, as well as the use of dummy variables is applied. These variables are subjected to the multiple stepwise regression procedure, which retains only the significant variables based on partial regression using the F test. The resulting coefficients are applied to tomorrow's weather forecast in order to arrive at the predicted natural gas sendout for tomorrow.

A four phase model was developed with the multiple stepwise regression performing the third phase. In excess of 97% of the variation occuring in the data was accounted for by the 25 variables. The model was allowed to generate a sample nine day period. The mean error of this sample run was -.7% with the highest variation being -3.3%.

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I INTRODUCTION

Generalization

A search for the optimization of a function whose behavior is more or less unknown to the observer necessarily involves much experimentation. It was through the direct measurement of each experiment that this model was derived. The purpose of this study is to develop and test a natural gas forecasting model. The usefulness of the model is its value in helping derive a future nomination* value and its worth to the daily gas dispatch operations. The design of the model includes continual updating and reformulation of the various variables on a daily basis so as to avoid obsolescence.

The results have revealed some interesting relationships between various weather factors and natural gas sendout. Although this program has not been put into production at the Inland Natural Gas Company, it is intended that this will occur when the present computer conversion is completed.

Background

Inland Natural Gas Co. Ltd. is a public utility operating its distribution system in the interior of British Columbia (see system map, Exhibit 1, Pg. 45). The customers being served can

*See "Glossary of Terms" Page 36, for definitions of technical terms.

be classified as to residential, commercial, small and large industrial. Peak sales of 148,223,000 cubic feet occurred on February 9, 1975, with total recorded sales for the year 1975 being 35,640,714,000 cubic feet. The natural gas required to meet these demands has been purchased solely from Westcoast Transmission Company Limited. Beginning in 1976, peak demands can be met by using an alternate supply from Alberta & Southern Gas Co. Ltd., although this must be returned to them the following summer.

The customer base has been growing at a compound rate in excess of 10 percent for the last three years (see Exhibit 4, Page 46 for load profile. A major portion of the natural gas sold is used for heating purposes. As a result, gas sales vary greatly with the weather, and it is difficult to forecast accurately in advance what the actual gas requirements will be. Weather causes annual variations in gas usage between "cold", "normal" and "warm" years, as indicated in Exhibit 2, Page 46. In addition, there is a large seasonal variation in gas usage between different months of the year as Exhibit 3 shows.

The requirement of all regular or so called "firm" customers must be supplied even on the coldest winter day, without curtailment or interruptions. Plant facilities must, therefore, be large enough for these peak day requirements. This means that the facilities will not be fully utilized at other times.

The maximum day sendout has increased from 123,579,000 cubic feet in 1973 to 136,485,000 cubic feet in 1974 and 148,223,000 cubic feet in 1975. Complex ramifications result from demand penalties, minimum bill provisions and contractual commitments listed below, coupled with the fact that the escalating maximum day sendout must be nominated* one year in advance. An additional pertinent item stems from the daily fluctuations in revenue due to varying weather patterns. This variation has created a need to develop a more satisfactory method of daily forecasting, which must comply with the following contractual commitments.

Contractual Commitments

- Nomination of gas (maximum quantity that can be purchased per day) must be submitted by November 1, to be effective November 1 next year, for a one year term.
- The minimum monthly billing demand is based on 92.5% of the nomination.
- A billing demand penalty in excess of seven fold is incurred for any gas taken in excess of the nomination.
- The yearly minimum that falls under a take or pay category is based on 65% of the nomination (365 x nomination x .65).
- Should the minimum billing demand be exceeded, a new minimum billing demand is then established up to the maximum where the minimum billing demand equals the nomination. Any gas exceeding the nomination is penalty gas.
- If it is known today that the quantity of gas required for tomorrow will exceed the nomination, sufficient advance notice must be given to certain industrial customers, whose gas supply can then be curtailed for the following day.

Gas Supply Mix

Inland has various alternatives available to it in order to meet the customer requirements.

- Basic gas supply from Westcoast Transmission Company Limited.
- Peak shaving, which consists of taking gas in the summer when consumption is low, and liquifying this gas. In the winter this gas is returned to the line on peak days, thus lowering the quantity of gas taken from Westcoast.
- Using propane, which is stored in rail cars. On severely cold days, propane is mixed with air and fed into the system.
- Alberta gas (any gas bought in the peak winter period must be returned the following summer).
- Using line pack, which consists of forcing more gas into the miles of pipeline by increasing the pressure through the use of compressors. Then on severe days more gas is taken from the system than is fed into it from Westcoast, thus reducing the pressure. This has limited use since working pressures must be maintained.

Model Overview

The model is based on a modified multiple stepwise regression program developed by Statistics Canada. Various methods of variable and observation weighting, use of dummy variables, as well as auto regressive variables are included. The stepwise algorithm performs an evaluation on the variables based on a partial regression using the F test. The procedure consists of gathering the initial data of 6 independent, 11 dummy, and 1 dependent variable. Phase 1 evaluates the dependent variable, and generates 1 additional independent variable, the day of the week factor. The effective temperature formula producing the lowest error is selected by phase 2, which calculates 3 additional independent variables, (variables 13, 16 & 18 in Table 5, Page 38). Phase 3 is entered with 11 dummy variables, 13 independent and 1 dependent variable, which performs the multiple stepwise regression procedure, thus retaining only the significant variables. The final phase consists of applying the coefficients to tomorrow's weather forecast in order to arrive at the predicted natural gas sendout.

A four phase model was developed with the multiple stepwise regression performing the third phase. The combination of variables accounted for in excess of 97% of the variation occurring in the data. The model was allowed to generate a sample nine day period. The mean error of this sample run was -.7% with the highest variation being -3.3%. To date, the model has been run in a test mode only. However, the model's performance has received acceptance from the engineers, who plan to implement it. The model will then become a productive tool to assist the natural gas dispatcher.

Significance of Literature in the Field

The literature review consisted of a search by the author and by the Pacific Coast Gas Association. This combined search covered extensive information on gas technology from 1960 through 1973. Several articles containing analytical approaches in identifying some of the principal factors affecting gas load were discovered. Published literature was not available which addressed itself specifically to the nomination of natural gas. In addition, all of the studies were conducted in comparatively warm regions in a relatively confined area.

Previous Research Findings

One of the earlier models developed in 1962 [1]** describes an analytical model that applies the first order linear form. It can be expressed as:

$$y = B_o + B_1X_1 + B_2X_2 ----- B_NX_N$$

Where y is the dependent variable to be forecast, the B's are the regression coefficients determined by the least squares criterion, the X's are the exogenous variables. This study considered the linear weather effects from temperature, wind velocity and daily illumination. This was refined by fitting a parabolic curve to the temperature data. A negligible day of the week correction factor was also included. The equation maintained better than 5% accuracy for 80% of the time, but errors in the magnitude of 10% were introduced from time to time.

In 1964 Van Note [11] used multiple linear correlation with variables including weighted temperature and a 24 hour lag effect. These were fitted to a second degree polynomial equation. Errors in excess of 6% were frequently experienced.

In 1967 Ruskin [9] developed a generalized simulation model. New factors such as rate of temperature change, and customer characteristics which include number and growth of customers, class of service and type of service were included. This study introduces the idea of scaling a variable such as wind so it can be included as a dichotomous variable. A major

**The numbers in parentheses refer to the references in the Bibliography, Page 37.

finding of this study is that the relationship of environmental changes to gas sendout is nonlinear. This includes the growth of the gas load with respect to time, since the customer growth is more likely to occur during the summer construction season than during the winter. Since the gas load accumulated from residential construction is different from that of commercial, the growth will be seasonally different. Economic changes affecting production schedules and the day to day mix of commercial and residential customers add more complexity to the daily sendout.

In 1968 Hingorani and Marcynski [5] developed a model using a non stationery time series and a cross product variable of wind velocity multiplied by temperature. The use of the time series model was intended to introduce economic and environmental effects in addition to weather. A forecast error as high as 10 percent of the gas load was experienced.

In 1973 Haenel [4] developed a model using the multiple stepwise regression technique as the base. A geometric weighting factor was applied to the data to introduce an autoregressive time series effect. In addition, an optimal weighting factor was introduced, which minimized the sum of the squared error. The model yielded 95 percent of all forecasts within $\pm$ 5.36 percent of actual, which is a considerable improvement over previous models.

In all of the studies, only a portion of the year's data was selected for modelling. Many used data from the previous year and all excluded holidays and non typical gas days. All partitioned the data, and within these partitions assumed the effects of the variables to have a near linear relationship with gas load.

The most difficult and important period for forecasting is that of the winter heating season. It is here that the peak day is encountered, and it is this sendout that has the greatest effect on yearly costs. If the dispatcher selects too low a nomination value, revenues will be reduced. If he chooses too high a value, considerable penalties could be realized.

The use of mathematical models in forecasting daily gas load is limited throughout the industry. Past model response to short term trends in the economy or from changes in customer habits have been unsatisfactory. Thus, obsolescence of the forecasting equation frequently results. The availability of information and the cost of acquiring this information must be considered. It is evident that continuous daily forecasting over a period of time will be necessary to demonstrate the usefulness of this tool.

Objective of the Study

The main framework of course, is to design a model that will forecast the demand of natural gas that will be needed tomorrow. The need has been created due to the increasing complexity of the gas system operations. As can be seen from the system map (Exhibit 1, Page 45), the operating region covers in excess of 700 miles, which crosses two mountain ranges. Consequently, very distinct weather patterns as well as geographical peculiarities exist. A cold front moving across such a vast area introduces diversity between the peak days in various towns. The ramifications encountered with multiple gas supplies, demand penalties and minimum bill provisions and advance notification of customers to be curtailed have created the need to develop a more satisfactory method of forecasting sendout. The following objectives are stated:

(1) Design a model with a forecast error not to exceed 5% of the actual demand for 95 percent of all forecasts. The benefit here will be in substantiating a dispatcher's calculation plus assisting in notifying customers in time to affect curtailment for the following day.

(2) Sources of data must be readily attainable and must be timely so that these can be acted upon for the following day. The nature of the current contract situation requires 8 hours notice to the interruptible*

customers, and improvement in predictions could increase the security of the system. Since the contract day begins at 8 a.m., this means that customers must be notified by midnight if curtailment is to be effective for the following day.

(3) Considerations will be given in the model design to provide for possible future obsolescence of variables which are no longer significant.

(4) An additional problem associated with gas dispatch is that of selecting a nomination value which will become effective one year hence. This requires forecasting future weather as well as future demand. A probabilistic approach to the uncertainty of weather can be achieved by using the Monte-Carlo simulation method. The simulated temperatures must have the same statistical properties as actual temperatures. By utilizing past historical data consisting of the extremes and the daily mean temperatures in conjunction with a random number generator, a sample set of simulated temperatures can be derived. Using this data as a base, it is possible to forecast for the subsequent year in order to arrive at a nomination value. However, although this is a stated objective, this will not be realized in this study. It is intended that the daily forecasting model will be in production and accepted before this phase will be attempted.

II RESEARCH DESIGN

Data Sources

Currently, the dispatch function is performed on a manual basis. Until recently, all weather information that the dispatcher required was received via telex. In December 1974, a P.D.P. 11/40 process control computer was installed. The first pase of its development was the monitoring of the telex line to capture any weather data pertaining to regions served by the distribution system. The unique code of the weather data is translated and printed in a readable format. It is from this source that the independent variables for this model originate.

The objective of the model is to forecast tomorrow's sendout. Weather data is received hourly, with forecasts received at 5 a.m., 10 a.m., 2:30 p.m., 7:30 p.m. and 10:30 p.m. These forecasts consist of general public information, with an outline of general area expectations. In addition, a 2:30 p.m. special forecast is received from the weather office indicating tonight's low, tomorrow's high, and the low tomorrow night. Should there be a drastic change in the weather, revised forecasts will be issued at any time.

The different variables included for each day are listed in Table 5.

Variable 1 - A Constant factor.

Variables 2-12 - These variables are dummy variables and are used to signify different weather regions. This is necessary in order to account for the separate effects on the gas sendout which are peculiar to each region.

Variables 13-15 - These variables form the autoregressive series. The temperature is measured in degrees Celsius, while the operational variable is measured in millions of cubic feet of gas. The variables are interval scaled over a continuous range.

Variables 16-18 - These variables are calculated weighting variables.

Variables 19-24 - These variables are the original independent variables received from the P.D.P. 11/40. When operational, these will be the forecasts for the following day.

Variable 25 - Is the dependent variable consisting of the actual gas sendout.

Additional variables such as cloud cover, illumination and precipitation were considered. The author did not have an opportunity to determine the effect on sendout from these weather variables, so no conclusion can be reached as to the benefit that could be derived from the inclusion of these variables. The reason for excluding this data was that it was either subject to human interpretation to translate it to a numerical value, or was unavailable for all of the regions under consideration, or both.

It is known from historical data within the Company that a spring and fall transition point occurs, i.e., the slope of the demand versus weather is different for winter than for summer. However, as mentioned earlier, the critical requirement for exact sendout is not present during these transition periods, so although it is recognized, this problem will not be pursued in this study.

Some of the earlier models were designed by considering one variable at a time and finding the optimum solution, fixing the relationship with demand and then considering the next variable. Although the multiple regression model allows cross correlations, these can be removed by placing different levels of tests on each independent variable. The fact that natural gas demand is dynamic would tend to indicate that models with fixed variables are slated for obsolescence.

If all the variables are continually made available to the Multiple Stepwise Regression Program, only those variables which best aid in explaining the variation in actual gas sendout will be chosen for any one forecast.

The best set of variables is continuously chosen by re-examining the interrelationships between the variables. The model will thus include different combinations of variables depending upon various economic or seasonal cycles.

The following is a description of the final variables included in the model:

- One constant factor.
- Eleven dummy variables allowing a separate description of each weather region.
- Yesterday's effective temperature, which is derived from a formula based on the weighted average temperatures of the past 4 weeks (see Page 17 Item iii, for the effective temperature formula used).
- Yesterday's average temperature which is computed from the 24 hourly temperatures.
- Yesterday's sendout consisting of the natural gas load in millions of cubic feet.
- Wind times corrected average temperature consisting of the wind speed in knots times tomorrow's forecasted average temperature.
- Day of the week factor consisting of a constant percentage determined by the actual day of the week being forecasted (see Exhibit 6, Page 47 for sample).
- Change in effective temperature consisting of the difference between the previous day's and yesterday's effective temperature.
- High temperature consisting of the high forecast for tomorrow.
- Low temperature consisting of the low forecast for tomorrow.

- Average temperature consisting of the forecasted average for tomorrow.
- Wet bulb average determined by the dispatchers for tomorrow.
- Daylight hours consisting of the hours between sunrise and sunset for tomorrow.
- Wind speed consisting of forecasted wind for tomorrow.

The Analytical Model

A Multiple Regression Program with modified variables was used in the formulation of the model. The program used was developed by Statistics Canada [10]. A very useful text relating to multiple regression was one written by Draper and Smith [2].

The steps employed by the forecasting model are as follows:

Step 1 - Segregate historical data by region, and analyze each region for day of the week variations.

Step 2 - Discount the day of the week variation, and analyze which formula of effective temperature produces the least error. The effective temperature is intended to show a warming or cooling trend. In addition, it also accounts for temperature latency* of buildings as well as human psychological factors.

The three different effective temperature formulas were taken from a study conducted by F. G. Van Note [11].

i) $T_E = aT_D + bT_{E,\ D-1}$

Where $a + b = 1$

T_D = Today's average temperature

T_{D-1} = Yesterday's average temperature

T_E = Effective temperature

$T_{E,D-1}$ = Yesterday's effective temperature

ii) $T_E = .7T_D + .22\ T_{E,\ D-1} + .06\ T_{E,\ D-2} + .02\ T_{E,\ D-3}$

iii) $T_E = .5\ (.7T_D + .22\ T_{E,\ D-1} + .06\ T_{E,\ D-2}$

$+ .02\ T_{E,\ D-3}) + .5(.7W_K + .22\ W_{K-1} + .06\ W_{K-2}$

$+ .02\ W_{K-3})$

Where W_K = Average temperature in the week.

The optimal formula is then used to calculate other effective temperature related variables.

<u>Step 3</u> - An increasing wind at the same temperature has a greater chilling effect. This effect is only noticed below 15^{o} Celsius. The formula as supplied by the Inland Natural Gas Dispatcher is:

$$CHILL_F = [(T_D - 15)\ X\ W]$$

Where T_D = Average temperature Celsius

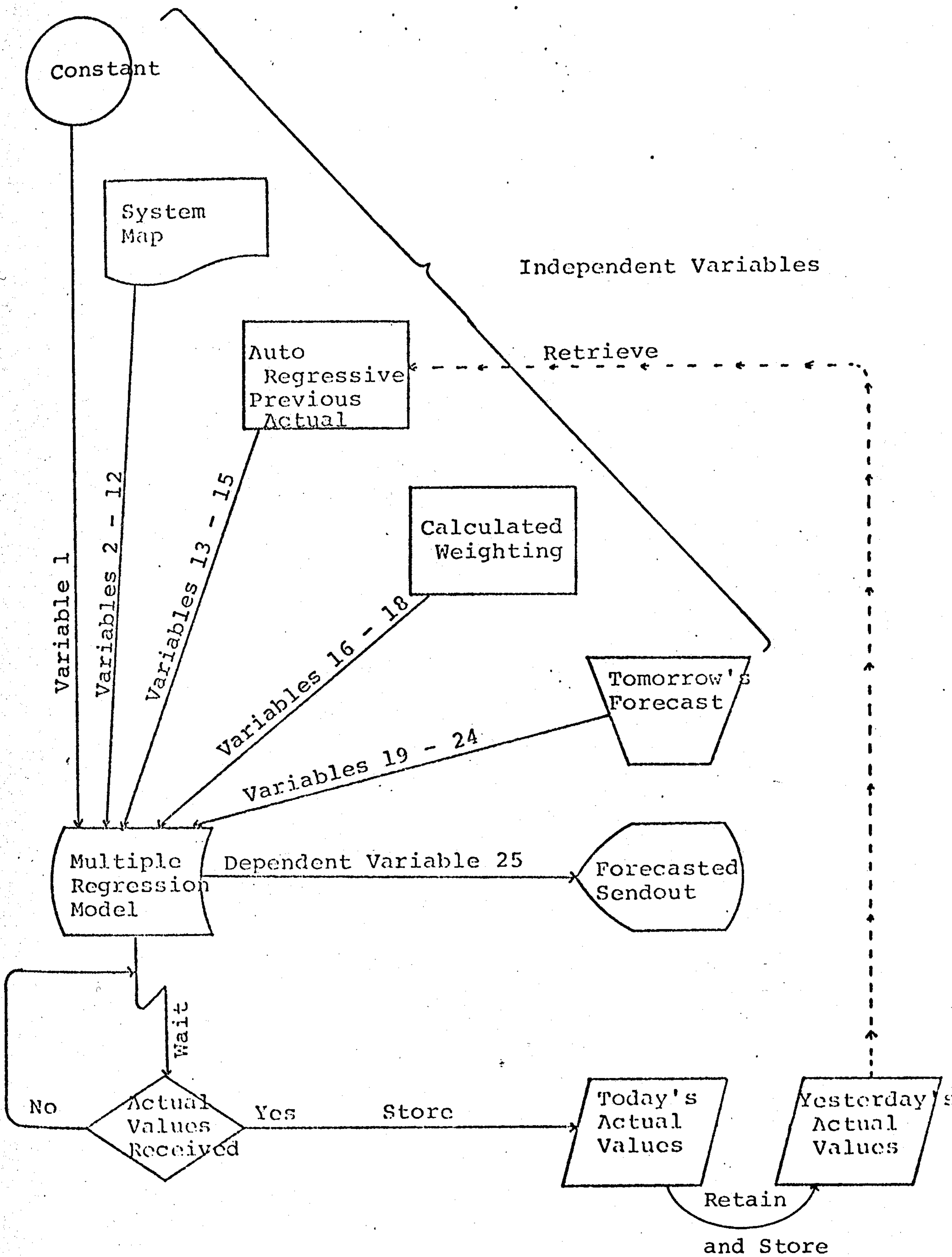
W = Wind speed in knots

Step 4 - Establish the twenty-five variables for each region for this day, taking into account the values established in the previous three steps.

Step 5 - Subject all of these variables to multiple regression, which finds the variable not yet in the regression with the highest F value, and if this is above the necessary level, adds the variable to the equation. Then the regression equation is tested for the variable with the lowest F value, this variable being removed if it is below the significant level. If still significant, the equation is tested without this lowest variable to find a lower error variance. If so, the variable is deleted, (see Appendix B, Page 40 for flow chart).

Step 6 - Using the coefficients established, include current forecasts for tomorrow for each of the regions, and derive a gas sendout by region. (Exhibit 12, Page 72 is an example of the final report. Figure 1 presents a pictorial overview of where the variables are derived from, and how they come together in the model).

Fig. 1 - Pictorial Presentation of Model Variables



The variables in regression equations usually take values over some continuous range. However, this model must account for the separate deterministic effects on the response due to the effect of different weather regions. Variables which help distinguish different levels of response are called dummy variables. In order to deal with r regions, (r-1) dummy variables are included in the regression analysis. For example, if 3 regions were included, then dummy variables would be included as follows:

x_1	x_2	
1	0	= region 1
0	1	= region 2
0	0	= region 3

The general form of the model is as follows:

$$\hat{y}(t) = B_o + \text{-----} b_i x_i(t) + \text{------} + b_k x_k(t)$$
$$+ \text{-----} b_i y_i(t) + \text{-----} b_k y_k(t)$$
$$+ \text{-----} b_i z_i(t-t_i) + \text{-----}$$

Where $\hat{y}$ is the dependent variable to be forecasted, the b's are the least square coefficients determined by the model for each forecast, the x variables are the dummy variables required to identify each region, the y variables are the exogenous series, and the $z(t-t_i)$ variables are autoregressive values of the forecasted series itself.

A sample calculation for region 4 for February 22 is:

Variable #	Variable Description	Coefficient	Variable Data
2	Region 1	.131959 -	0
4	Region 3	1.51517	0
5	Region 4	.229602	1
6	Region 5	.11887	0
7	Region 6	.111314 -	0
10	Region 9	.121379 -	0
11	Region 10	.0928959	0
12	Region 11	.120182 -	0
13	Yesterday's Effective temperature	.00308867 -	6.3-
14	Yesterday's Avg. Temp.	.0212799	.6-
15	Yesterday's sendout	.860937	2.999
16	Wind x Temp.	.00010965	217.1
17	Day of the Week Factor	.751174	.969
18	Change in Effective Temp.	.0571149	1.6-
19	Effective Temp.	.0102688	4.7-
20	Forecasted High Temp.	.0181356 -	5.0
21	Forecasted Low Temp.	.0192658 -	.6-
22	Forecasted Avg. Temp.	.0192827	3.3
23	Forecasted Wet Bulb	.0147737	2.2-
24	Forecasted Daylight Hrs.	.369423	10.1
25	Forecasted Wind	.00668735 -	13.
	Constant	.90258 -	1

(#'s 3, 8 & 9 were dropped due to partial F being insignificant)

February 22 $\hat{y} = 2.765$

The actual sendout for region 4 for February 22 was 2.735, thus the forecast resulted in a residual error of .030 or 1.1%.

TABLE 1

ERROR ANALYSIS OF REGION 4

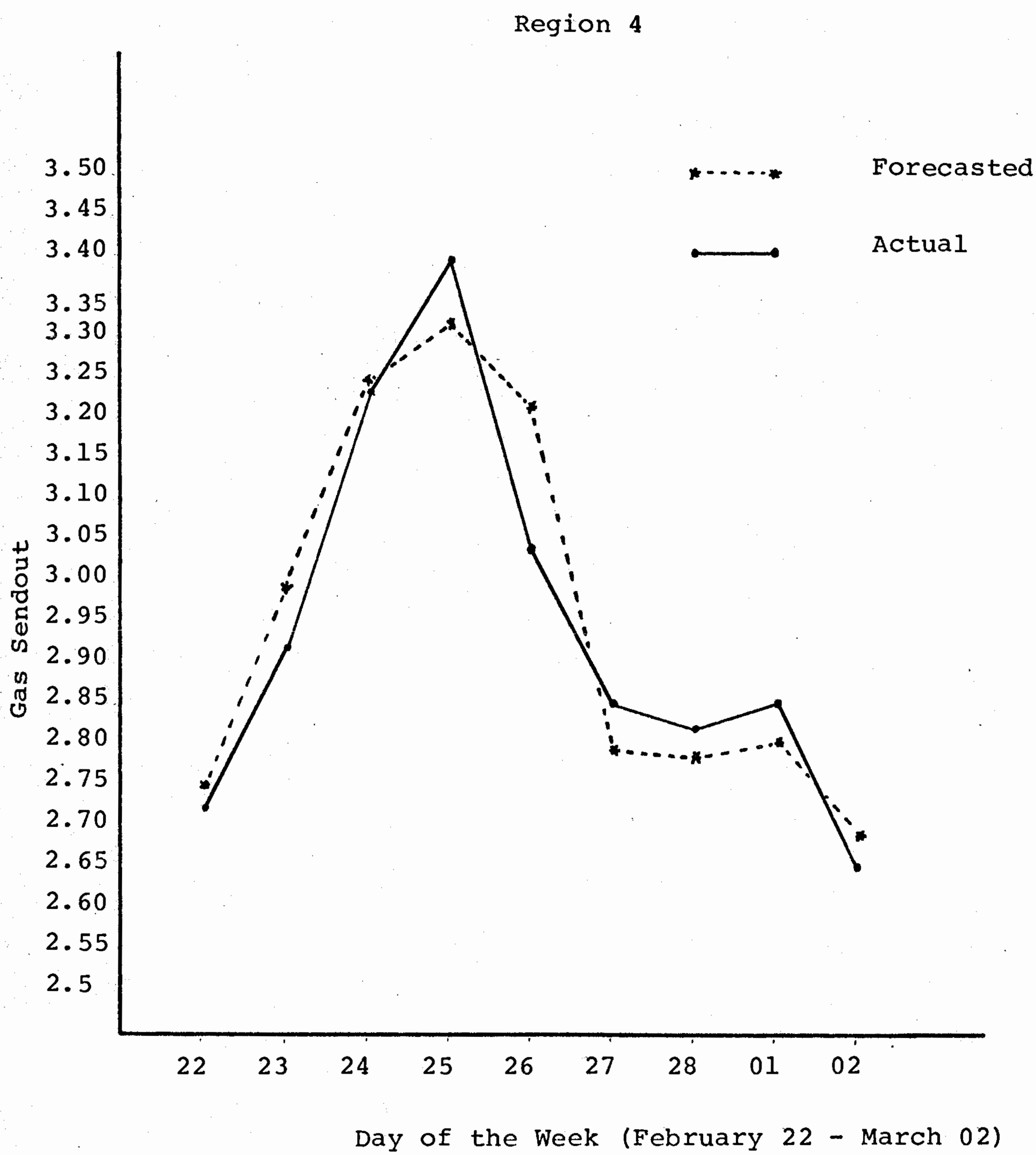
	Actual	Forecasted	Residual	%
02/22/75	2.735	2.765	.030-	1.1-
02/23/75	2.928	2.998	.070-	2.4-
02/24/75	3.230	3.244	.014-	.4-
02/25/75	3.399	3.321	.078	2.3
02/26/75	3.043	3.235	.192-	6.3-
02/27/75	2.852	2.799	.053	1.9
02/28/75	2.838	2.784	.054	1.9
03/01/75	2.872	2.808	.064	2.2
03/02/75	2.652	2.669	.017	.6-

Average % error	-.28%
Average Residual	-.004
Standard Deviation	.085

However, it should be noted that the key element of success of this model does not rely on forecasting each region individually, but rather on predicting the requirement for the entire system. Although certain individual region forecasts were beyond the acceptable criteria, the combining of the 11 regions in the system forms a normal distribution whose mean was well within the stated objective (see Exhibit 11, Page 69).

An indication of the model's ability to predict turning points, and a comparison of Forecasted Versus Actual Natural Gas Sendout is shown in Figure 2.

Fig. 2 - Comparative Graph of Forecasted Versus Actual Sendout



Alternatives Tested

Although many alternatives were tested, only a few of the significant variables and their associated effect on the final formula will be discussed.

As indicated earlier and as evidenced by the system map, an extensive area is being served by the distribution system. The solution to treating the diverse weather patterns was to divide the system into 11 distinct regions.

Another distinct pattern identified was the consistent variation in consumption based on the day of the week. An example of these variations can be seen in Exhibit 6, Page 47. Discounting a major upheaval such as a strike, indications were that consumption by region, for the same day of the week, tended to be quite stable.

Earlier mention was made of the different formulas used in arriving at the effective temperature. Exhibit 7, Page 48 shows three sample runs made from the same basic data, with only the effective temperature formula changed.

TABLE 2

EFFECTIVE TEMPERATURE COMPARISONS

	Effective Temperature Formula 1	Effective Temperature Formula 2	Effective Temperature Formula 3
Multiple Correlation Coefficient	97.371%	97.294%	97.476%
Error of Standard Deviation	.622033	.626323	.609495
Regression F	305.57	344.18	318.61

The method used in all of the testing was to vary the data on one variable only, thus determining whether the effect of this one variable was positive or negative.

Finally, the dummy variables were introduced to account for the 11 distinct weather regions. Exhibit 9, Page 52 indicates the slight improvement in explaining variations in the dependent variable by the inclusion of the deterministic effects of the dummy variables. This is a by-product of the weather data, which had to be submitted regionally. A region by region forecast is also provided.

	Without Dummy Variables	With Dummy Variables
R^2	.98253	.98424
$\bar{R}^2$	.98237	.98370
Error of Std. Deviation	.523918	.504052
Error Mean	.001191	.00000716

Computer Facilities

The same equipment was used throughout the development and design of the model. Many different programs and methods of manipulating the data were attempted before settling with the program developed by Statistics Canada.

All access to the Simon Fraser 370/155 computer was through a remote terminal. Data was submitted in the form of cards through a 2501 card reader. The reports were produced on a Telex 5403 printer. These terminals are located in the academic building at Simon Fraser University.

The original test data and sample runs consisting of 3 months of data required a 120K region of memory. However, as the time span of the data base was increased to the longest period of December 17th to June 22nd, it was found that the memory size had to be increased to a 240K region. This was due to the fact that all the data was kept in memory in a matrix, rather than using auxilliary storage devices. Consequently, the runs were very fast, requiring about one minute to execute.

The location of the terminals made it necessary to keypunch the weather data and associated dependent variables. This data was then transported to the terminals, where the computer runs could be performed. Although this was accomplished in order to design the model, it is certainly not practical for daily forecasting from a dispatcher's viewpoint. Mention as to the implementation of this model will be made in a later section.

Comparison of Exhibit 11, Page 69 and Exhibit 12, Page 72 also indicates that the longer historical data base did not produce results with the same accuracy as the shorter time span. Thus it is interesting to note that the longer time span is more expensive to maintain, by requiring more memory and computer time, while producing poorer results.

III THE MODEL DESIGN

Model Analysis

Typical data weighting and arrival at the forecast take the following form. The last day's actual weather variables and gas sendout are added to the data base for each region. The earliest observations (consisting of 1 day of data) are deleted, so that a constant time frame is maintained. This new data base is analyzed to determine the day of the week factor for each region. The effective temperature which produced the lowest error is then chosen. Now the other independent variables are generated, which become input to the multiple regression. The resulting coefficients are combined with the forecasted weather for tomorrow, from which the new forecast for tomorrow's sendout for all regions results in the total sendout for the next 24 hours.

Many of the past models use a correction factor from last year, or a weighting to reflect previous weather patterns. The author contends that this is irrelevant, and possibly misleading. As an example, peak days in the past 3 years occurred on February 8, 1973, January 10, 1974 and February 9, 1975. If the corresponding day from the previous year had been allowed to influence the current forecast, it is evident that an error would have been introduced into the model.

In analyzing Exhibit 11, Page 69 it can be seen that the percentage errors for each individual region are quite high, and vary quite considerably. However, the variation between regions is random, with the fluctuations netting out to an acceptable forecast for the entire system for one day.

The multiple correlation coefficient has been used as the measure of the success of the regression equation in explaining the variation of the data. The observed mean square ratio is statistically significant, indicating that the variation in the data, which has been accounted for by the equation, is greater than would be expected by chance.

Examining the residuals from Exhibit 10, Page 55 gives no indication of time dependent nonrandomness or unusual behavior. Occasional sporadic points ranging to several standard errors are observed for certain observations. No specific explanation has been uncovered to account for these departures. Further research will be necessary to determine the cause, and derive a variable which will account for these sporadic points. However, it should be noted that contrary to several past studies, no data points such as holidays or weekends were removed. With the trend towards flexible hours, a shorter work week, and options regarding holidays, it was felt that possible maximum exposure that a dispatcher could be subjected to should be shown. However, in the case of national holidays, although this day was forecasted, in practice such a holiday should be suppressed in the data base, to prevent future forecasts from being biased.

Data Weighting Validation

Two different time periods were tested to determine the influence of historical events on tomorrow's sendout. Both sets included the same variables and began at the same time. The actual error values were calculated as actual gas sendout minus the forecasted sendout. This difference was taken as a percent of actual gas sendout.

The shorter time span was found to improve the model significantly by reducing the forecast error. This is due to the fact that conditions during the past several weeks are much more relevant than conditions say, four months ago. The longer time span allowed too much weighting to be placed on older historical data. Exhibit 11, Page 69 and Exhibit 12, Page 72 contain a sample of the different time periods.

TABLE 3

Time Period Model Comparisons

	Dec. 17 - Feb. 22	Dec. 17 - June 28
Mean Percent Error	-.7	3.0
Standard Deviation	.456	.704
Multiple Coefficient of Determination	98.406%	97.905%

Selection of Variables

The final set of variables are shown in Table 5. As can be seen from Exhibit 10, Page 55 these variables accounted for in excess of 98% of the variation in the dependent variable. Additional variables such as cloud cover, precipitation and wind direction were also considered. These variables were discarded due to the fact that they were either not available in all of the areas, were subject to human interpretation, and also were most prone to forecasting error from the weather bureau.

A human psychological factor is evidenced by the fact that the thermostat is not set as high on the first day of a cold spell, as it is on the 3rd or 4th day of continuing cold. The effective temperature was intended to account for this fact. In all of the variations of testing performed, the effective temperature, yesterday's effective temperature, and the change in effective temperature remained significantly high and were never excluded from the equation.

One of the other significant effects that the model was intended to allow for was the speed of temperature change. This was accomplished by showing the high, low and average temperatures, and the change of temperatures from the previous day. Although hourly readings are received, it can be seen how massive the data base would become if all of these variables were accumulated by the hour for each region.

According to J. M. Wetz [2], the range of values of the observed F ratio should be considerably greater than the selected percentage point of the F distribution. The inaccuracy of a regression equation derives from the regression lack of fit and pure error. The F ratio consists of the (regression mean square)/(residual mean square). The test of lack of fit and the satisfactory results for F(21, 715,.05) = 1.56 are shown in the following table:

TABLE 4

Analysis of Variance

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Regression	21	505.34717	505.34717	
Rcsidual	715	8.18577	.24044	
Total	736	513.53288		
				2101.76

IV CONCLUSION

Present Model Design

As evidenced by Exhibit 11, Page 69 the forecasting model has met the original objectives. The work in the study has been designed around the dispatching philosophy of the Company. The variables selected have been chosen on the basis of availability and timeliness to the dispatching personnel.

The basic philosophy of the model has been to leave it open ended. In this manner, it is intended that as economic and personal habits change, the model will dynamically adjust the coefficients. In addition, should any of the variables become insignificant due to changes such as consumer habits or economic conditions, the variables will simply drop from the regression equation.

The dispatcher will have to operate the system under appropriate guidance and controls, in order to gain confidence in the forecasting system. The forecasting design must work in the environment which actually exists in order to prove the application.

The model is modular in design, and provides progressive information of the data that is selected. Although a number of variables must be entered by the dispatcher, they are all based on information available to him. The one disadvantage is the considerable computer capacity required to derive the forecasting coefficients.

Future Considerations

Earlier mention was made of the use of the computer facilities existing at Simon Fraser University. It is intended that the model will be implemented in the following manner.

The weather data originating from Toronto will be captured by a PDP 11/40. The PDP is also controlling the telemetry lines indicating actual gas sendout. The PDP will be linked to a Univac 90/30 consisting of 131K of memory and 120 million bytes of online disc storage. The 90/30 will poll the PDP and receive from it both the telemetry and weather data. The dispatcher is linked with the 90/30 via a Uniscope 200 cathode ray tube. Through the terminal, the dispatcher can request the forecast program, which will prompt him for the necessary forecasted weather data for each region. When the final variable is received, these are linked with the actual data received from the PDP 11/40 and a forecast will be generated. This will be displayed back to the dispatcher on his terminal. The data base will be automatically updated as actual data is received from the PDP.

It is evident that further research will be necessary to improve the model to account for unknown variations, and for drastic changes that could occur. Since the computing facilities will be available, this will probably be accomplished by maintaining a parallel set of variables which will periodically be tested for significance.

SUMMARY

The primary intent of the study was to design a model which would assist dispatching personnel in forecasting daily natural gas sendout. The first problem was formulating an analytical model which would simulate the natural gas environment. Statistical measures had to be applied to determine the significance of the model results.

The first phase consisted of removing non-weathcr effects, such as day of the week, after the system had been segregated into distinct weather regions. Then data weighting had to be applied to help determine which factors produced the most relevant forecast. These factors were finally subjected to Multiple Regression Analysis. The final resulting model consisting of the variables listed in Table 5 included the use of the dummy variables which helped to account for the unique influence from each geographical region.

Although considerable work has gone into the formulation of the model, much remains to be proven, as the model is actually implemented and proves itself in a real time working environment. Only a bit of a byte has been taken out of the entire spectrum of accurate natural gas forecasting.

GLOSSARY OF TERMS

Base Load	- The portion of the sendout that is relatively constant, with some variations from day to day due to work schedule and customer habits.
Interruptible Customers	- An industrial customer whose gas supply may be curtailed, following a specified number of hours of advance notice.
Nomination	- The maximum daily volume of gas that the supplier is obligated to provide to the Company, and the basis for contractual minimums and "take or pay" clauses.
Sendout	- A term used to represent the amount of gas delivered from a system. It is the dependent variable in the equation.
Transition Zone	- A term used to describe a section of the equation where the correlation becomes poor.
Temperature Latency	- A physical attribute of a building whereby it will require from 24 to 48 hours to readjust to a rapid external environmental change in temperature.

Bibliography

1. Barn, M.D. and W. J. Gunderson, "Load Forecasting and Dispatching for Distribution Companies". Paper presented at the 1962 American Gas Association Conference, Houston, Texas (CEP-62-16).

2. Draper, N.R. and H. Smith, Applied Regression Analysis. New York. John Wiley & Sons, Inc., 1966.

3. Gertz, M.L. "Development and Utilization of Load Sendout Forecasting". Paper presented at the 1968 American Gas Association Dispatching Workshop.

4. Haenel, R.D., "An Analysis and Model for Forecasting Daily Natural Gas Load", Masters Dissertation, Northrop Institute of Technology, Inglewood, California, 1973.

5. Hingorani, G. and L. F. Marcynski, "Sendout Forecasting Technique Development and Utilization". Paper presented at the 1968 American Gas Association Conference, Cleveland, Ohio (68-T-41).

6. Luecke, M.C., "Guidelines on Developing a Successful Model". Management Adviser, January-February, 1973.

7. Naylor, T.M. and J. L. Balintfy. Computer Simulation Technique. John Wiley & Sons, Inc., 1966.

8. Rivett, P., Principles of Model Building: The Construction of Models for Decision Analysis. The Mendy's Press, Bath.1972

9. Ruskin, V.W. "Simulation of Companies by Models". Paper presented at the 1970 Canadian Gas Association Conference, Vancouver, B.C.

10. Statistics Canada, "General Purpose Multiple Regression Program." Program documentation made available through Simon Fraser University.

11. Van Note, F.G. "Statistical and Computer Analysis of the Effect of Weather on Gas Sendout". A.G.A. Operating Section Procedures, 1964.

12. Wilde, D.J. Optimum Seeking Methods, New Jersey: Prentice-Hall, Inc., 1964.

TABLE 5

Variables for Regression Model

No.	Variable
1	Exogenous
2	Region 1
3	Region 2
4	Region 3
5	Region 4
6	Region 5
7	Region 6
8	Region 7
9	Region 8
10	Region 9
11	Region 10
12	Region 11
13	Yesterday's effective temperature
14	Yesterday's average temperature
15	Yesterday's sendout
16	Wind x corrected average temperature
17	Day of the week factor
18	Change in effective temperature
19	High Temperature in Celsius
20	Low temperature in Celsius
21	Average temperature in Celsius
22	Wet bulb average
23	Daylight hours
24	Wind speed in knots
25	Actual gas load in MMCF

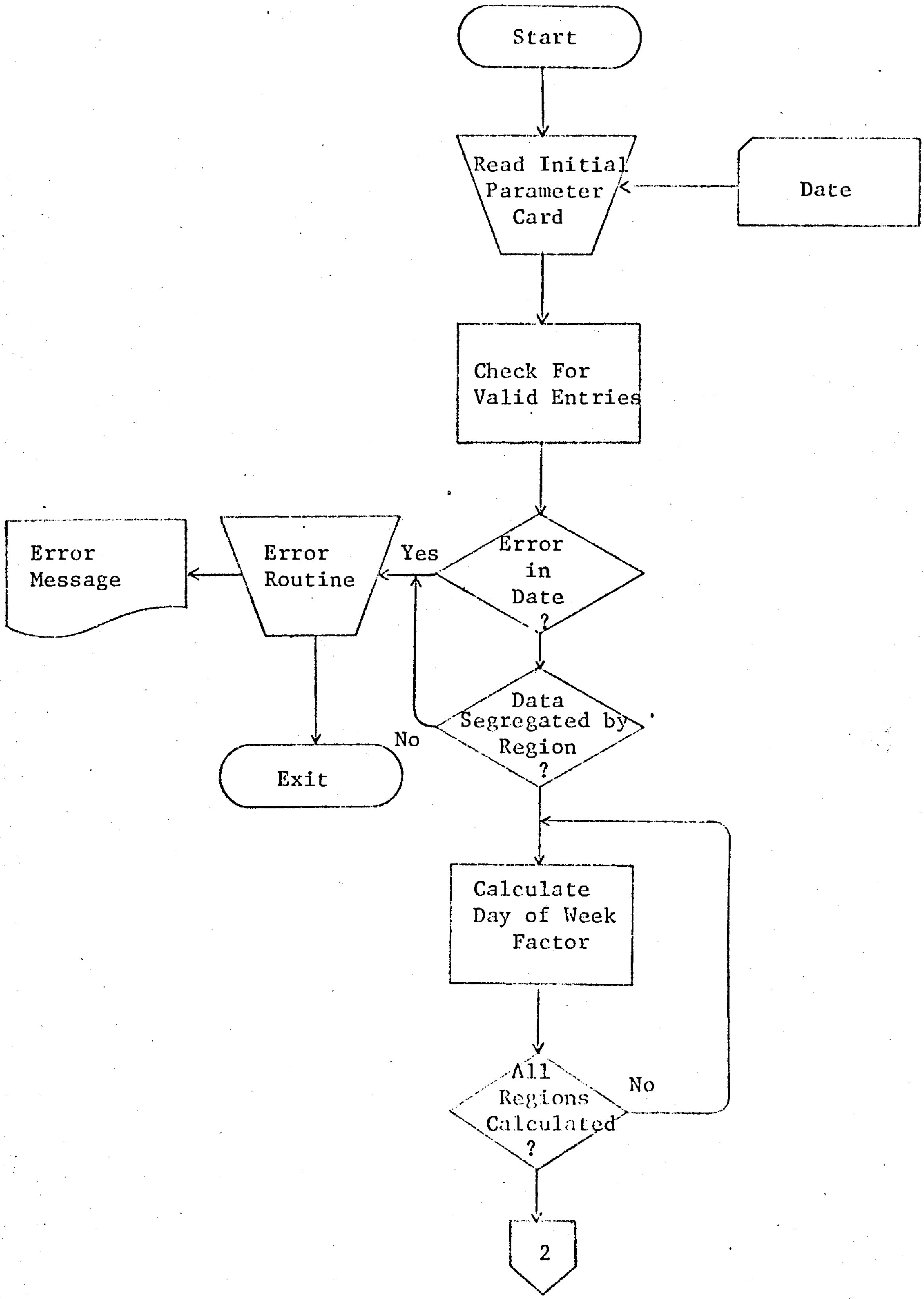
APPENDIX A

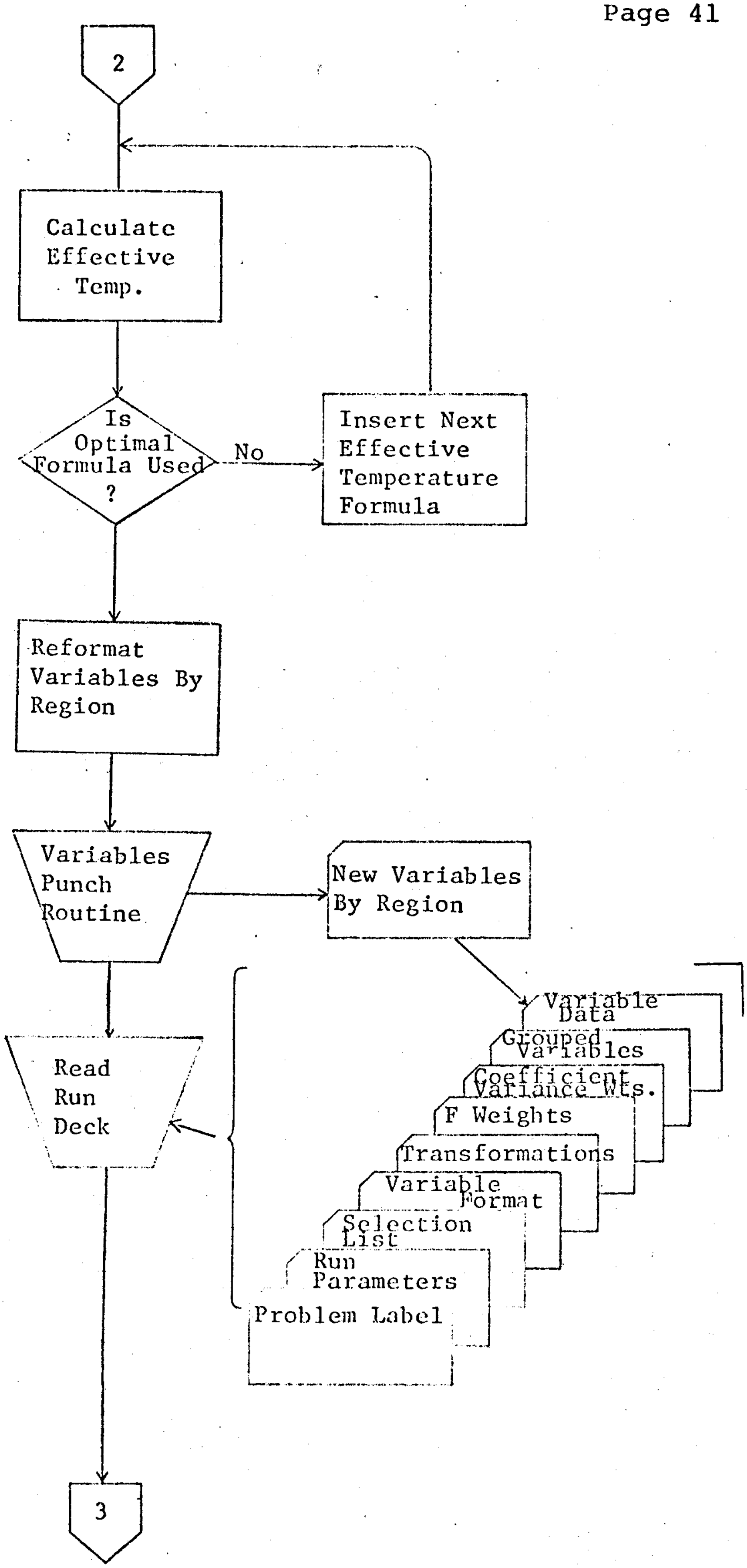
Sample Data Listing

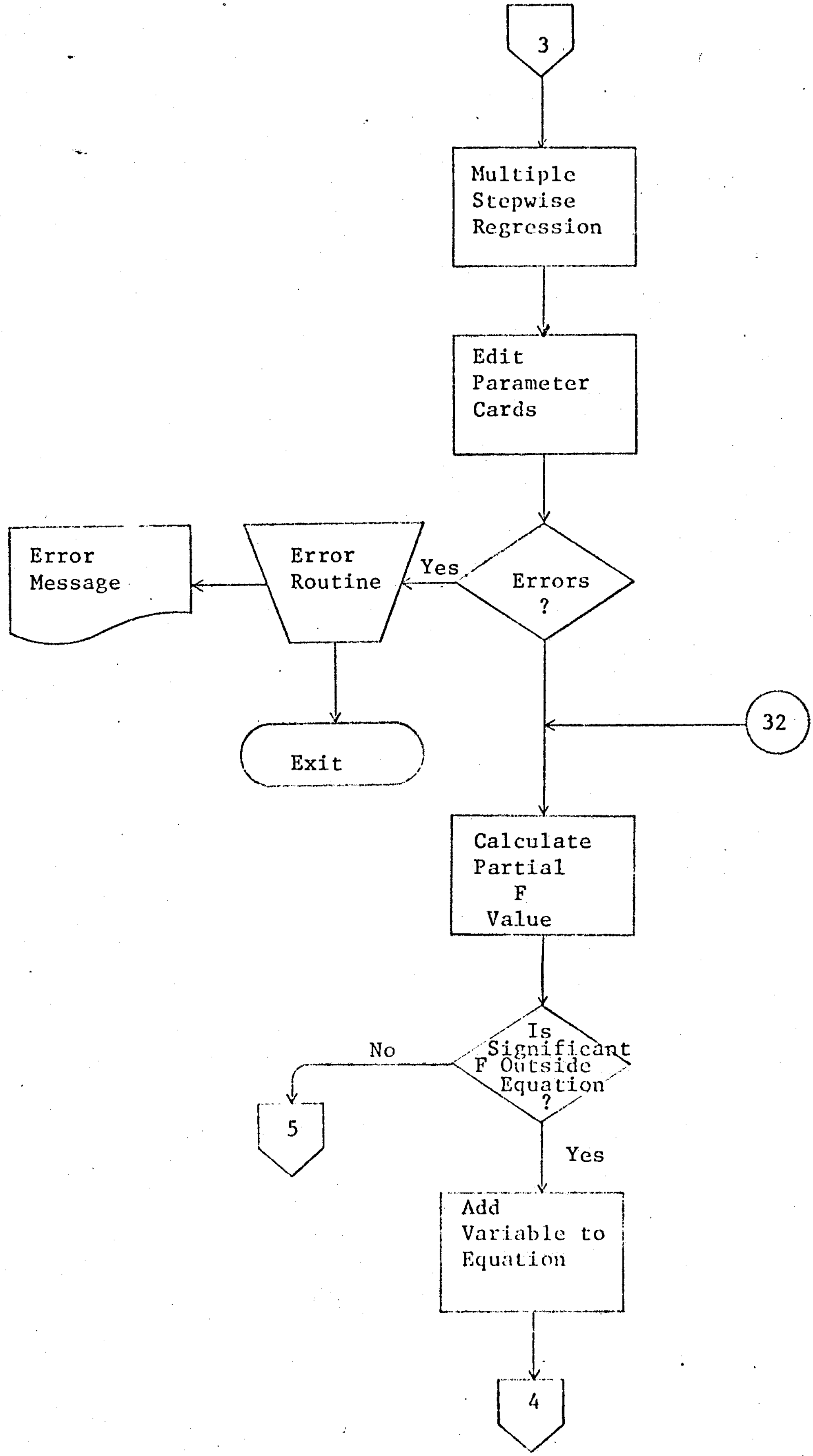
```
//A254ABCD JOB (****,*****),'DICK TJEWS',TIME=0001                          JOB  118
//A EXEC REGRD7,REGION=240K
//SYSIN DD *
* NATURAL GAS FORECASTING   WITHOUT DUMMY VARIABLES
 627 25 26  0  5  0   1.  0.0  0  0  0  0  0  0  0 -1  0  0  0  0 0  0  0
GAS LOAD26X0     01REGION 102REGION 203REGION 304REGION 405REGION 506REGION 607
REGION 708REGION 809REGION 910REGON 1011REGON 1112EFTV T-113AVG T-1 14SNDOUT-115
WNDXTMP 160/WK FTR17CHNG ET 18EFTV TMP19HIGH TMP20LOW TEMP21AVRG TMP22WET BULB23
DALIT HR24WIND SPD25
1(12F1.0,3X,2F4.1,F5.3,F5.1,4X,F4.3,5F4.1,F3.1,F2.0,F5.3)
1100000000000000  31      468 2990     1006   9- 40   5- 56- 30- 33 7413  440 1001
1010000000000000- 30- 11  761  882     1067  26- 56- 11- 72- 94- 94 74 3  821 1002
1001000000000000- 29-  6 8943 1330     1095  18- 47   5-155- 66- 66 740510572 1003
1000000000010000- 29-  6  764 1330      960  18- 47   5-155- 66- 66 7405  702 1010
1000100000000000- 32- 40 1849          1005  21- 53   5-144- 94-116 74 0 1958 1004
1000000000001000- 32- 40  152          1152  21- 53   5-144- 94-116 74 0  179 1011
1000010000000000- 32- 22 1841  238     1027  21- 53- 27-138- 68-105 74 1 1854 1005
1000001000000000  21-      410  288     913  36- 57- 27-138- 68-105 74 1  437 1006
1000000100000000  17-     1171  768     983- 10-  7  27- 11   8- 44 80 4 1106 1007
1000000010000000  40  33 1064  945      990   5  15  27   5  11     80 5 1094 1008
1000000001000000- 19- 17  254  769      975- 10-  9  27- 11   8- 44 80 4  252 1009
1100000000000000- 40- 30  440 3132     1059  13- 53- 44- 77- 61-116 7412  491 1101
1010000000000000- 56- 94  821 1264     1139  17- 73- 83-200-116-133 74 4 1340 1102
1001000000000000- 47- 66103572 1170    1085- 20- 27- 66-133   5-122 74 613226 1103
1000000000010000- 47- 66  702 1170      824- 20- 27- 66-133   5-122 74 6 1093 1110
1000100000000000- 53- 94 1955          1061  22- 75-111-166-138-155 74 0 3463 1104
1000000000001000- 53- 94  179          1080  22- 75-111-166-138-155 74 0  217 1111
1000010000000000- 53- 88 1854  933     1035  15- 68- 66-144-111-111 74 3 2084 1105
1000001000000000- 57- 88  437  933      954  13- 70- 66-144-111-111 74 3  535 1106
1000000100000000-  7   8 1106 1250      969  16- 23   5-111- 50-111 80 5 1139 1107
1000000010000000  15  11 1094  844      966  10   5  11- 50- 11- 27 80 4 1288 1108
1000000001000000-  9   8  252 1250      929  17- 26   5-111- 50-111 80 5  383 1109
1100000000000000- 53- 61  491 3332     1012-  3- 50    - 72- 38- 94 7414  825 1201
1010000000000000- 73-116 1340 1362     1074- 13- 60- 16-161- 66- 88 74 7 1104 1202
1001000000000000- 27     513226 4046   1047   9- 36    - 94- 38- 77 741712738 1203
1000000000010000- 27   5 1093 4046      568   9- 36    - 94- 38- 77 7417  999 1210
1000100000000000- 75-138 3463 1530      969- 22- 53   5-155- 55- 77 74 6 2717 1204
1000000000001000- 75-138  217 1530      827- 22- 53   5-155- 55- 77 74 6  119 1211
1000010000000000- 55-111 2084 3315      984- 15- 53- 27-116- 55- 83 7413 2072 1205
1000001000000000- 70-111  535 3315      998- 15- 55- 27-116- 55- 83 7413  499 1206
1000000100000000- 23- 50 1139 1530      992   7- 30   5-100- 55-111 80 6 1141 1207
1000000010000000   5- 11 1288 2024      857-  7  12  33- 33  16- 33 8011 1274 1208
1000000001000000- 26- 50  383 1530      892   7- 33   5-100- 55-111 80 6  341 1209
1100000000000000- 50- 38  825 3510     1067- 16- 34  11- 22   5- 66 7418  499 1301
1010000000000000- 60- 66 1104 1589      925- 18- 42   5- 61- 27- 44 74 7 1218 1302
1001000000000000- 36- 3812738 2886     1000-  2- 34    - 61- 22- 66 741311057 1303
1000000000010000- 36- 38  999 2886      751-  2- 34    - 61- 22- 66 7413 1119 1310
1000100000000000- 53- 55 2717 1165      955- 15- 38  27-133- 33- 61 74 5 1914 1304
1000000000001000- 53- 55  119 1165      651- 15- 38  27-133- 33- 61 74 5   99 1311
* GAS SENDOUT  WITH DUMMY VARIABLES
                                   99 99          26 12
  2                                          01.0
  3                                          01.0
  4                                          01.0
  5                                          01.0
  6                                          01.0
  7                                          01.0
  8                                          01.0
  9                                          01.0
 10                                          01.0
 11                                          01.0
 12                                          01.0
/*
```

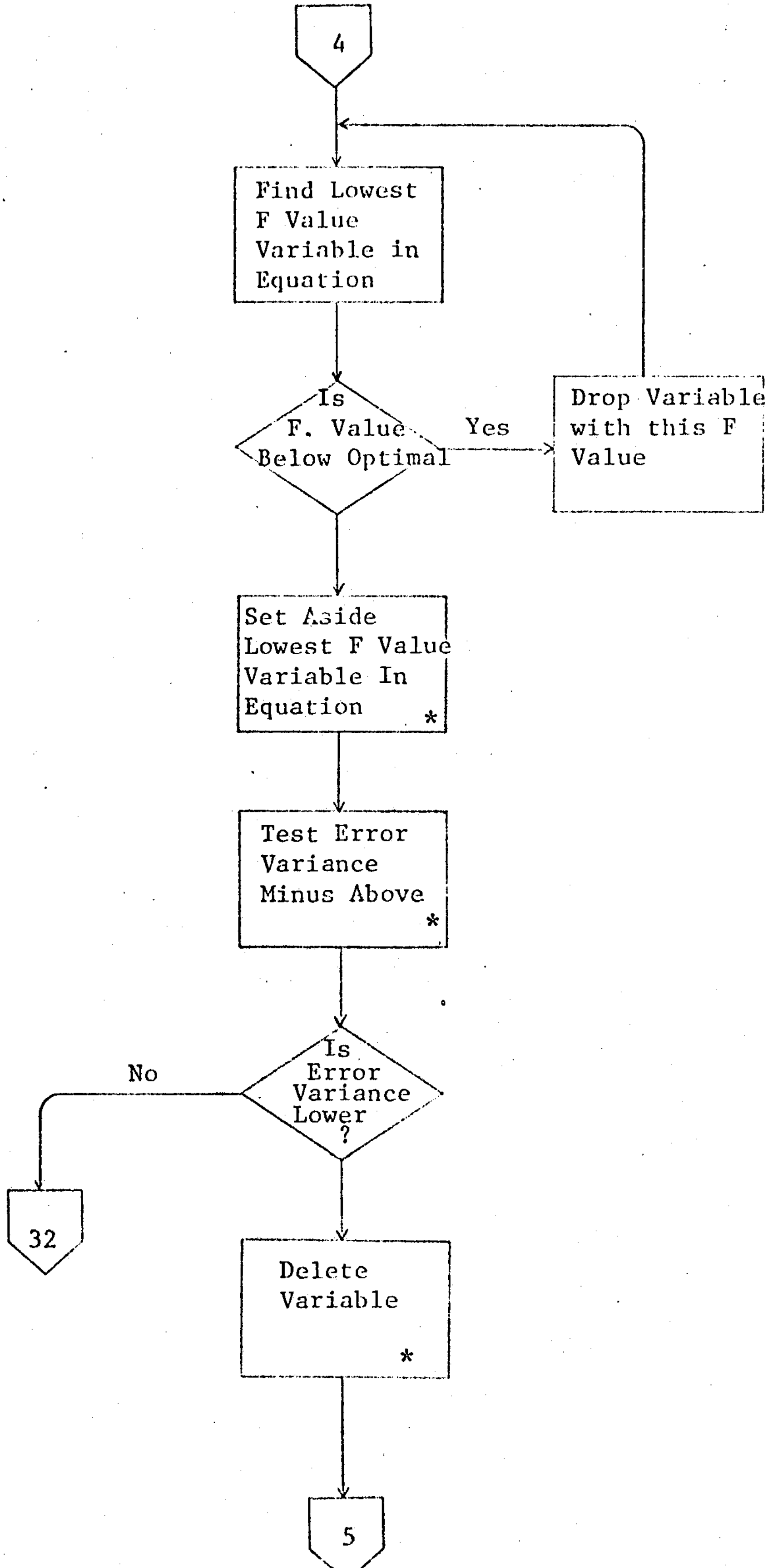
APPENDIX B

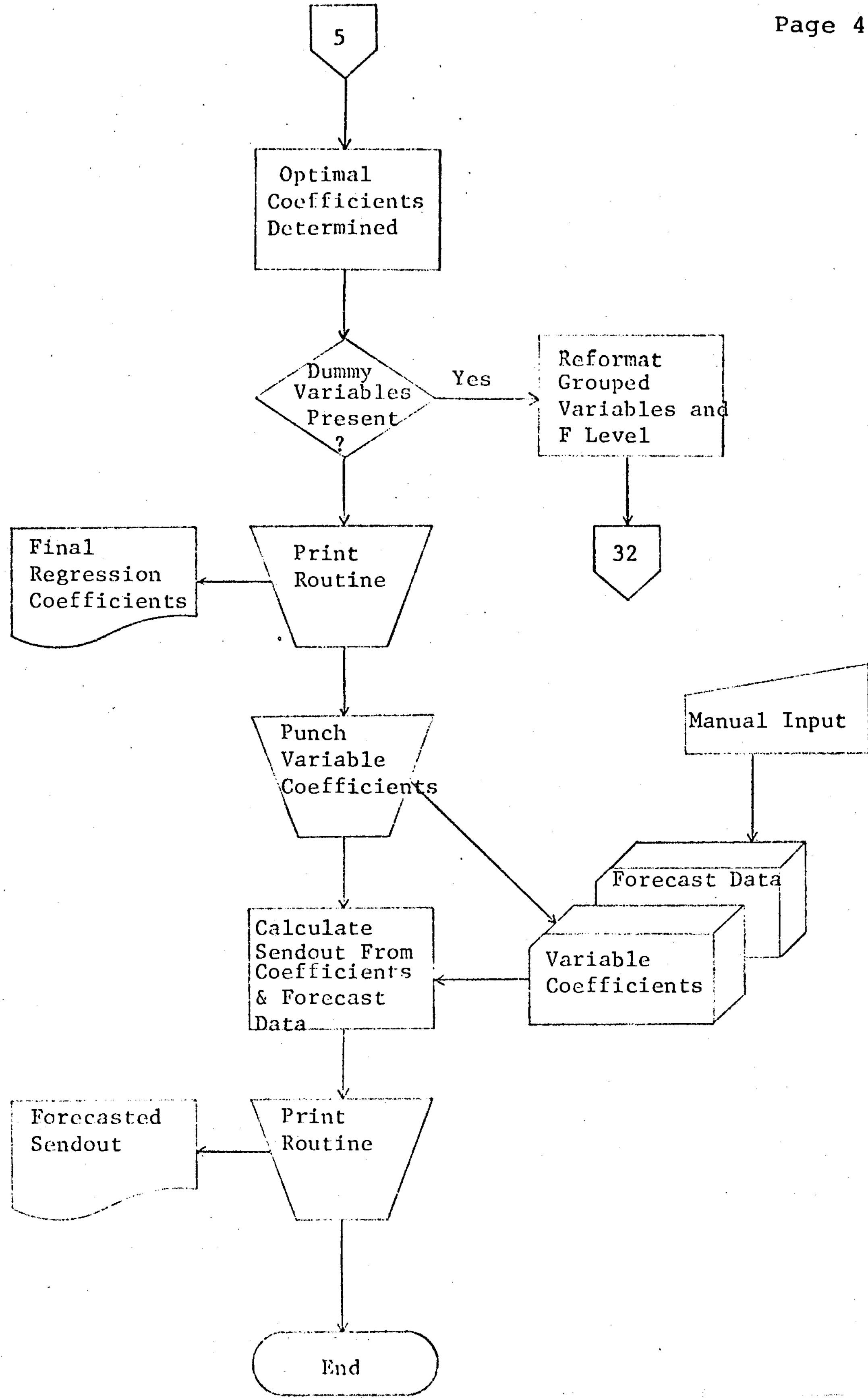
FORECASTING MODEL FLOW CHART




2
Calculate Effective Temp.
Is Optimal Formula Used ?
No
Insert Next Effective Temperature Formula
Reformat Variables By Region
Variables Punch Routine
New Variables By Region
Read Run Deck
Variable Data
Grouped Variables
Coefficient Variance Wts.
F Weights
Transformations
Variable Format
Selection List
Run Parameters
Problem Label
3


3
Multiple Stepwise Regression
Edit Parameter Cards
Errors ?
Yes
Error Routine
Error Message
Exit
32
Calculate Partial F Value
Is Significant F Outside Equation ?
No
5
Yes
Add Variable to Equation
4


4
Find Lowest F Value Variable in Equation
Is F. Value Below Optimal
Yes
Drop Variable with this F Value
Set Aside Lowest F Value Variable In Equation *
Test Error Variance Minus Above *
Is Error Variance Lower ?
No
32
Delete Variable *
5


5
Optimal Coefficients Determined
Dummy Variables Present ?
Yes
Reformat Grouped Variables and F Level
32
Print Routine
Final Regression Coefficients
Punch Variable Coefficients
Manual Input
Forecast Data
Variable Coefficients
Calculate Sendout From Coefficients & Forecast Data
Print Routine
Forecasted Sendout
End

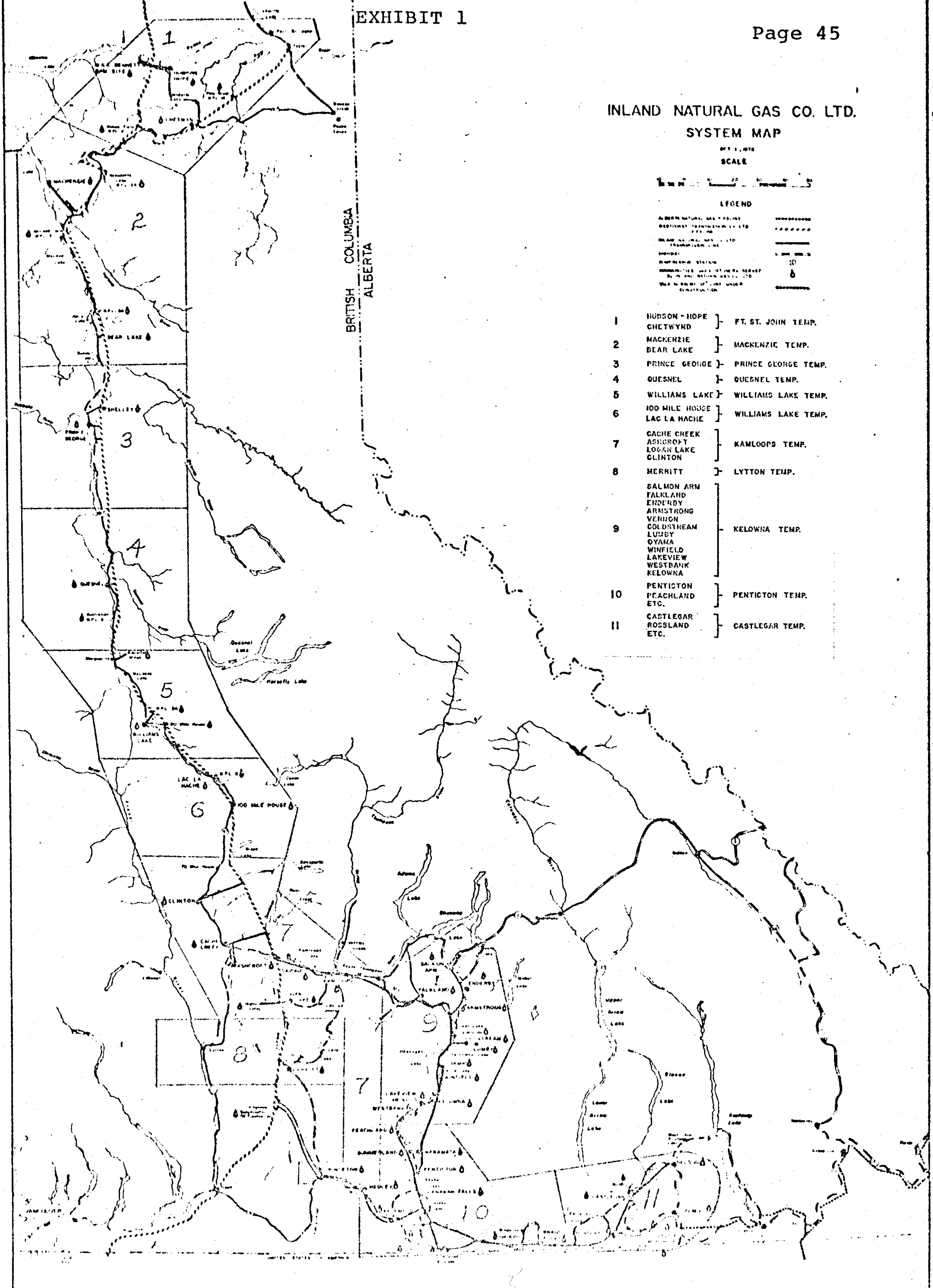
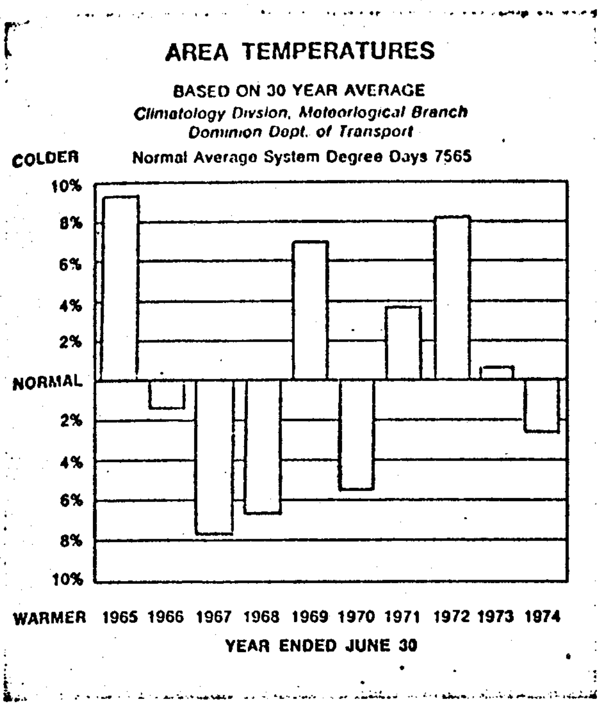

INLAND NATURAL GAS CO. LTD.
SYSTEM MAP
SCALE
LEGEND
1 HUDSON - HOPE CHETWYND — FT. ST. JOHN TEMP.
2 MACKENZIE BEAR LAKE — MACKENZIE TEMP.
3 PRINCE GEORGE — PRINCE GEORGE TEMP.
4 QUESNEL — QUESNEL TEMP.
5 WILLIAMS LAKE — WILLIAMS LAKE TEMP.
6 100 MILE HOUSE LAC LA HACHE — WILLIAMS LAKE TEMP.
7 CACHE CREEK ASHCROFT LOGAN LAKE CLINTON — KAMLOOPS TEMP.
8 MERRITT — LYTTON TEMP.
9 SALMON ARM FALKLAND ENDERBY ARMSTRONG VERNON COLDSTREAM LUMBY OYAMA WINFIELD LAKEVIEW WESTBANK KELOWNA — KELOWNA TEMP.
10 PENTICTON PEACHLAND ETC. — PENTICTON TEMP.
11 CASTLEGAR ROSSLAND ETC. — CASTLEGAR TEMP.
BRITISH COLUMBIA
ALBERTA
1
2
3
4
5
6
7
8
9
10
MACKENZIE
BEAR LAKE
SHELLEY
QUESNEL
WILLIAMS LAKE
100 MILE HOUSE
LAC LA HACHE
CLINTON
ASHCROFT
FALKLAND
ARMSTRONG
WESTBANK
PEACHLAND
PENTICTON

EXHIBIT 2



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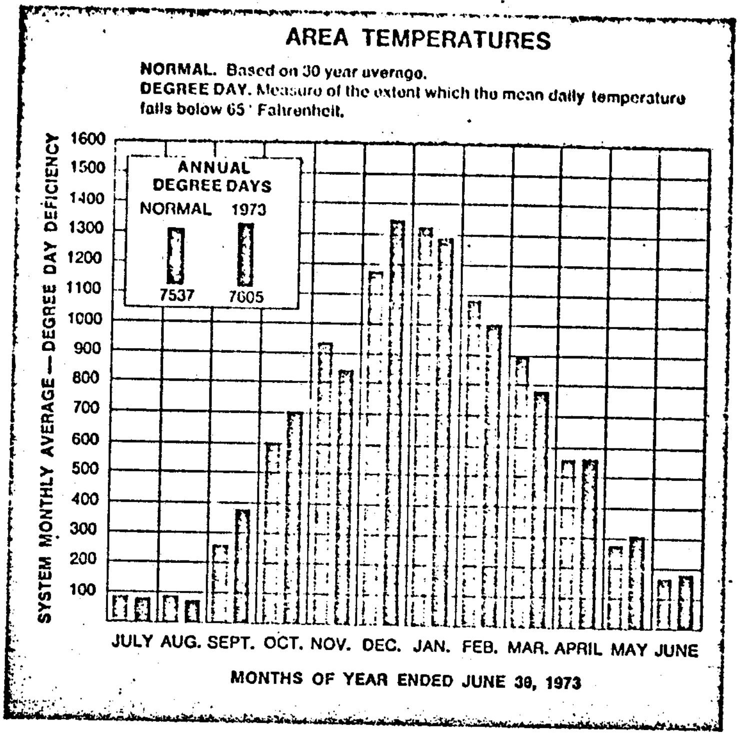

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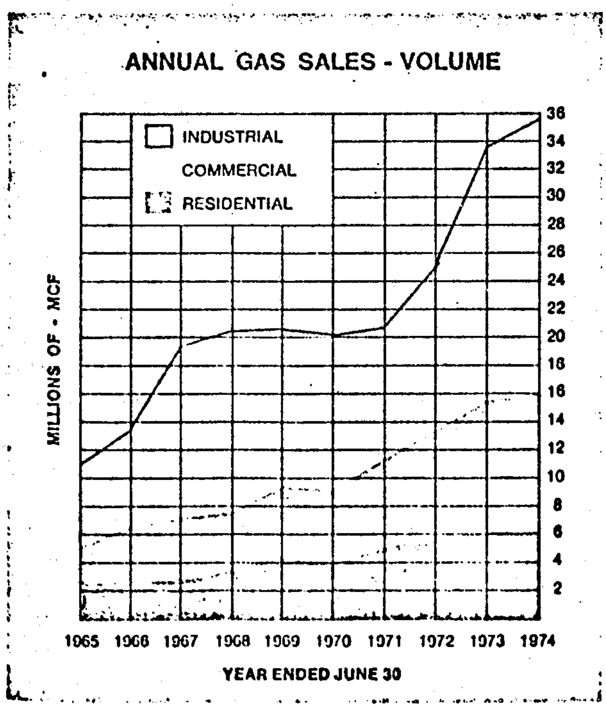

EXHIBIT 5

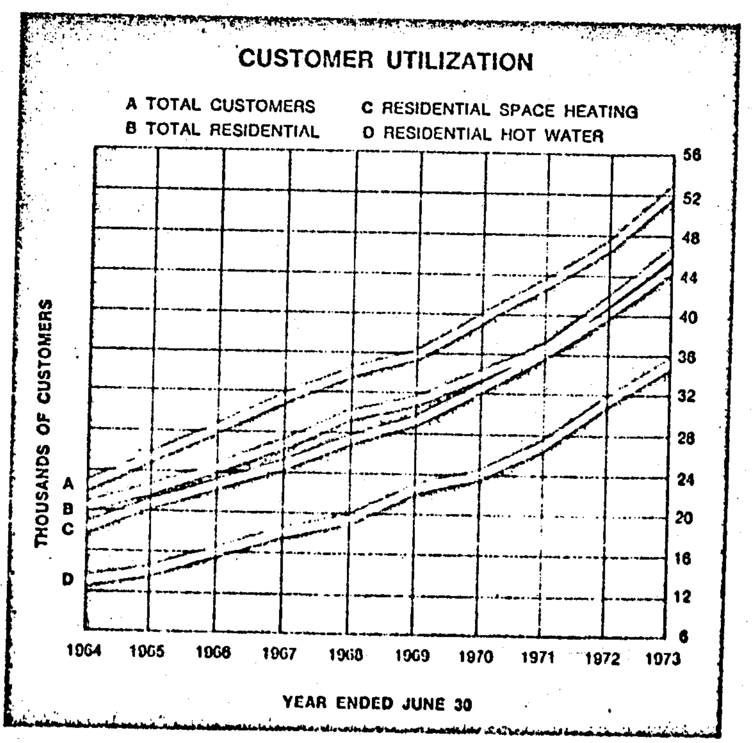

EXHIBIT 6

REGION 1-3 MNTHS   DEMAND PREDICTION MODEL

DAY OF WEEK FACTOR WITH MON = 100.0
TUE = 100.9
WED = 102.0
THR = 100.6
FRI = 106.9
SAT = 101.2
SUN = 106.7

REGION 2-3 MNTHS   DEMAND PREDICTION MODEL

DAY OF WEEK FACTOR WITH MON = 100.0
TUE = 101.7
WED = 104.5
THR = 106.7
FRI = 113.9
SAT = 107.4
SUN = 92.5

REGION 3 3 MNTHS   DEMAND PREDICTION MODEL

DAY OF WEEK FACTOR WITH MON = 100.0
TUE = 104.7
WED = 108.1
THR = 108.9
FRI = 109.5
SAT = 108.5
SUN = 104.7

REGION 4-3 MNTHS   DEMAND PREDICTION MODEL

DAY OF WEEK FACTOR WITH MON = 100.0
TUE = 101.6
WED = 101.8
THR = 100.5
FRI = 106.1
SAT = 96.9
SUN = 95.5

REGION 5-3 MNTHS   DEMAND PREDICTION MODEL

DAY OF WEEK FACTOR WITH MON = 100.0
TUE = 102.6
WED = 103.1
THR = 102.7
FRI = 103.5
SAT = 98.4
SUN = 91.2

GAS SENDOUT EFFECTIVE TEMP TYPE 1

REGRESSAND IS -26 GAS LOAD F TEST LEVEL 1.0

R SQUARE 0.97371 R BAR SQ 0.97052 ERROR STD.DEV. 0.622033

REGRESSION F 305.57 (8 AND 66. D.F.)

COEFFICIENT	STD.DEV.	NULL T	STD.COEF	RSQ.CONT	VARIABLE # GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
0.288530	0.615598E-01	4.69	0.2886	0.2869	SNDOUT-1 15	21.97	0.4997	-0.0005	0.9943	-236.70
0.150763E-02	0.576228E-03	2.79	0.0264	0.0220	WNDXTMP 16	7.78	0.3248	-0.0002	0.7590	-26.77
6.08315	0.794609	7.56	0.3887	0.3781	D/WK FTR 17	58.70	0.6861	-0.0013	0.9916	-218.23
0.457249E-01	0.329365E-01	1.39	0.0115	0.0007	CHNG ET 18	1.93	0.1684	-0.0000	0.6870	-151.86
-0.151617	0.285312E-01	-5.66	-0.0984	0.0713	HIGH TMP 20	32.09	-0.5720	-0.0007	0.9285	-61.63
-0.709277E-01	0.241886E-01	-2.93	-0.0808	0.0736	LOW TEMP 21	8.60	-0.3395	-0.0002	0.9716	-86.78
-0.605822E-01	0.309632E-01	-1.96	-0.0635	0.0578	WET BULB 23	3.83	-0.2341	-0.0001	0.9795	-73.74
0.202165	0.785056E-01	2.58	0.1114	0.1082	DALIT HR 24	6.63	0.3022	-0.0001	0.9885	-139.47

TRACE X'X INVERSE (STD.&WGTD.) 488.372

TOTAL COEF. VARIANCE " " 0.6951

VARS. NOT IN

VARIABLE # GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
EFTV T-1-13	0.06	-0.0315	0.0000	0.9827	237.07
AVG T-1 -14	0.62	-0.0972	0.0000	0.9658	172.06
EFTV TMP-19	0.13	-0.0447	0.0000	0.9844	248.63
AVRG TMP-22	0.05	0.0265	0.0000	0.9828	156.86
WIND SPD-25	0.01	0.0103	0.0000	0.9705	75.09
CONSTANT-99	0.50	-0.0671	0.0000	0.9993	1259.17

CORRELATIONS, THRESH= 0.0

WNDXTMP 16
15 -0.291

D/WK FTR 17
15 -0.614 16 0.118

CHNG ET 18
15 0.780 16 -0.102 17 -0.543

HIGH TMP 20
15 0.350 16 -0.010 17 -0.170 18 0.340

LOW TEMP 21
15 0.404 16 -0.377 17 -0.193 18 0.265 20 0.095

WET BULB 23
15 0.141 16 0.139 17 -0.164 18 0.168 20 -0.516 21 -0.589

DALIT HR 24
15 -0.243 16 -0.029 17 -0.574 18 -0.112 20 -0.322 21 -0.084 23 0.156

GAS SENDOUT EFFECTIVE TEMP TYPE 2

REGRESSAND IS -26 GAS LOAD F TEST LEVEL 1.0

R SQUARE 0.97294 R BAR SQ 0.97012 ERROR STD.DEV. 0.626323

REGRESSION F 344.18 (7 AND 67. D.F.)

COEFFICIENT	STD.DEV.	NULL T	STD.COEF	RSQ.CONT	VARIABLE #	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
0.221898	0.388142E-01	5.72	0.2220	0.2206	SNDOUT-1 15		32.68	0.5726	-0.0007	0.9855	-89.63
0.168900E-02	0.577194E-03	2.93	0.0277	0.0231	WNDXTMP 16		8.56	0.3366	-0.0002	0.7565	-18.28
5.58676	0.672043	9.95	0.4269	0.4153	D/WK FTR 17		99.00	0.7723	-0.0022	0.9881	-143.43
-0.175077	0.270184E-01	-6.48	-0.1066	0.0772	HIGH TMP 20		41.99	-0.6207	-0.0009	0.9192	-39.86
-0.798191E-01	0.234862E-01	-3.40	-0.0909	0.0828	LOW TEMP 21		11.55	-0.3835	-0.0003	0.9694	-62.28
-0.678162E-01	0.307321E-01	-2.21	-0.0710	0.0648	WET BULB 23		4.87	-0.2603	-0.0001	0.9789	-70.19
0.214406	0.785468E-01	2.73	0.1182	0.1147	DALIT HR 24		7.45	0.3164	-0.0002	0.9883	-141.54

TRACE X'X INVERSE (STD.&WGTD.) 336.517

TOTAL COEF. VARIANCE " " 0.4929

VARS. NOT IN

VARIABLE #	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
EFTV T-1-13		0.13	0.0446	0.0000	0.9661	334.09
AVG T-1 -14		0.10	-0.0381	0.0000	0.9620	249.50
CHNG ET -18		0.40	0.0772	0.0000	0.6940	160.22
EFTV TMP-19		0.15	-0.0468	0.0000	0.9840	155.30
AVRG TMP-22		0.32	-0.0698	0.0000	0.9755	59.72
WIND SPD-25		0.00	-0.0014	0.0000	0.9703	75.32
CONSTANT-99		0.29	-0.0660	0.0000	0.9993	1287.07

CORRELATIONS. THRESH= 0.0

WNDXTMP 16	15 -0.340					
D/WK FTR 17	15 -0.363	16 0.075				
HIGH TMP 20	15 0.144	16 0.026	17 0.018			
LOW TEMP 21	15 0.326	16 -0.365	17 -0.061	20 0.006		
WET BULB 23	15 0.016	16 0.160	17 -0.088	20 -0.618	21 -0.667	
DALIT HR 24	15 -0.250	16 -0.041	17 -0.761	20 -0.303	21 -0.056	23 0.178

GAS SENDOUT EFFECTIVE TEMP TYPE 3

REGRESSAND IS -26 GAS LOAD F TEST LEVEL 1.0

R SQUARE 0.97476 R BAR SQ 0.97170 ERROR STD.DEV. 0.609495

REGRESSION F 315.61 (8 AND 66. D.F.)

COEFFICIENT	STD.DEV.	NULL T	STD.COEF	RSQ.CONT	VARIABLE # GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
0.173343	0.437352E-01	3.97	0.1739	0.1728	SNDOUT-1 15	15.80	0.4395	-0.0003	0.9892	-148.22
0.177623E-02	0.563110E-03	3.15	0.0292	0.0243	WNDXTMP 16	9.95	0.3619	-0.0002	0.7578	-21.51
7.92465	0.865172	9.15	0.5059	0.4922	D/WK FTR 17	83.70	0.7478	-0.0017	0.9932	-275.27
-0.688229E-01	0.315758E-01	-2.18	-0.0490	0.0445	EFTV TMP 19	4.75	-0.2591	-0.0001	0.9574	-150.34
-0.165927	0.266255E-01	-6.23	-0.1010	0.0732	HIGH TMP 20	38.84	-0.6086	-0.0008	0.9212	-47.52
-0.657541E-01	0.237487E-01	-2.77	-0.0749	0.0682	LOW TEMP 21	7.67	-0.3226	-0.0002	0.9717	-66.64
-0.703532E-01	0.299290E-01	-2.35	-0.0737	0.0672	WET BULB 23	5.53	-0.2779	-0.0001	0.9789	-72.36
0.105156	0.914053E-01	1.15	0.0580	0.0563	DALIT HR 24	1.32	0.1402	-0.0000	0.9918	-238.39

TRACE X'X INVERSE (STD.&WGTD.) 485.855

TOTAL COEF. VARIANCE " " 0.6652

VARS. NOT IN

VARIABLE # GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
EFTV T-1-13	0.01	-0.0104	0.0000	0.9832	252.03
AVG T-1 -14	0.08	-0.0361	0.0000	0.9620	246.81
CHNG ET -18	0.03	-0.0210	0.0000	0.6231	156.77
AVRG TMP-22	0.01	-0.0122	0.0000	0.9768	64.22
WIND SPD-25	0.01	0.0138	0.0000	0.9704	74.77
CONSTANT-99	0.05	-0.0280	0.0000	0.9993	1236.63

CORRELATIONS. THRESH= 0.0

WNDXTMP 16	15 -0.329						
D/WK FTR 17	15 -0.567	16 0.103					
EFTV TMP 19	15 0.504	16 -0.071	17 -0.656				
HIGH TMP 20	15 0.043	16 0.037	17 0.117	19 -0.158			
LOW TEMP 21	15 0.134	16 -0.331	17 0.134	19 -0.272	20 0.048		
WET BULB 23	15 0.033	16 0.156	17 -0.092	19 0.039	20 -0.616	21 -0.652	
DALIT HR 24	15 0.096	16 -0.073	17 -0.840	19 0.548	20 -0.337	21 -0.194	23 0.170

NATURAL GAS FORECASTING WITHOUT DUMMY VARIABLES

REGRESSAND IS -14 GAS LOAD F TEST LEVEL 1.0 ADD 10 AVRG TMP

R SQUARE 0.98253 R BAR SQ 0.98237 ERROR STD.DEV. 0.523918

REGRESSION F 5924.68 (6 AND 632. D.F.)

COEFFICIENT	STD.DEV.	NULL T	STD.COEF	RSQ.CONT	VARIABLE	#	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
0.335567E-01	0.735191E-02	4.56	0.0967	-0.0490	AVG T-1	2		20.83	0.1786	-0.0004	0.9576	-34.64
0.992900	0.526333E-02	187.93	0.9936	0.9831	SNDOUT-1	3		*******	0.9912	-0.6729	0.3142	-2.34
0.526653E-01	0.177711E-01	3.54	0.0274	0.0017	CHNG ET	6		12.52	0.1394	-0.0002	0.6822	-32.34
-0.324411E-01	0.561504E-02	-3.53	-0.0674	0.0295	HIGH TMP	8		12.49	-0.1392	-0.0002	0.9476	-75.62
-0.278013E-01	0.713450E-02	-3.89	-0.1065	0.0585	LOW TEMP	9		15.10	-0.1528	-0.0003	0.9746	-103.30
0.243494E-01	0.141507E-01	1.72	0.0702	-0.0359	AVRG TMP	10		2.96	0.0683	-0.0001	0.9885	-124.13

TRACE X'X INVERSE (STD.&WGTD.) 174.996

TOTAL COEF. VARIANCE " " 2.1073

VARS. NOT IN

VARIABLE	#	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
EFTV T-1	-1	0.04	-0.0080	0.0000	0.9001	15.47
WNDXTMP	-4	0.00	-0.0027	0.0000	0.5832	4.93
C/WK FTR	-5	0.62	0.0315	0.0000	0.8168	22.56
EFTV TMP	-7	0.20	0.0179	0.0000	0.9288	23.00
WET BULB	-11	0.93	-0.0383	0.0000	0.9771	64.18
DALIT HR	-12	0.00	0.0025	0.0000	0.8172	22.61
WIND SPD	-13	0.01	0.0033	0.0000	0.5095	6.43
CONSTANT	-99	0.02	0.0053	0.0000	0.8183	18.29

CORRELATIONS, THRESH= 0.0

SNDOUT-1	3					
		2 -0.003				
CHNG ET	6					
		2 -0.748	3 0.052			
HIGH TMP	8					
		2 -0.255	3 -0.065	6 0.109		
LOW TEMP	9					
		2 -0.251	3 0.142	6 -0.068	8 0.604	
AVRG TMP	10					
		2 -0.253	3 0.005	6 0.423	8 -0.715	9 -0.796

ERROR MEAN	SKEWNESS
0.1191E-02	-1.027

GAS SENDOUT WITH DUMMY VARIABLES

REGRESSAND IS -26 GAS LOAD F TEST LEVEL 0.0 DROP -9 REGION 8

R SQUARE 0.98424 R BAR SQ 0.98370 ERROR STD.DEV. 0.504052

REGRESSION F 1832.01 (21 AND 616. D.F.)

COEFFICIENT	STD.DEV.	NULL T	STD.COEF	RSQ.CONT	VARIABLE	#	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
-0.239324	0.897893E-01	-2.67	-0.0174	0.0027	REGION 1	2	A	7.10	-0.1068	-0.0002	0.4023	-5.43
1.88761	0.264927	7.13	0.1375	0.1279	REGION 3	4	C	50.77	0.2759	-0.0013	0.9313	-30.93
0.259548	0.856999E-01	3.03	0.0189	0.0013	REGION 4	5	D	9.17	0.1211	-0.0002	0.3439	-7.35
0.101968	0.805483E-01	1.27	0.0074	-0.0000	REGION 5	6	E	1.60	0.0509	-0.0000	0.2573	-4.49
-0.200216	0.831387E-01	-2.41	-0.0146	0.0025	REGION 6	7	F	5.80	-0.0966	-0.0001	0.3029	-4.77
-0.114646	0.808522E-01	-1.42	-0.0084	0.0010	REGION 7	8	G	2.01	-0.0570	-0.0001	0.2629	-4.51
-0.217958	0.840099E-01	-2.59	-0.0159	0.0028	REGION 9	10	I	6.73	-0.1040	-0.0002	0.3173	-6.65
-0.175231	0.829316E-01	-2.11	-0.0128	0.0019	REGON 11	12	K	4.46	-0.0848	-0.0001	0.2994	-4.01
-0.466106E-02	0.825993E-02	-0.56	-0.0077	0.0011	EFTV T-1	13		0.32	-0.0227	-0.0000	0.8623	-13.84
0.263020E-01	0.833693E-02	3.15	0.0597	-0.0093	AVG T-1	14		9.95	0.1261	-0.0003	0.9286	-19.99
0.845479	0.202912E-01	41.67	0.8443	0.8351	SNDOUT-1	15		1736.16	0.8591	-0.0444	0.9377	-31.05
0.125667E-03	0.519655E-03	0.24	0.0046	0.0003	WNDXTMP	16		0.06	0.0097	-0.0000	0.9299	-31.35
0.659053	0.223152	2.95	0.0164	0.0044	D/WK FTR	17		8.72	0.1182	-0.0002	0.1722	-1.70
0.477925E-01	0.182134E-01	2.62	0.0251	0.0011	CHNG ET	18		6.89	0.1051	-0.0002	0.7194	-13.12
0.944738E-02	0.109243E-01	0.86	0.0145	-0.0023	EFTV TMP	19		0.75	0.0348	-0.0000	0.9088	-22.45
-0.199165E-01	0.909803E-02	-2.19	-0.0420	0.0062	HIGH TMP	20		4.79	-0.0879	-0.0001	0.9304	-32.83
-0.190831E-01	0.898024E-02	-2.13	-0.0471	0.0083	LOW TEMP	21		4.52	-0.0853	-0.0001	0.9479	-35.27
0.225908E-01	0.166789E-01	1.35	0.0512	-0.0085	AVRG TMP	22		1.83	0.0545	-0.0000	0.9821	-71.14
-0.207316E-01	0.117125E-01	-1.77	-0.0498	0.0080	WET BULB	23		3.13	-0.0711	-0.0001	0.9677	-49.23
0.184561E-01	0.355054E-01	0.52	0.0038	0.0000	DALIT HR	24		0.27	0.0209	-0.0000	0.5125	-9.97
-0.683531E-02	0.165202E-01	-0.41	-0.0080	-0.0002	WIND SPD	25		0.17	-0.0167	-0.0000	0.9316	-33.91
-0.654947	0.345107	-1.90	-0.1660	0.0002	CONSTANT	99		3.60	-0.0762	-0.0001	0.9967	-4.96

TRACE X'X INVERSE (STD.&WGTD.) 230.213

TOTAL COEF. VARIANCE " " 3.6280

VARS. NOT IN

VARIABLE	#	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
REGION 2	-3	B	0.81	-0.0362	0.0000	0.4505	6.55
REGION 8	-9	H	0.00	-0.0021	0.0000	0.5573	11.85
REGON 10	-11	J	0.86	0.0374	0.0000	0.4283	5.05

CORRELATIONS. THRESH= 0.0

REGION 3 4	2 -0.163								
REGION 4 5	2 0.115	4 0.442							
REGION 5 6	2 0.217	4 0.279	5 0.326						
REGION 6 7	2 0.330	4 -0.217	5 0.111	6 0.200					
REGION 7 8	2 0.212	4 -0.048	5 0.138	6 0.150	7 0.187				
REGION 9 10	2 0.244	4 -0.234	5 0.053	6 0.099	7 0.241	8 0.334			
REGON 11 12	2 0.311	4 -0.177	5 0.166	6 0.208	7 0.317	8 0.224	10 0.258		
EFTV T-1 13	2 0.070	4 0.044	5 0.020	6 0.038	7 -0.004	8 -0.055	10 -0.056	12 -0.001	
AVG T-1 14	2 -0.079	4 -0.169	5 -0.088	6 -0.086	7 -0.013	8 0.070	10 0.103	12 0.014	13 -0.427
SNDOUT-1 15	2 0.275	4 -0.951	5 -0.381	6 -0.199	7 0.305	8 0.117	10 0.304	12 [illegible]	
WNDXTMP 16	[illegible]								

SNDOUT-1 15	2 0.275	4 -0.951	5 -0.381	6 -0.199	7 0.305	8 0.117	10 0.304	12 0.276	13 -0.032	14 0.156
WNDXTMP 16	2 -0.092	4 0.021	5 0.023	6 0.026	7 0.050	8 -0.098	10 -0.087	12 0.015	13 -0.028	14 -0.001
	15 -0.008									
D/WK FTR 17	2 -0.197	4 -0.054	5 -0.095	6 -0.113	7 0.033	8 -0.065	10 -0.004	12 -0.165	13 -0.007	14 -0.014
	15 -0.038	16 0.087								
CHNG ET 18	2 0.067	4 -0.059	5 0.005	6 -0.005	7 0.022	8 0.028	10 0.028	12 0.055	13 -0.120	14 -0.551
	15 0.070	16 -0.081	17 -0.078							
EFTV TMP 19	2 0.183	4 0.043	5 0.081	6 0.074	7 0.130	8 -0.067	10 -0.068	12 0.068	13 -0.518	14 0.031
	15 -0.021	16 -0.001	17 0.032	18 -0.002						
HIGH TMP 20	2 -0.038	4 0.106	5 -0.024	6 0.054	7 0.061	8 -0.102	10 -0.123	12 -0.101	13 -0.019	14 -0.183
	15 -0.113	16 0.165	17 0.039	18 0.017	19 0.059					
LOW TEMP 21	2 -0.047	4 0.075	5 0.075	6 0.106	7 0.071	8 -0.116	10 -0.130	12 0.039	13 -0.023	14 -0.225
	15 -0.059	16 0.185	17 -0.018	18 -0.031	19 -0.046	20 0.442				
AVRG TMP 22	2 -0.063	4 -0.076	5 -0.018	6 0.008	7 -0.006	8 -0.058	10 -0.033	12 0.028	13 0.116	14 -0.124
	15 0.071	16 0.168	17 0.023	18 0.277	19 -0.378	20 -0.435	21 -0.356			
WET BULB 23	2 0.132	4 -0.044	5 -0.028	6 -0.117	7 -0.072	8 0.210	10 0.205	12 0.006	13 0.051	14 -0.089
	15 0.050	16 -0.200	17 -0.031	18 0.127	19 0.174	20 -0.276	21 -0.357	22 -0.464		
DALIT HR 24	2 0.246	4 0.163	5 0.136	6 0.140	7 0.102	8 -0.144	10 -0.165	12 0.060	13 0.201	14 -0.278
	15 -0.123	16 -0.041	17 -0.038	18 0.080	19 0.417	20 0.024	21 -0.050	22 -0.197	23 0.219	
WIND SPD 25	2 0.019	4 -0.046	5 -0.004	6 -0.060	7 -0.063	8 0.113	10 0.106	12 0.013	13 0.038	14 0.018
	15 0.021	16 -0.948	17 -0.060	18 0.103	19 -0.016	20 -0.169	21 -0.235	22 -0.203	23 0.288	24 -0.002
CONSTANT 99	2 -0.097	4 -0.051	5 -0.068	6 -0.068	7 -0.153	8 0.090	10 0.061	12 -0.001	13 -0.142	14 0.176
	15 0.066	16 0.075	17 -0.588	18 -0.021	19 -0.304	20 -0.063	21 0.129	22 0.108	23 -0.114	24 -0.749
	25 -0.080									

```
GROUP A   1 VARS, RSQ INC 0.0002  TEST F  1.00  F=    7.10
   COEF ADJ.  0.217567E-01
  2 -0.217567

GROUP C   1 VARS, RSQ INC 0.0013  TEST F  1.00  F=   50.77
   COEF ADJ. -0.171601
  4   1.71301

GROUP D   1 VARS, RSQ INC 0.0002  TEST F  1.00  F=    9.17
   COEF ADJ. -0.235953E-01
  5  0.235953

GROUP E   1 VARS, RSQ INC 0.0000  TEST F  1.00  F=    1.60
   COEF ADJ. -0.926980E-02
  6  0.926980E-01

GROUP F   1 VARS, RSQ INC 0.0001  TEST F  1.00  F=    5.80
   COEF ADJ.  0.182014E-01
  7 -0.182014
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GROUP F    1 VARS. RSQ INC 0.0001   TEST F  1.00  F=     5.80
   COEF ADJ.  0.182014E-01
  7 -0.182014

GROUP G    1 VARS. RSQ INC 0.0001   TEST F  1.00  F=     2.01
   COEF ADJ.  0.104223E-01
  8 -0.104224

GROUP I    1 VARS. RSQ INC 0.0002   TEST F  1.00  F=     6.73
   COEF ADJ.  0.198144E-01
 10 -0.198144

GROUP K    1 VARS. RSQ INC 0.0001   TEST F  1.00  F=     4.46
   COEF ADJ.  0.159301E-01
 12 -0.159301

ADJ.CONST.  -0.536605


      ERROR MEAN   SKEWNESS
      0.7160E-05    -0.501
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GAS SENDOUT COEFFICIENTS CALCULATION FOR DEC 17 TO FEB 21

REGRESSAND IS -26 GAS LOAD F TEST LEVEL 0.0

R SQUARE 0.98406 R BAR SQ 0.98359 ERROR STD.DEV. 0.490348

REGRESSION F 2101.76 (21 AND 715. D.F.)

COEFFICIENT	STD.DEV.	NULL T	STC.COEF	RSQ.CONT	VARIABLE	#	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
-0.145155	0.821117E-01	-1.77	-0.0109	0.0017	REGION 1	2	A	3.13	-0.0660	-0.0001	0.4145	-4.86
1.66669	0.235076	7.09	0.1253	0.1161	REGION 3	4	C	50.27	0.2563	-0.0011	0.9286	-29.13
0.252562	0.800014E-01	3.16	0.0190	0.0013	REGICN 4	5	D	9.97	0.1172	-0.0002	0.3832	-8.73
0.130776	0.759865E-01	1.72	0.0098	-0.0001	REGION 5	6	E	2.96	0.0642	-0.0001	0.3163	-6.32
-0.122446	0.788959E-01	-1.55	-0.0092	0.0016	REGION 6	7	F	2.41	-0.0579	-0.0001	0.3658	-5.93
-0.133517	0.735344E-01	-1.82	-0.0100	0.0018	REGION 9	10	I	3.30	-0.0677	-0.0001	0.2700	-4.15
0.102185	0.792109E-01	1.29	0.0077	-0.0006	REGON 10	11	J	1.66	0.0482	-0.0000	0.3708	-4.74
-0.132200	0.756733E-01	-1.75	-0.0099	0.0015	REGCN 11	12	K	3.05	-0.0652	-0.0001	0.3106	-4.08
-0.308867E-02	0.788825E-02	-0.39	-0.0054	0.0008	EFTV T-1	13		0.15	-0.0146	-0.0000	0.3827	-15.62
0.212799E-01	0.731719E-02	2.91	0.0494	-0.0079	AVG T-1	14		8.46	0.1081	-0.0002	0.9226	-19.69
0.860937	0.183544E-01	46.91	0.8605	0.8512	SND CUT-1	15		2200.21	0.8688	-0.0491	0.9337	-28.97
0.109651E-03	0.478066E-03	0.23	0.0040	0.0003	WND XTMP	16		0.05	0.0085	-0.0000	0.9275	-29.89
0.751174	0.215603	3.48	0.0192	0.0050	D/WK FTR	17		12.14	0.1292	-0.0003	0.2670	-2.23
0.571149E-01	0.170438E-01	3.35	0.0299	0.0014	CHNG ET	18		11.23	0.1244	-0.0003	0.7199	-13.71
0.102688E-01	0.102805E-01	1.00	0.0169	-0.0027	EFTV TMP	19		1.00	0.0373	-0.0000	0.9222	-22.28
-0.181356E-01	0.799513E-02	-2.27	-0.0385	0.0058	HIGH TMP	20		5.15	-0.0845	-0.0001	0.9227	-26.08
-0.192656E-01	0.744556E-02	-2.59	-0.0492	0.0088	LOW TEMP	21		6.70	-0.0963	-0.0001	0.9385	-28.01
0.192827E-01	0.136722E-01	1.41	0.0446	-0.0076	AVRG TMP	22		1.99	0.0527	-0.0000	0.9777	-56.58
-0.147737E-01	0.875798E-02	-1.69	-0.0364	0.0059	WET BULB	23		2.85	-0.0630	-0.0001	0.9520	-32.24
0.369423E-01	0.339138E-01	1.09	0.0080	0.0001	DALIT HR	24		1.19	0.0407	-0.0000	0.5912	-10.09
-0.668735E-02	0.150021E-01	-0.45	-0.0080	-0.0003	WIND SPD	25		0.20	-0.0167	-0.0000	0.9301	-31.76
-0.949752	0.353519	-2.69	-0.2483	0.0002	CONSTANT	99		7.22	-0.1000	-0.0002	0.9974	-6.43

TRACE X'X INVERSE (STD.&WGTD.) 205.578

TOTAL COEF. VARIANCE " " 3.2772

VARS. NOT IN

VARIABLE	#	GRP	PART.F	PART.COR	RSQ INC	MULTICOL	TR INC
REGION 2	-3	B	0.00	0.0010	0.0000	0.5344	12.99
REGICN 7	-8	G	0.88	-0.0352	0.0000	0.3210	3.98
REGION 8	-9	H	0.95	0.0364	0.0000	0.3948	4.45

CORRELATICNS. THRESH= 0.0

REGION 3	4	2	-0.107																
REGION 4	5	2	0.179	4	0.465														
REGICN 5	6	2	0.291	4	0.305	5	0.372												
REGICN 6	7	2	0.383	4	-0.151	5	0.182	6	0.274										
REGION 9	10	2	0.229	4	-0.204	5	0.061	6	0.114	7	0.246								
REGCN 10	11	2	0.311	4	0.101	5	0.274	6	0.319	7	0.357	10	0.209						
REGCN 11	12	2	0.343	4	-0.120	5	0.208	6	0.255	7	0.349	10	0.234	11	0.257				
EFTV T-1	13	2	0.098	4	0.040	5	0.042	6	0.067	7	0.031	10	-0.023	11	0.069	12	0.032		
AVG T-1	14	2	-0.137	4	-0.165	5	-0.132	6	-0.145	7	-0.082	10	0.060	11	-0.125	12	-0.050	13	-0.411

```
SNDOUT-1 15
    2  0.233    4 -0.948    5 -0.395    6 -0.211    7  0.257   10  0.272   11 -0.019   12  0.231   13 -0.019   14  0.135
WNDXTMP  16
    2  0.005    4  0.028    5  0.078    6  0.084    7  0.102   10 -0.019   11  0.154   12  0.079   13  0.003   14 -0.041
   15  0.004
D/WK FTR 17
    2 -0.055    4 -0.015    5  0.013    6  0.015    7  0.161   10  0.096   11  0.354   12 -0.070   13  0.008   14 -0.030
   15 -0.040   16  0.115
CHNG ET  18
    2  0.042    4 -0.064    5 -0.006    6 -0.008    7  0.019   10  0.012   11 -0.020   12  0.045   13 -0.159   14 -0.529
   15  0.073   16 -0.059   17 -0.067
EFTV TMP 19
    2  0.198    4  0.066    5  0.137    6  0.140    7  0.179   10 -0.024   11  0.158   12  0.121   13 -0.541   14  0.033
   15 -0.030   16  0.002   17  0.089   18 -0.013
HIGH TMP 20
    2  0.028    4  0.080    5  0.006    6  0.081    7  0.118   10 -0.089   11  0.048   12 -0.047   13 -0.018   14 -0.163
   15 -0.078   16  0.136   17  0.058   18  0.020   19  0.062
LOW TEMP 21
    2  0.072    4  0.057    5  0.134    6  0.161    7  0.163   10 -0.086   11  0.103   12  0.132   13 -0.023   14 -0.192
   15 -0.018   16  0.160   17 -0.034   18 -0.026   19 -0.029   20  0.344
AVRG TMP 22
    2 -0.013    4 -0.063    5 -0.025    6 -0.006    7 -0.024   10  0.003   11  0.011   12  0.018   13  0.138   14 -0.221
   15  0.069   16  0.201   17  0.008   18  0.352   19 -0.361   20 -0.427   21 -0.355
WET BULB 23
    2 -0.028    4 -0.049    5 -0.077    6 -0.157    7 -0.148   10  0.138   11 -0.088   12 -0.064   13  0.035   14 -0.041
   15  0.026   16 -0.180   17 -0.027   18  0.073   19  0.098   20 -0.294   21 -0.363   22 -0.373
DALIT HR 24
    2  0.330    4  0.176    5  0.236    6  0.257    7  0.225   10 -0.074   11  0.261   12  0.178   13  0.209   14 -0.512
   15 -0.105   16 -0.012   17  0.069   18  0.053   19  0.436   20  0.034   21  0.001   22 -0.189   23  0.182
WIND SPD 25
    2 -0.098    4 -0.060    5 -0.078    6 -0.137    7 -0.135   10  0.023   11 -0.206   12 -0.069   13 -0.001   14  0.082
   15  0.010   16 -0.946   17 -0.108   18  0.076   19 -0.028   20 -0.150   21 -0.231   22 -0.217   23  0.267   24 -0.043
CONSTANT 99
    2 -0.235    4 -0.083    5 -0.195    6 -0.217    7 -0.307   10 -0.054   11 -0.424   12 -0.133   13 -0.156   14  0.218
   15  0.056   16  0.013   17 -0.652   18 -0.008   19 -0.359   20 -0.093   21  0.075   22  0.125   23 -0.085   24 -0.776
   25  0.004

ROUP A    1 VARS, RSQ INC 0.0001   TEST F  1.00   F=    3.13
   COEF ADJ.  0.131959E-01
  2 -0.131959

ROUP C    1 VARS, RSQ INC 0.0011   TEST F  1.00   F=   50.27
   CCEF ADJ. -0.151517
  4   1.51517

ROUP D    1 VARS, RSQ INC 0.0002   TEST F  1.00   F=    9.97
   COEF ADJ. -0.229602E-01
  5  0.229602

ROUP E    1 VARS, RSQ INC 0.0001   TEST F  1.00   F=    2.96
   COEF ADJ. -0.118887E-01
  6  0.118887

ROUP F    1 VARS, RSQ INC 0.0001   TEST F  1.00   F=    2.41
   CCEF ADJ.  0.111314E-01
  7 -0.111314

GROUP I   1 VARS, RSQ INC 0.0001   TEST F  1.00   F=    3.30
              0.121379E-01
```

```
GROUP J    1 VARS, RSQ INC 0.0000  TEST F  1.00  F=    1.65
    COEF ADJ. -0.928959E-02
  11  0.928959E-01

GRCUP K    1 VARS, RSQ INC 0.0001  TEST F  1.00  F=    3.05
    COEF ADJ.  0.120182E-01
  12 -0.120182

ADJ.CCNST.  -0.802580
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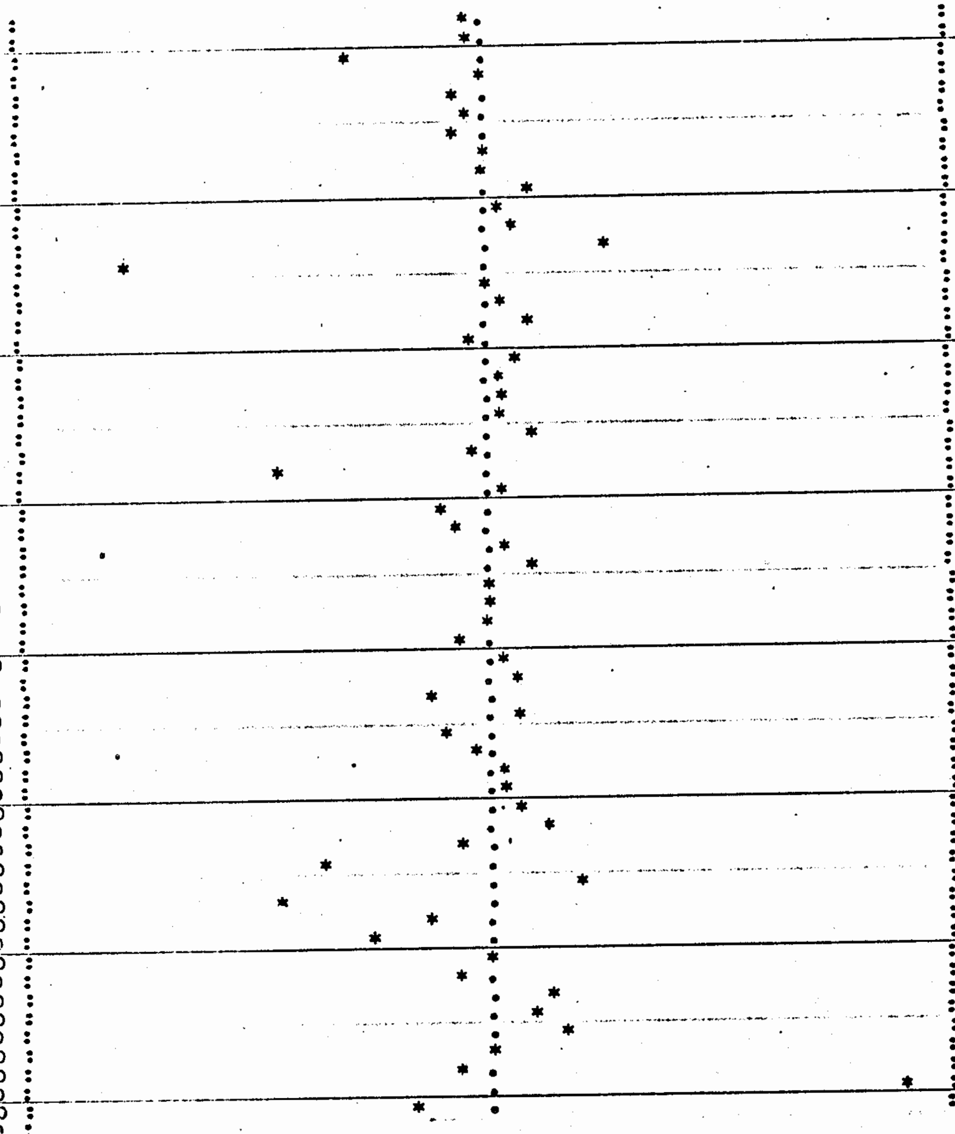
GAS SENDOUT COEFFICIENTS CALCULATION FOR DEC 17 TO FEB 21

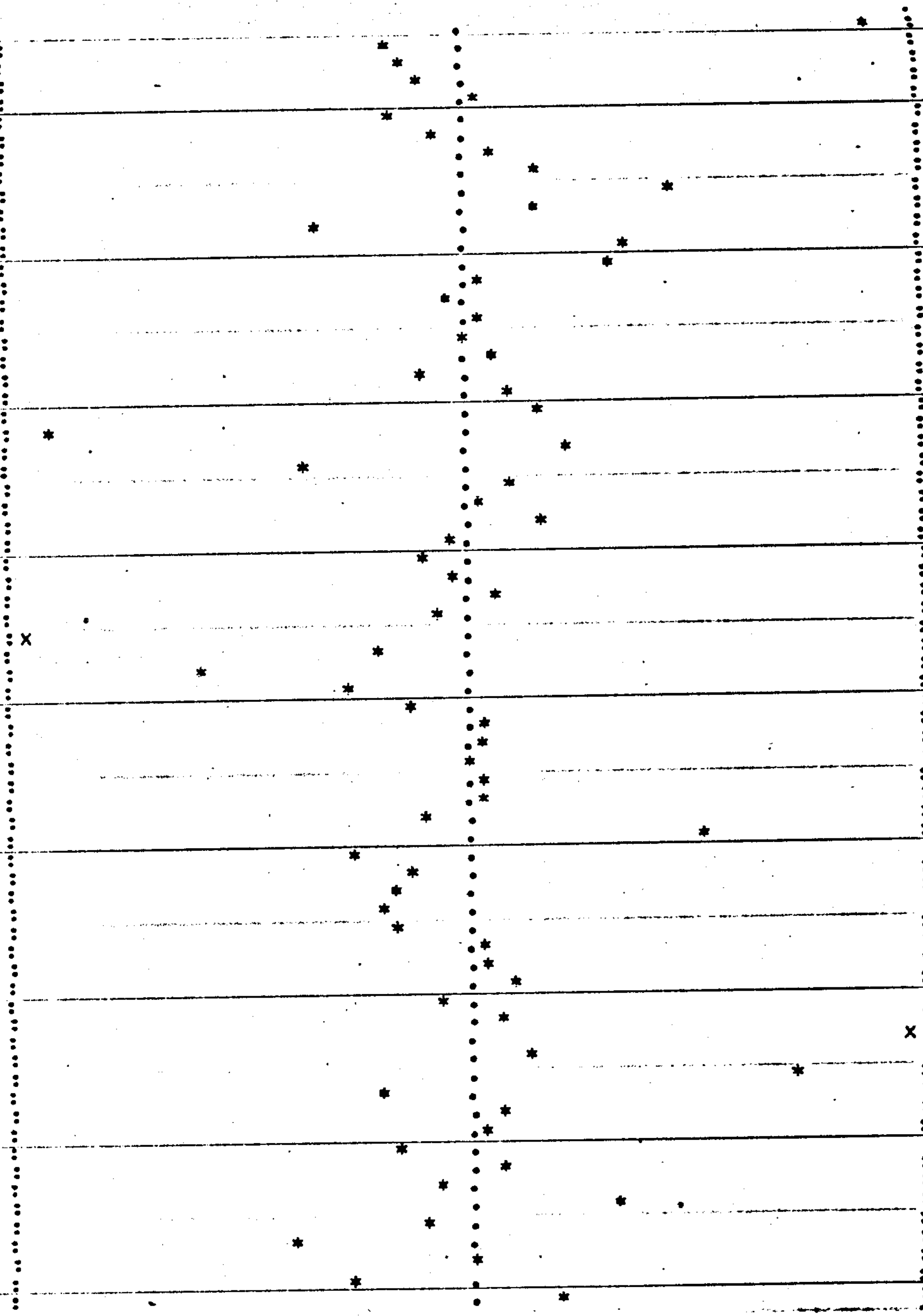
RESIDUAL ANALYSIS. THRESH.= 0.0

PLOT LIMITS +,-3.0

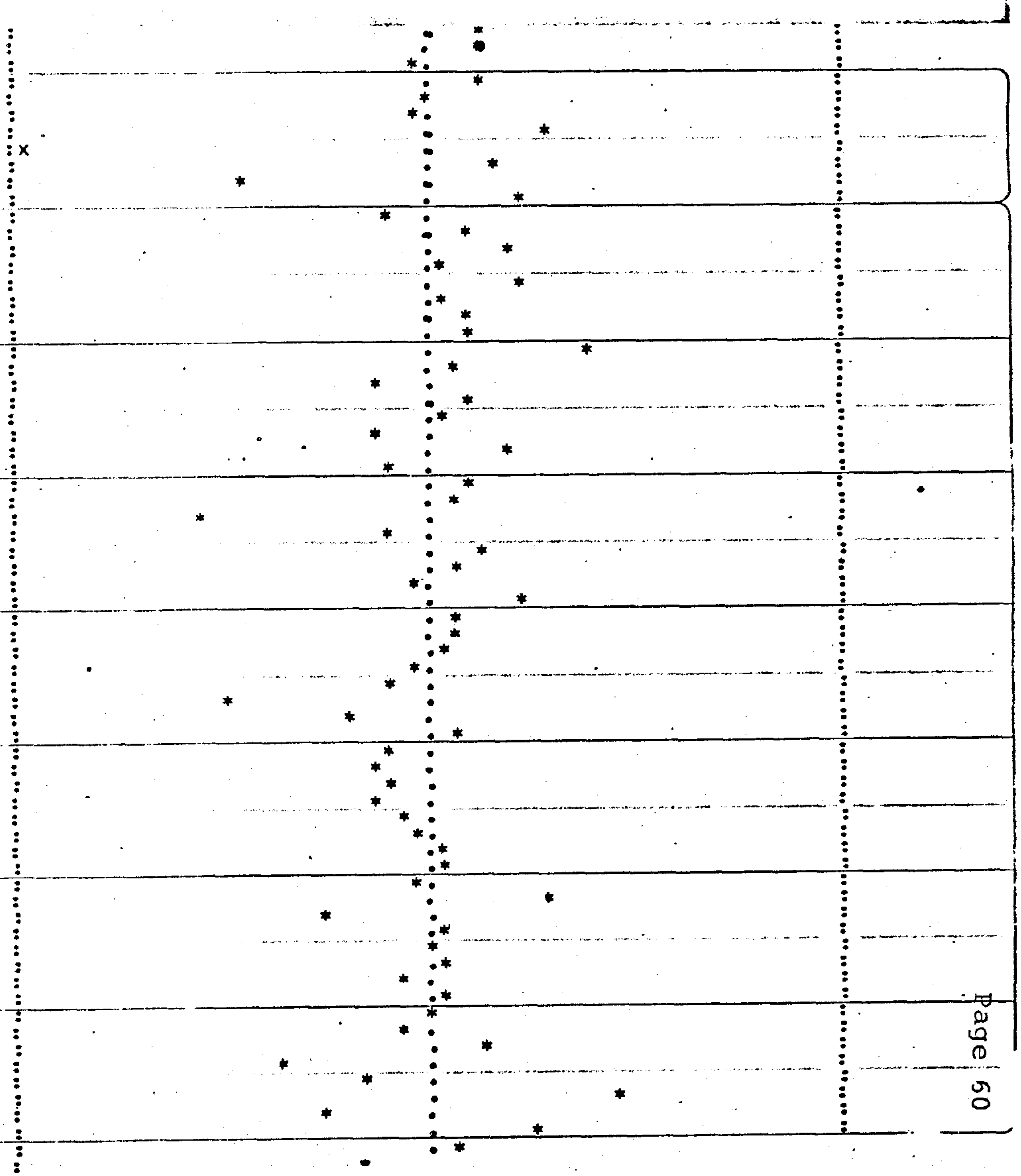
	REGRESSAND	ESTIMATE	ERROR	STD.ERR.	WGT
1	0.62700	0.66669	-0.39686E-01	-0.08	1.0
2	1.4990	1.5395	-0.40545E-01	-0.08	1.0
3	10.797	11.226	-0.42886	-0.87	1.0
4	2.1090	2.1312	-0.22208E-01	-0.05	1.0
5	2.9950	3.0930	-0.98036E-01	-0.20	1.0
6	1.0820	1.1514	-0.69443E-01	-0.14	1.0
7	2.0870	2.1698	-0.82829E-01	-0.17	1.0
8	0.37000	0.36176	0.82371E-02	0.02	1.0
9	0.98900	0.97644	0.12561E-01	0.03	1.0
10	1.3750	1.2296	0.14542	0.30	1.0
11	0.28300	0.23736	0.45644E-01	0.09	1.0
12	0.55500	0.44514	0.10986	0.22	1.0
13	1.6540	1.2731	0.38091	0.78	1.0
14	9.8830	11.057	-1.1745	-2.40	1.0
15	1.9460	1.9373	0.87433E-02	0.02	1.0
16	2.9070	2.8820	0.25047E-01	0.05	1.0
17	1.1820	1.0395	0.14249	0.29	1.0
18	2.0060	2.0540	-0.48049E-01	-0.10	1.0
19	0.37000	0.27227	0.97725E-01	0.20	1.0
20	0.99600	0.93020	0.65802E-01	0.13	1.0
21	1.2950	1.2594	0.36553E-01	0.07	1.0
22	0.28800	0.21741	0.70594E-01	0.14	1.0
23	0.59200	0.44686	0.14514	0.30	1.0
24	1.4910	1.5329	-0.41934E-01	-0.09	1.0
25	9.6260	10.318	-0.69150	-1.41	1.0
26	1.8840	1.8183	0.65671E-01	0.13	1.0
27	2.8520	2.9987	-0.14670	-0.30	1.0
28	1.1260	1.2392	-0.11324	-0.23	1.0
29	2.0150	1.9659	0.49058E-01	0.10	1.0
30	0.36600	0.22235	0.14365	0.29	1.0
31	1.0140	1.0122	0.18339E-02	0.00	1.0
32	1.3340	1.3105	0.23464E-01	0.05	1.0
33	0.26600	0.26310	0.29004E-02	0.01	1.0
34	0.61600	0.70656	-0.90550E-01	-0.18	1.0
35	1.5440	1.4827	0.61265E-01	0.12	1.0
36	10.263	10.188	0.74726E-01	0.15	1.0
37	1.5770	1.7623	-0.18534	-0.38	1.0
38	3.0990	2.9787	0.12031	0.25	1.0
39	0.97200	1.1222	-0.15023	-0.31	1.0
40	1.9850	2.0585	-0.73485E-01	-0.15	1.0
41	0.39700	0.33485	0.62154E-01	0.13	1.0
42	0.93400	0.87658	0.57420E-01	0.12	1.0
43	1.2520	1.1552	0.96776E-01	0.20	1.0
44	0.28200	0.90499E-01	0.19150	0.39	1.0
45	0.70900	0.80300	-0.94004E-01	-0.19	1.0
46	1.2590	1.8066	-0.54756	-1.12	1.0
47	11.330	11.053	0.27729	0.57	1.0
48	0.95900	1.6503	-0.69129	-1.41	1.0
49	2.9950	3.1798	-0.18482	-0.38	1.0
50	0.47200	0.85718	-0.38518	-0.79	1.0
51	2.0450	2.0420	0.29869E-02	0.01	1.0
52	0.44900	0.56885	-0.11985	-0.24	1.0
53	1.0510	0.83429	0.21671	0.44	1.0
54	1.2730	1.1317	0.14128	0.29	1.0
55	0.31900	0.52140E-01	0.26686	0.54	1.0
56	0.71300	0.70716	0.58420E-02	0.01	1.0
57	1.2530	1.3706	-0.11762	-0.24	1.0
58	13.287	11.905	1.3821	2.82	1.0
59	1.0030	1.2246	-0.22159	-0.45	1.0
60	3.1900	3.3719	-0.18193	-0.37	1.0



[illegible]	[illegible]	1.2246	-0.22159	-0.45	1.0
60	3.1900	3.3719	-0.18193	-0.37	1.0
61	0.45800	0.58667	-0.12867	-0.26	1.0
62	2.3650	2.2932	0.71768E-01	0.15	1.0
63	0.54600	0.79911	-0.25311	-0.52	1.0
64	1.1740	1.2575	-0.83488E-01	-0.17	1.0
65	1.4790	1.3627	0.11625	0.24	1.0
66	0.43200	0.20674	0.22526	0.46	1.0
67	0.75700	0.48979E-01	0.70802	1.44	1.0
68	1.1100	0.87466	0.23534	0.48	1.0
69	12.481	12.950	-0.46883	-0.96	1.0
70	1.3210	0.77427	0.54673	1.11	1.0
71	3.5030	3.0209	0.48210	0.98	1.0
72	0.33700	0.28406	0.52938E-01	0.11	1.0
73	2.3180	2.3610	-0.42986E-01	-0.09	1.0
74	0.53400	0.47973	0.54271E-01	0.11	1.0
75	1.3650	1.3795	-0.14512E-01	-0.03	1.0
76	1.6530	1.5761	0.76884E-01	0.16	1.0
77	0.48700	0.61081	-0.12381	-0.25	1.0
78	0.44200	0.29609	0.14591	0.30	1.0
79	0.97800	0.73856	0.23944	0.49	1.0
80	10.620	11.970	-1.3497	-2.75	1.0
81	1.0770	0.74677	0.33023	0.67	1.0
82	2.6020	3.1335	-0.53153	-1.08	1.0
83	0.25700	0.11319	0.14381	0.29	1.0
84	2.0560	2.0171	0.38872E-01	0.08	1.0
85	0.41100	0.16971	0.24129	0.49	1.0
86	1.1810	1.2298	-0.48788E-01	-0.10	1.0
87	1.1960	1.3553	-0.15931	-0.32	1.0
88	0.29100	0.33076	-0.39761E-01	-0.08	1.0
89	0.46800	0.35324	0.11476	0.23	1.0
90	0.76100	0.87890	-0.11790	-0.24	1.0
91	8.9430	10.901	-1.9582	-3.99	1.0
92	0.76400	1.0449	-0.28089	-0.57	1.0
93	1.8490	2.7508	-0.90183	-1.84	1.0
94	0.16200	0.53647	-0.37447	-0.76	1.0
95	1.8410	2.0248	-0.18376	-0.37	1.0
96	0.41000	0.34535	0.64651E-01	0.13	1.0
97	1.1710	1.1056	0.65401E-01	0.13	1.0
98	1.0640	1.0604	0.35677E-02	0.01	1.0
99	0.26400	0.22529	0.38711E-01	0.08	1.0
100	0.44000	0.39266	0.47344E-01	0.10	1.0
101	0.82100	0.96303	-0.14203	-0.29	1.0
102	10.572	9.8039	0.76813	1.57	1.0
103	0.70200	1.0964	-0.39436	-0.80	1.0
104	1.9580	2.1717	-0.21374	-0.44	1.0
105	0.17900	0.44500	-0.26600	-0.54	1.0
106	1.8540	2.1362	-0.28216	-0.58	1.0
107	0.43700	0.68107	-0.24407	-0.50	1.0
108	1.1050	1.0571	0.48883E-01	0.10	1.0
109	1.0940	1.0530	0.40975E-01	0.08	1.0
110	0.25200	0.10961	0.14239	0.29	1.0
111	0.49100	0.56461	-0.73608E-01	-0.15	1.0
112	1.3400	1.2303	0.10974	0.22	1.0
113	13.226	11.178	2.0482	4.18	1.0
114	1.0930	0.91978	0.17322	0.35	1.0
115	3.4630	2.4079	1.0551	2.15	1.0
116	0.21700	0.50578	-0.28878	-0.59	1.0
117	2.0840	2.0102	0.73774E-01	0.15	1.0
118	0.53500	0.46397	0.71026E-01	0.14	1.0
119	1.1390	1.3654	-0.22644	-0.46	1.0
120	1.2880	1.1719	0.11613	0.24	1.0
121	0.38300	0.46989	-0.86891E-01	-0.18	1.0
122	0.82500	0.32668	0.49832	1.02	1.0
123	1.1040	1.2394	-0.13542	-0.28	1.0
124	12.738	13.349	-0.61122	-1.25	1.0
125	0.99900	0.97915	0.19850E-01	0.04	1.0
126	2.7170	3.1088	-0.39182	-0.80	1.0
127	0.11500	-0.17720	0.29620	0.60	1.0



128	2.0720	1.8709	0.20113	0.41	1.0
129	0.49900	0.29314	0.20586	0.42	1.0
130	1.1410	1.1996	-0.58608E-01	-0.12	1.0
131	1.2740	1.0778	0.19622	0.40	1.0
132	0.34100	0.33795	0.30465E-02	0.01	1.0
133	0.49900	0.54622	-0.47219E-01	-0.10	1.0
134	1.2180	0.79308	0.42492	0.87	1.0
135	11.057	12.709	-1.6523	-3.37	1.0
136	1.1190	0.85125	0.26775	0.55	1.0
137	1.9140	2.6204	-0.70645	-1.44	1.0
138	0.99000E-01	-0.22938	0.32838	0.67	1.0
139	1.7670	1.8905	-0.12354	-0.25	1.0
140	0.41600	0.24558	0.17042	0.35	1.0
141	1.1110	0.83301	0.27798	0.57	1.0
142	1.0720	1.0465	0.25529E-01	0.05	1.0
143	0.30000	-0.40229E-01	0.34023	0.69	1.0
144	0.47800	0.41776	0.60240E-01	0.12	1.0
145	1.3910	1.2485	0.14254	0.29	1.0
146	11.555	11.414	0.14071	0.29	1.0
147	1.8430	1.2585	0.59052	1.20	1.0
148	2.3960	2.3153	0.80721E-01	0.16	1.0
149	0.14900	0.36792	-0.21892	-0.45	1.0
150	2.0570	1.8907	0.16631	0.34	1.0
151	0.49400	0.44012	0.53882E-01	0.11	1.0
152	1.1550	1.3355	-0.18051	-0.37	1.0
153	1.4270	1.1479	0.27907	0.57	1.0
154	0.36500	0.52036	-0.15536	-0.32	1.0
155	0.48100	0.31012	0.17088	0.35	1.0
156	1.2040	1.1285	0.75504E-01	0.15	1.0
157	10.784	11.597	-0.81323	-1.66	1.0
158	1.4910	1.6261	-0.13515	-0.28	1.0
159	2.4640	2.2634	0.20056	0.41	1.0
160	0.14100	0.34295E-01	0.10671	0.22	1.0
161	1.7650	1.8225	-0.57522E-01	-0.12	1.0
162	0.50900	0.15063	0.35837	0.73	1.0
163	1.1450	1.0554	0.89575E-01	0.18	1.0
164	1.3610	1.2592	0.10179	0.21	1.0
165	0.28000	0.23900	0.41002E-01	0.08	1.0
166	0.47200	0.51378	-0.41784E-01	-0.09	1.0
167	1.0390	1.2013	-0.16235	-0.33	1.0
168	10.538	11.280	-0.74177	-1.51	1.0
169	1.3330	1.6387	-0.30571	-0.62	1.0
170	2.7200	2.6158	0.10421	0.21	1.0
171	0.25600	0.42037	-0.16437	-0.34	1.0
172	1.7240	1.9415	-0.21753	-0.44	1.0
173	0.40700	0.56023	-0.15323	-0.31	1.0
174	1.0400	1.2263	-0.18632	-0.38	1.0
175	1.2950	1.3825	-0.87513E-01	-0.18	1.0
176	0.30800	0.37161	-0.63610E-01	-0.13	1.0
177	0.45100	0.38106	0.69940E-01	0.14	1.0
178	1.0800	1.0375	0.42504E-01	0.09	1.0
179	10.790	10.856	-0.65590E-01	-0.13	1.0
180	1.6880	1.2648	0.42325	0.86	1.0
181	2.2290	2.6150	-0.38597	-0.79	1.0
182	0.25000	0.21928	0.30715E-01	0.06	1.0
183	1.7790	1.7688	0.10233E-01	0.02	1.0
184	0.35400	0.32683	0.27170E-01	0.06	1.0
185	1.0020	1.0936	-0.91629E-01	-0.19	1.0
186	1.2350	1.2046	0.30364E-01	0.06	1.0
187	0.31300	0.29077	0.22234E-01	0.05	1.0
188	0.55300	0.65919	-0.10619	-0.22	1.0
189	1.4650	1.2772	0.18782	0.38	1.0
190	10.809	11.325	-0.51598	-1.05	1.0
191	1.4690	1.7282	-0.25917	-0.53	1.0
192	3.3290	2.6532	0.67584	1.38	1.0
193	0.18800	0.57888	-0.39088	-0.80	1.0
194	2.3430	1.9721	0.37091	0.76	1.0
195	0.52200	0.43119	0.90810E-01	0.19	1.0
196	0.83200	1.0893	-0.25728	-0.52	1.0
197	1.2680	1.1675	0.10052	[illegible]	



196	0.83200	[illegible]			
197	1.2680	1.1675	0.10052	0.20	1.0
198	0.31100	0.33181	-0.20812E-01	-0.04	1.0
199	0.59900	1.0126	-0.41361	-0.84	1.0
200	1.7360	1.5553	0.18068	0.37	1.0
201	11.169	11.228	-0.58762E-01	-0.12	1.0
202	1.1570	1.2623	-0.10529	-0.21	1.0
203	2.9950	3.1756	-0.18058	-0.37	1.0
204	0.30700	-0.20045E-01	0.32704	0.67	1.0
205	2.2020	2.3223	-0.12030	-0.25	1.0
206	0.43200	0.51183	-0.79827E-01	-0.16	1.0
207	1.0020	0.84448	0.15752	0.32	1.0
208	1.3290	1.1980	0.13097	0.27	1.0
209	0.33200	0.18658	0.14542	0.30	1.0
210	0.95700	1.1023	-0.14530	-0.30	1.0
211	0.79800	1.4547	-0.65666	-1.34	1.0
212	10.235	11.258	-1.0232	-2.09	1.0
213	1.2870	0.88691	0.40009	0.82	1.0
214	2.8540	2.8666	-0.12557E-01	-0.03	1.0
215	0.24400	-0.60757E-01	0.30476	0.62	1.0
216	1.7510	2.0102	-0.25921	-0.53	1.0
217	0.39700	0.19708	0.19992	0.41	1.0
218	0.80900	1.0474	-0.23838	-0.49	1.0
219	1.2140	1.1737	0.40281E-01	0.08	1.0
220	0.29800	0.28749	0.10510E-01	0.02	1.0
221	0.98700	1.2507	-0.26368	-0.54	1.0
222	1.3820	1.3029	0.79126E-01	0.16	1.0
223	11.575	10.902	0.67347	1.37	1.0
224	1.6430	1.5981	0.44945E-01	0.09	1.0
225	2.7500	3.1220	-0.37202	-0.76	1.0
226	0.75500	0.49022	0.26478	0.54	1.0
227	2.2270	2.0002	0.22682	0.46	1.0
228	0.44000	0.57189	-0.13189	-0.27	1.0
229	0.98000	1.0018	-0.21820E-01	-0.04	1.0
230	1.5020	1.2551	0.24690	0.50	1.0
231	0.38200	0.42765	-0.45648E-01	-0.09	1.0
232	1.0050	1.3583	-0.35328	-0.72	1.0
233	1.6960	1.7024	-0.63686E-02	-0.01	1.0
234	14.880	12.201	2.6786	5.46	1.0
235	1.8770	2.0357	-0.15872	-0.32	1.0
236	3.5080	2.9769	0.53108	1.08	1.0
237	0.93400	0.96473	-0.30732E-01	-0.06	1.0
238	2.4830	2.2871	0.19591	0.40	1.0
239	0.41800	0.42020	-0.22012E-02	-0.00	1.0
240	1.1210	1.0204	0.10062	0.21	1.0
241	1.5100	1.7486	-0.23856	-0.49	1.0
242	0.40300	0.37356	0.29440E-01	0.06	1.0
243	1.1580	1.1954	-0.37420E-01	-0.08	1.0
244	2.2760	2.2453	0.30730E-01	0.06	1.0
245	18.875	15.399	3.4756	7.09	1.0
246	2.0260	2.5643	-0.53828	-1.10	1.0
247	4.1990	3.9232	0.27580	0.56	1.0
248	1.2490	1.5117	-0.26269	-0.54	1.0
249	2.9770	2.9853	-0.82521E-02	-0.02	1.0
250	0.48000	0.90531	-0.42531	-0.87	1.0
251	1.0180	1.1424	-0.12441	-0.25	1.0
252	2.0020	1.5712	0.43077	0.88	1.0
253	0.41900	0.41856	0.43529E-03	0.00	1.0
254	1.0530	1.3002	-0.24725	-0.50	1.0
255	2.4890	2.7573	-0.26827	-0.55	1.0
256	20.963	18.789	2.1745	4.43	1.0
257	2.1670	2.6167	-0.44967	-0.92	1.0
258	4.7960	4.5500	0.24604	0.50	1.0
259	0.85700	1.7359	-0.87886	-1.79	1.0
260	3.4160	3.3883	0.27701E-01	0.06	1.0
261	0.61100	1.0173	-0.40631	-0.83	1.0
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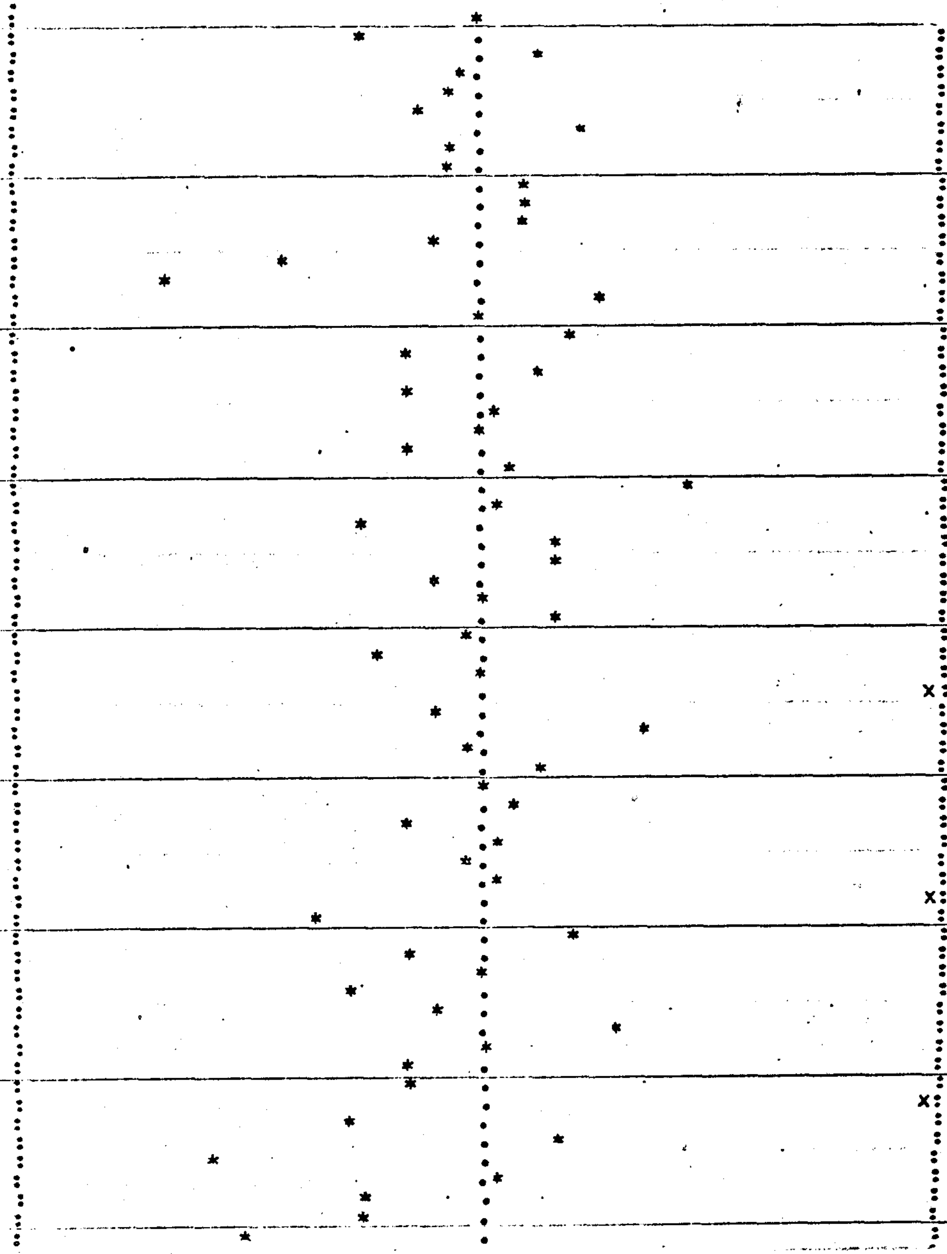
263	1.6110	2.4186	-0.80762	-1.65	1.0



264	0.59900	0.91414	-0.31514	-0.64	1.0
265	1.2440	1.2815	-0.37479E-01	-0.08	1.0
266	2.5730	2.5967	-0.23652E-01	-0.05	1.0
267	22.859	20.388	2.4714	5.04	1.0
268	1.7940	2.4449	-0.65095	-1.33	1.0
269	5.1160	5.0370	0.79010E-01	0.16	1.0
270	0.83300	1.2753	-0.44227	-0.90	1.0
271	3.7110	3.7207	-0.97141E-02	-0.02	1.0
272	0.74300	0.97593	-0.23293	-0.48	1.0
273	1.5760	1.7842	-0.20823	-0.42	1.0
274	2.9260	1.9103	1.0157	2.07	1.0
275	0.66600	1.0674	-0.40138	-0.82	1.0
276	1.0650	1.0792	-0.13227E-01	-0.03	1.0
277	2.2830	2.3049	-0.21875E-01	-0.04	1.0
278	20.386	21.342	-0.95634	-1.95	1.0
279	1.3900	1.2824	0.10755	0.22	1.0
280	4.2240	4.5657	-0.34169	-0.70	1.0
281	0.63500	0.38687	0.24813	0.51	1.0
282	3.4370	3.2114	0.22564	0.46	1.0
283	0.72300	0.39760	0.32540	0.66	1.0
284	1.6030	1.6570	-0.48964E-01	-0.10	1.0
285	2.3400	2.8395	-0.49953	-1.02	1.0
286	0.63000	0.67206	-0.42059E-01	-0.09	1.0
287	0.85200	0.71646	0.13554	0.28	1.0
288	1.5890	1.3689	0.22012	0.45	1.0
289	13.508	18.590	-5.0821	-10.36	1.0
290	1.2900	0.48432	0.80568	1.64	1.0
291	3.5150	3.4674	0.47615E-01	0.10	1.0
292	0.35600	-0.23563	0.59163	1.21	1.0
293	2.4890	2.7662	-0.27722	-0.57	1.0
294	0.53500	0.12457	0.41043	0.84	1.0
295	1.1830	1.1845	-0.15469E-02	-0.00	1.0
296	1.6770	1.8411	-0.16411	-0.33	1.0
297	0.45700	0.16739	0.28961	0.59	1.0
298	0.75700	1.2734	-0.51640	-1.05	1.0
299	1.4730	1.6863	-0.21330	-0.44	1.0
300	12.830	13.442	-0.61230	-1.25	1.0
301	1.6740	1.3236	0.35044	0.71	1.0
302	3.5050	3.6216	-0.11656	-0.24	1.0
303	0.61700	0.51710	0.99902E-01	0.20	1.0
304	2.6920	2.6674	0.24584E-01	0.05	1.0
305	0.49300	0.50532	-0.12324E-01	-0.03	1.0
306	1.1490	1.2442	-0.95207E-01	-0.19	1.0
307	1.8000	1.6484	0.15160	0.31	1.0
308	0.42700	0.64274	-0.21574	-0.44	1.0
309	0.63200	0.56237	0.69634E-01	0.14	1.0
310	1.4330	1.3600	0.73029E-01	0.15	1.0
311	13.926	13.263	0.66314	1.35	1.0
312	1.9610	2.0434	-0.82408E-01	-0.17	1.0
313	3.9480	3.9337	0.14284E-01	0.03	1.0
314	0.82700	1.1527	-0.32571	-0.66	1.0
315	3.0900	2.7448	0.34524	0.70	1.0
316	0.48300	0.53824	-0.55239E-01	-0.11	1.0
317	1.2680	1.1207	0.14732	0.30	1.0
318	1.9480	1.8689	0.79134E-01	0.16	1.0
319	0.53600	0.35203	0.18397	0.38	1.0
320	0.42100	0.46952	-0.48518E-01	-0.10	1.0
321	1.7640	1.5903	0.17370	0.35	1.0
322	14.775	14.112	0.66255	1.35	1.0
323	1.9870	2.1710	-0.18397	-0.38	1.0
324	4.1870	3.9375	0.24954	0.51	1.0
325	1.0680	1.0550	0.12989E-01	0.03	1.0
326	3.1500	3.0193	0.13070	0.27	1.0
327	0.50800	0.48780	0.20197E-01	0.04	1.0
328	1.2690	1.3055	-0.36475E-01	-0.07	1.0
329	2.0900	2.0229	0.67057E-01	0.14	1.0
330	0.55600	0.55456	0.14414E-02	0.00	1.0
331	0.40700	-0.16415	0.57115	1.16	1.0
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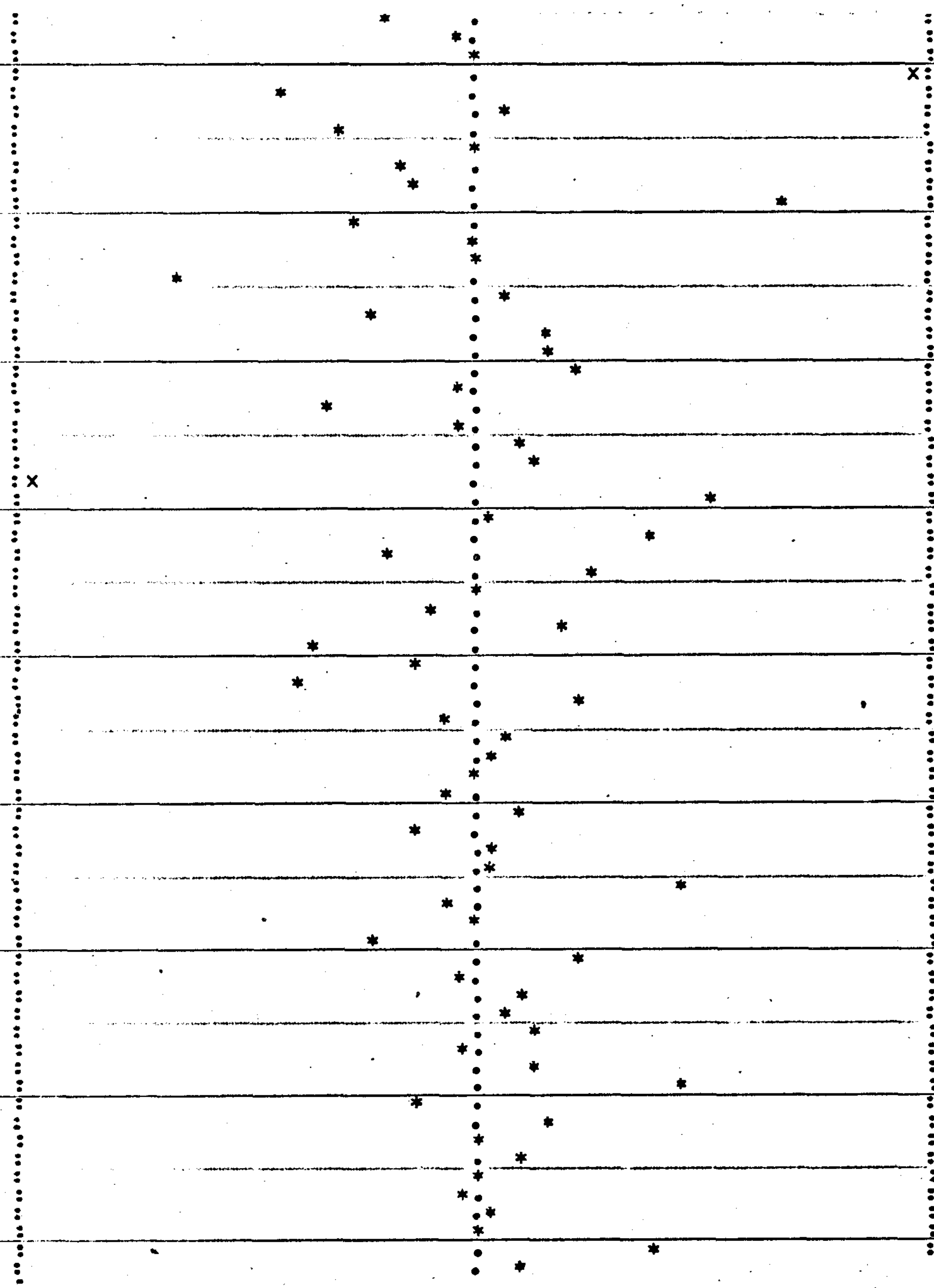
333	14.311	14.460	-0.14934	-0.30	[illegible]



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335	3.7960	3.8199	-0.23905E-01	-0.05	1.0	
336	1.0880	0.86030	0.22770	0.46	1.0	
337	2.9620	2.8607	0.10128	0.21	1.0	
338	0.40200	0.36123	0.40767E-01	0.08	1.0	
339	1.0800	1.4086	-0.32857	-0.67	1.0	
340	1.8520	1.9566	-0.10461	-0.21	1.0	
341	0.39900	0.50502	-0.10602	-0.22	1.0	
342	0.60300	0.51430	0.94698E-01	0.19	1.0	
343	1.7200	1.8242	-0.10418	-0.21	1.0	
344	12.254	13.959	-1.7047	-3.48	1.0	X
345	1.6660	1.5992	0.66839E-01	0.14	1.0	
346	3.3940	3.4708	-0.76765E-01	-0.16	1.0	
347	0.93400	0.76886	0.16514	0.34	1.0	
348	2.4280	2.6374	-0.20944	-0.43	1.0	
349	0.47000	0.73096	-0.26096	-0.53	1.0	
350	0.91300	1.1520	-0.23901	-0.49	1.0	
351	1.5350	1.4995	0.35547E-01	0.07	1.0	
352	0.33800	0.18159	0.15641	0.32	1.0	
353	0.50800	0.64900E-01	0.44310	0.90	1.0	
354	1.5250	1.6215	-0.96478E-01	-0.20	1.0	
355	11.392	12.252	-0.86003	-1.75	1.0	
356	1.1960	1.2121	-0.16110E-01	-0.03	1.0	
357	2.9380	3.0011	-0.63073E-01	-0.13	1.0	
358	0.69500	0.39174	0.30326	0.62	1.0	
359	2.0320	2.2439	-0.21193	-0.43	1.0	
360	0.42200	0.97329	-0.55129	-1.12	1.0	
361	0.81700	0.83472	-0.17722E-01	-0.04	1.0	
362	1.4250	1.2553	0.16971	0.35	1.0	
363	0.31800	0.10800	0.21000	0.43	1.0	
364	0.47300	0.24018	0.23282	0.47	1.0	
365	1.2770	0.94539	0.33161	0.68	1.0	
366	9.6130	11.432	-1.8192	-3.71	1.0	X
367	1.4300	0.90256	0.52744	1.08	1.0	
368	2.7180	2.9209	-0.20293	-0.41	1.0	
369	0.46500	0.37673	0.88271E-01	0.18	1.0	
370	1.6510	1.8003	-0.14926	-0.30	1.0	
371	0.35000	0.67239	-0.32239	-0.66	1.0	
372	0.80600	0.76822	0.37780E-01	0.08	1.0	
373	1.2530	0.97785	0.27515	0.56	1.0	
374	0.25200	0.15689	0.95111E-01	0.19	1.0	
375	0.37700	0.44520	-0.68201E-01	-0.14	1.0	
376	1.2680	1.0677	0.20027	0.41	1.0	
377	11.097	10.210	0.88691	1.81	1.0	
378	1.3530	1.5652	-0.21224	-0.43	1.0	
379	2.9800	2.7506	0.22938	0.47	1.0	
380	1.1430	0.42617	0.71683	1.46	1.0	
381	2.0530	1.7181	0.33485	0.68	1.0	
382	0.40300	-0.25804	0.66104	1.35	1.0	
383	0.98100	0.99553	-0.14532E-01	-0.03	1.0	
384	1.3470	1.2016	0.14538	0.30	1.0	
385	0.31500	0.36705	-0.52045E-01	-0.11	1.0	
386	0.58700	-0.37221E-01	0.62422	1.27	1.0	
387	1.7810	1.2087	0.57234	1.17	1.0	
388	10.701	11.109	-0.40785	-0.83	1.0	
389	1.9580	1.1050	0.85295	1.74	1.0	
390	3.1920	2.7308	0.46121	0.94	1.0	
391	1.0140	0.85462	0.15938	0.33	1.0	
392	1.8870	1.9986	-0.11159	-0.23	1.0	
393	0.32500	0.12870	0.19630	0.40	1.0	
394	0.92700	1.0024	-0.75398E-01	-0.15	1.0	
395	1.5070	1.4822	0.24804E-01	0.05	1.0	
396	0.33700	0.12826	0.20874	0.43	1.0	
397	0.49500	0.49005	0.49497E-02	0.01	1.0	
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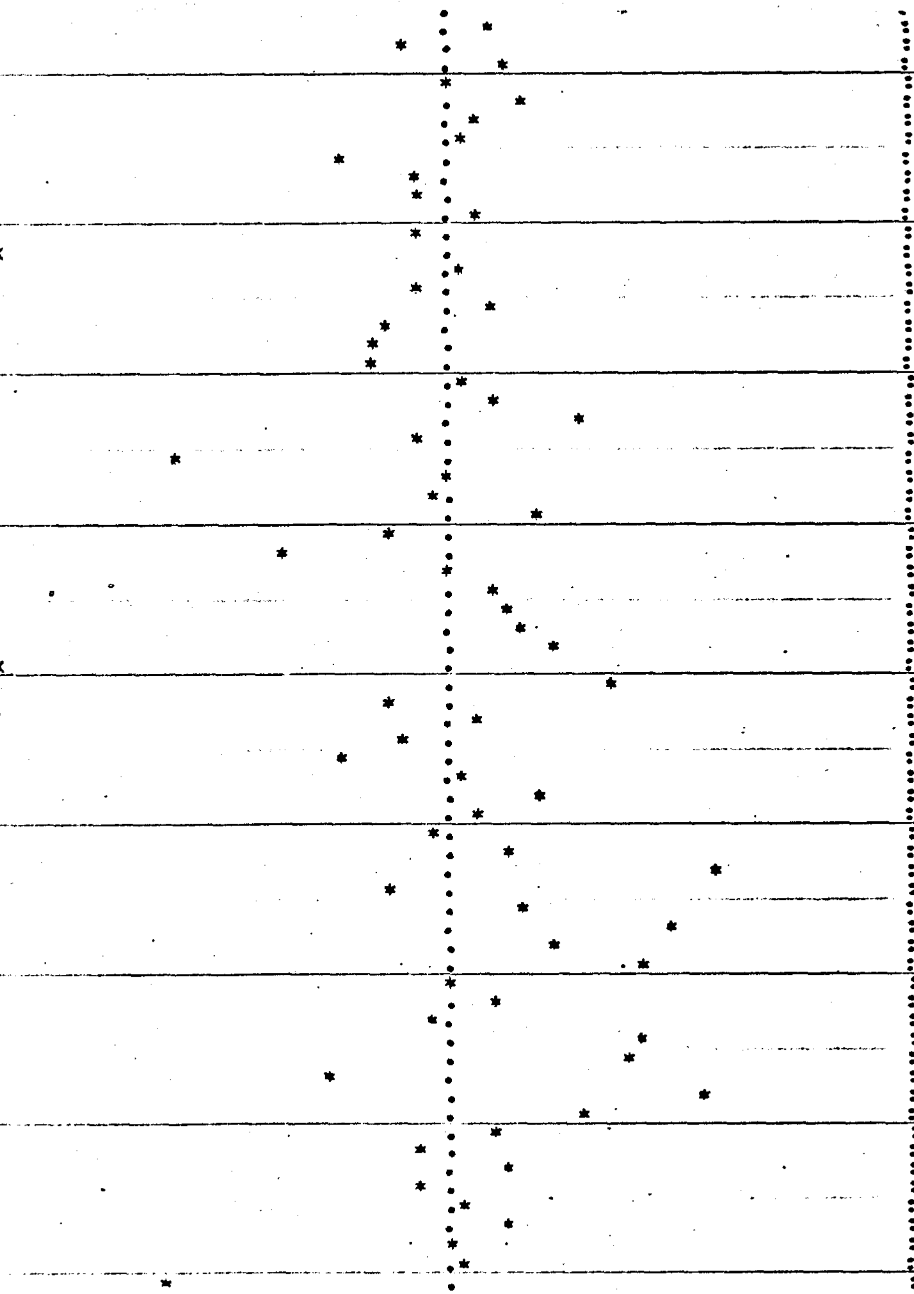

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402	0.80500	0.71105	0.93951E-01	0.19	1.0
403	1.9510	1.8194	0.14162	0.29	1.0
404	0.32200	0.18063	0.14137	0.29	1.0
405	0.94100	0.84892	C.92082E-01	0.19	1.0
406	1.4620	1.3851	0.76901E-01	0.16	1.0
407	0.31600	0.11271	0.20329	0.41	1.0
408	0.29600	0.44875	-0.15275	-0.31	1.0
409	1.4270	1.4908	-0.63848E-01	-0.13	1.0
410	9.9830	10.376	-0.39275	-0.80	1.0
411	1.9890	1.7457	0.24328	0.50	1.0
412	2.6110	2.8770	-0.26603	-0.54	1.0
413	1.1630	0.84897	0.31403	0.64	1.0
414	1.8540	1.9115	-0.57527E-01	-0.12	1.0
415	0.26500	0.87602	-0.61102	-1.25	1.0
416	0.85800	0.92712	-0.69124E-01	-0.14	1.0
417	1.3130	1.0650	0.24799	0.51	1.0
418	0.28600	0.31035	-0.24348E-01	-0.05	1.0
419	0.51800	0.47791	0.40085E-01	0.08	1.0
420	1.6030	1.6278	-0.24772E-01	-0.05	1.0
421	10.076	10.628	-0.55156	-1.12	1.0
422	1.7240	1.9847	-0.26066	-0.53	1.0
423	3.2190	2.9094	0.30956	0.63	1.0
424	1.0050	1.2923	-0.28731	-0.59	1.0
425	2.4060	2.1701	0.23591	0.48	1.0
426	0.39300	-0.98738E-01	0.49174	1.00	1.0
427	0.89700	0.73559	0.16141	0.33	1.0
428	1.3490	1.3200	0.28975E-01	0.06	1.0
429	0.29300	0.20907	0.83934E-01	0.17	1.0
430	0.66600	0.64704	0.18964E-01	0.04	1.0
431	1.716C	1.8415	-0.12551	-0.26	1.0
432	11.830	10.827	1.0029	2.05	1.0
433	1.0000	1.7123	-0.71228	-1.45	1.0
434	3.1290	3.3430	-0.21398	-0.44	1.0
435	0.78000	0.94543	-0.16543	-0.34	1.0
436	2.7050	2.5202	0.18483	0.38	1.0
437	0.53300	0.40181	C.13119	0.27	1.0
438	1.0490	1.0165	0.32532E-01	0.07	1.0
439	1.4150	1.4435	-0.28544E-01	-0.06	1.0
440	C.36900	0.43936	-C.70362E-01	-0.14	1.0
441	0.67800	0.80518	-0.12718	-0.26	1.0
442	1.4220	1.8494	-0.42742	-0.87	1.0
443	12.838	12.161	0.67696	1.38	1.0
444	1.4260	1.0855	0.34046	0.69	1.0
445	3.2520	3.1488	0.10325	0.21	1.0
446	0.34400	0.51330	-0.16930	-0.35	1.0
447	2.3380	2.7198	-0.38177	-0.78	1.0
448	0.55600	0.53824	0.17758E-01	0.04	1.0
449	1.2100	1.0981	0.11190	0.23	1.0
450	1.6960	1.5638	0.13222	0.27	1.0
451	0.44600	0.42471	0.21295E-01	0.04	1.0
452	C.41600	0.58422	-0.16822	-0.34	1.0
453	1.4690	1.4470	C.21955E-C1	0.04	1.0
454	13.299	12.976	0.32337	0.66	1.0
455	2.0120	1.5508	0.46120	0.94	1.0
456	3.5630	3.3478	0.21522	0.44	1.0
457	C.35800	0.45941	-0.10141	-0.21	1.0
458	2.5470	2.3526	0.19441	0.40	1.0
459	0.49500	0.54432	-0.49325E-01	-0.10	1.0
460	1.3530	1.3323	0.20741E-01	0.04	1.0
461	1.9400	1.8331	C.10688	0.22	1.0
462	0.49000	0.54838	-0.58383E-01	-0.12	1.0
463	0.57500	0.58869	-0.13690E-01	-0.03	1.0
464	1.7330	1.7072	0.25825E-01	0.05	1.0
465	13.464	13.547	-0.83318E-01	-0.17	1.0
466	1.9160	2.2151	-0.29909	-0.61	1.0
467	3.5620	3.5252	0.36849E-01	0.08	1.0
468	0.73200	0.47123	0.26077	0.53	1.0
469	2.5980	2.6776	-0.79648E-01	-0.16	1.0
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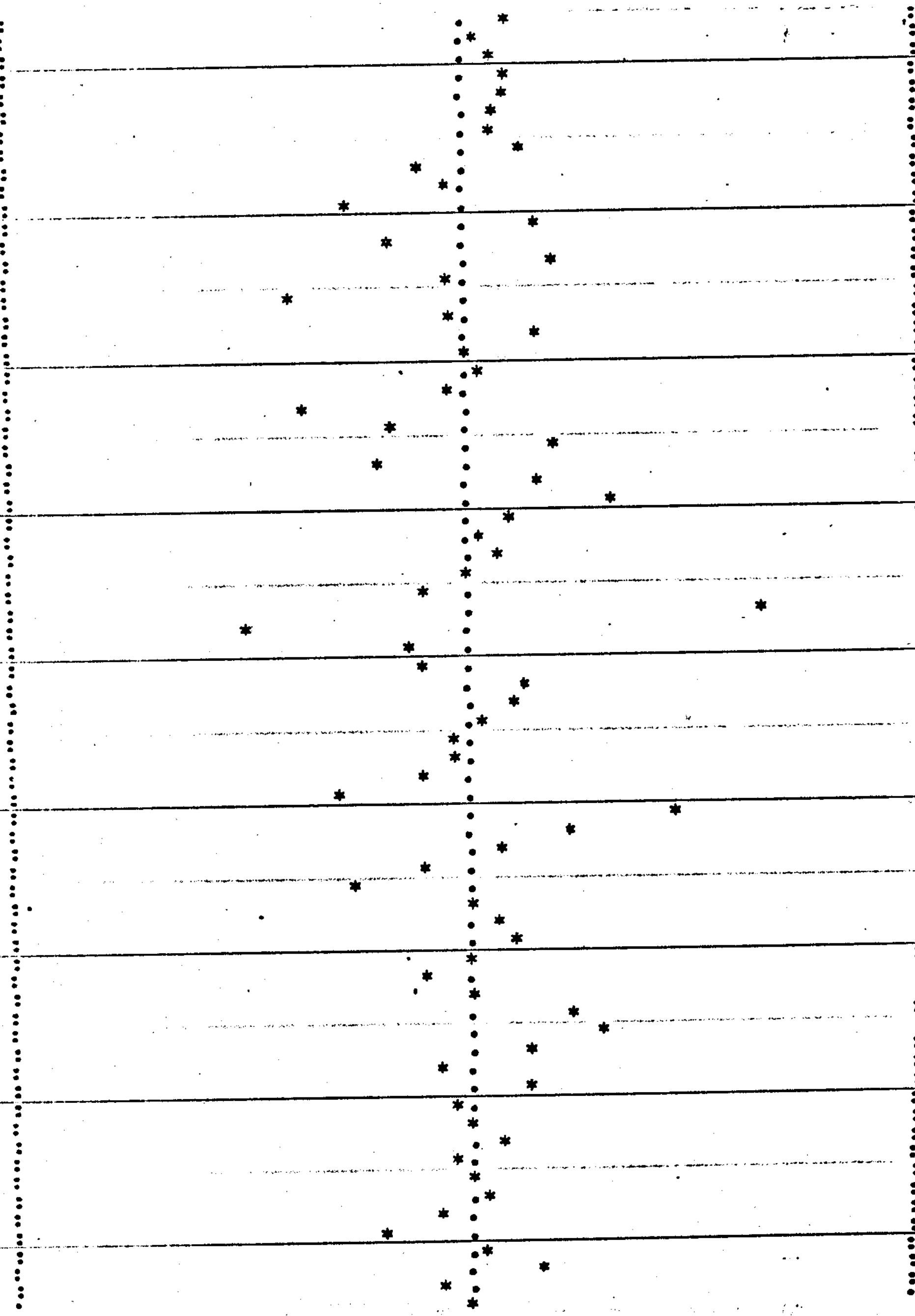

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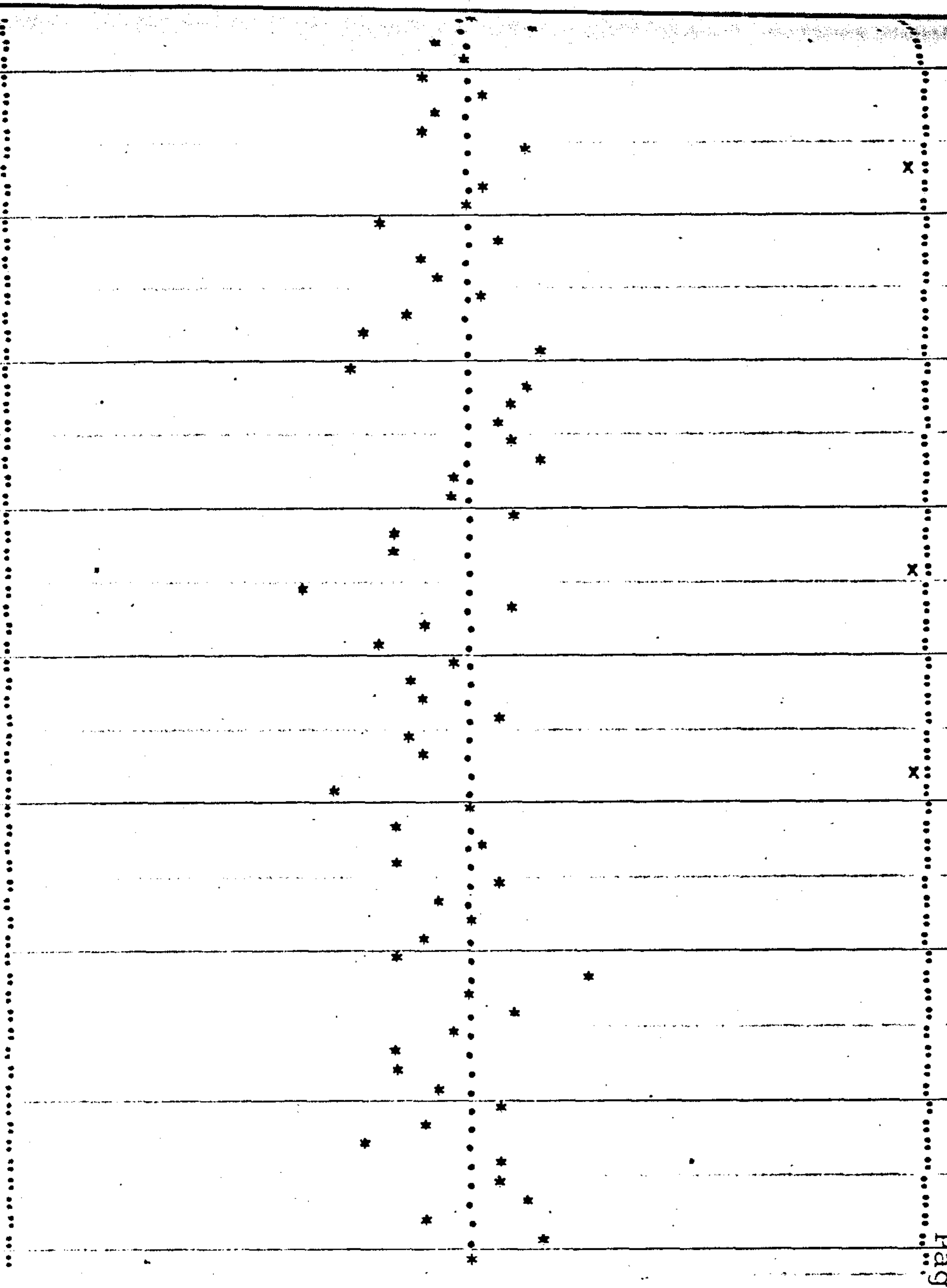
470	0.57900	0.58985	-0.10853E-01	-0.02	1.0
471	1.2520	1.4158	-0.16376	-0.33	1.0
472	1.9250	1.8878	0.37185E-01	0.08	1.0
473	0.45100	0.56673	-0.11573	-0.24	1.0
474	0.70000	0.83808	-0.13808	-0.28	1.0
475	1.8800	1.6672	0.21275	0.43	1.0
476	15.310	13.669	1.6409	3.35	1.0
477	2.1210	2.0867	0.34332E-01	0.07	1.0
478	3.7450	3.7638	-0.18811E-01	-0.04	1.0
479	0.85500	1.1319	-0.27689	-0.56	1.0
480	2.8650	2.7692	0.95754E-01	0.20	1.0
481	0.55400	0.71454	-0.16054	-0.33	1.0
482	1.2770	1.3579	-0.80944E-01	-0.17	1.0
483	2.0410	1.9822	0.58807E-01	0.12	1.0
484	0.48300	0.66435	-0.18135	-0.37	1.0
485	0.65300	0.99013	-0.33713	-0.69	1.0
486	2.2010	1.9629	0.23813	0.49	1.0
487	14.510	14.926	-0.41640	-0.85	1.0
488	2.1090	1.9056	0.20341	0.41	1.0
489	3.6760	3.5325	0.14347	0.29	1.0
490	0.85400	0.77008	0.83919E-01	0.17	1.0
491	2.7610	2.5968	0.16421	0.33	1.0
492	0.51600	0.25914	0.25686	0.52	1.0
493	1.3020	1.3602	-0.58221E-01	-0.12	1.0
494	1.9440	1.9990	-0.54972E-01	-0.11	1.0
495	0.45900	0.33053	0.12847	0.26	1.0
496	0.88900	1.1491	-0.26007	-0.53	1.0
497	2.4030	2.6306	-0.22762	-0.46	1.0
498	16.442	14.734	1.7079	3.48	1.0
499	1.7460	2.2971	-0.55106	-1.12	1.0
500	3.9390	3.8074	0.13158	0.27	1.0
501	0.85000	1.0074	-0.15737	-0.32	1.0
502	2.5660	2.8385	-0.27250	-0.56	1.0
503	0.52200	0.57871	-0.56712E-01	-0.12	1.0
504	1.1630	1.3542	-0.19123	-0.39	1.0
505	1.6540	1.7805	-0.12663	-0.26	1.0
506	0.37600	0.25687	0.11913	0.24	1.0
507	0.79100	0.99157	-0.20057	-0.41	1.0
508	2.4280	2.5572	-0.12920	-0.26	1.0
509	18.147	16.340	1.8069	3.68	1.0
510	1.3340	1.7635	-0.42954	-0.88	1.0
511	4.0830	4.0846	-0.16460E-02	-0.00	1.0
512	0.67200	0.93378	-0.26178	-0.53	1.0
513	3.0320	2.9789	0.53142E-01	0.11	1.0
514	0.72300	0.97285	-0.24985	-0.51	1.0
515	1.2440	1.1365	0.10752	0.22	1.0
516	1.5750	1.6843	-0.10933	-0.22	1.0
517	0.43700	0.44957	-0.12573E-01	-0.03	1.0
518	0.98900	1.1223	-0.13327	-0.27	1.0
519	2.1240	2.3832	-0.25919	-0.53	1.0
520	18.189	17.814	0.37517	0.77	1.0
521	1.5740	1.5874	-0.13419E-01	-0.03	1.0
522	4.2880	4.1530	0.13499	0.28	1.0
523	0.55700	0.60324	-0.46235E-01	-0.09	1.0
524	2.9900	3.2496	-0.25962	-0.53	1.0
525	0.73400	0.95808	-0.22408	-0.46	1.0
526	1.4270	1.5401	-0.11309	-0.23	1.0
527	1.8850	1.7807	0.10426	0.21	1.0
528	0.55400	0.69177	-0.13777	-0.28	1.0
529	0.87800	1.2307	-0.35266	-0.72	1.0
530	2.1680	2.0822	0.85842E-01	0.18	1.0
531	17.837	17.766	0.12096	0.25	1.0
532	2.0810	1.8618	0.21916	0.45	1.0
533	4.1470	4.3151	-0.16806	-0.34	1.0
534	0.96300	0.71815	0.24985	0.51	1.0
535	3.0310	3.0070	0.23973E-01	0.05	1.0



536	0.67000	0.79717	-0.12717	-0.26	1.0
537	1.5810	1.5819	-0.91362E-03	-0.00	1.0
538	2.0910	2.1060	-0.14963E-01	-0.03	1.0
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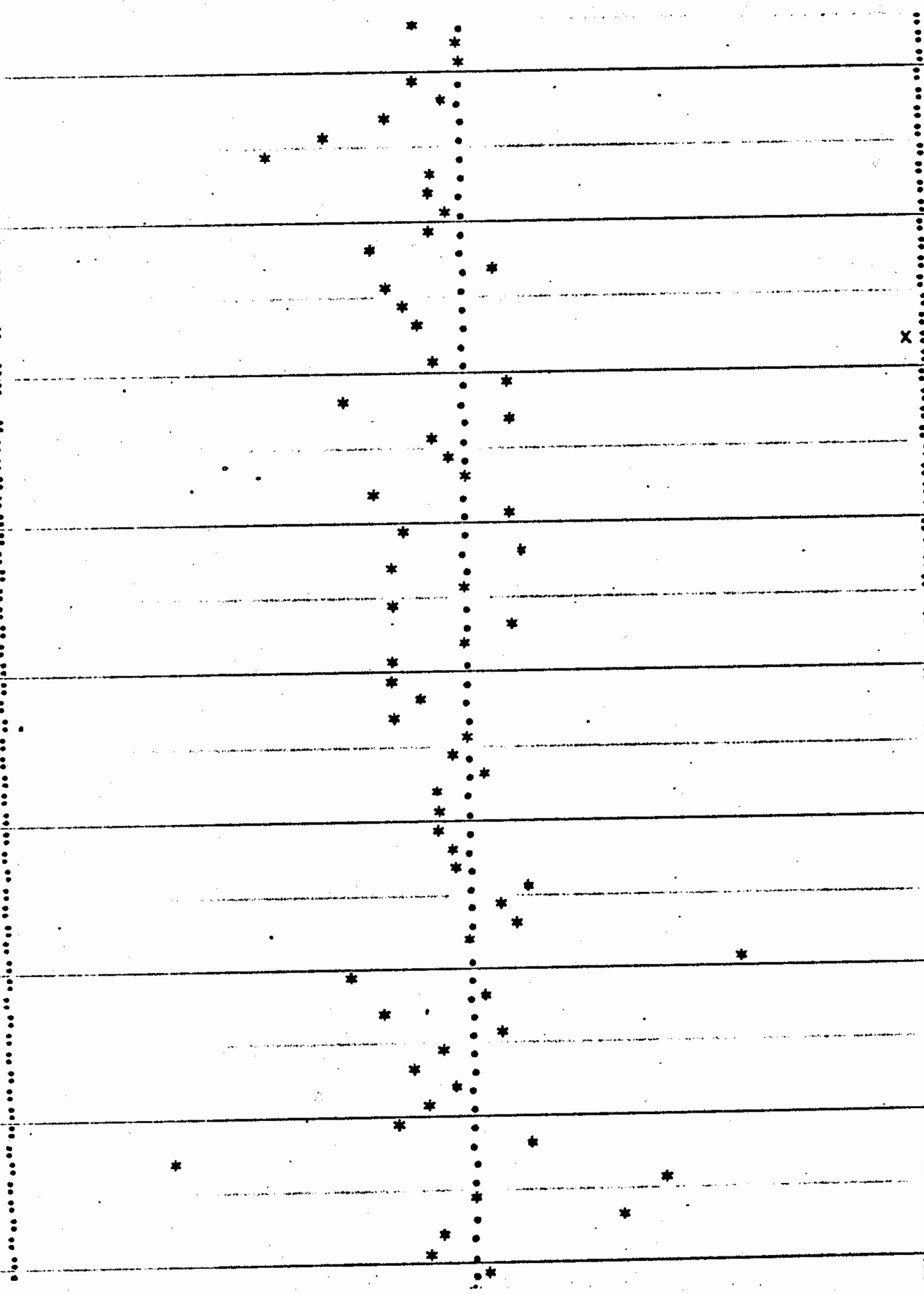
540	C.95300	1.0037	-0.50733E-01	-0.10	1.0
541	2.0850	2.3393	-0.25434	-0.52	1.0
542	17.343	17.767	-0.42389	-0.86	1.0
543	1.9030	2.5441	-0.64114	-1.31	1.0
544	4.2310	4.3428	-0.11185	-0.23	1.0
545	1.1980	1.3113	-0.11331	-0.23	1.0
546	3.2800	3.3512	-0.71216E-01	-0.15	1.0
547	0.72200	0.82912	-0.10712	-0.22	1.0
548	1.5180	1.8007	-0.28267	-0.58	1.0
549	2.1920	2.0820	C.11001	0.22	1.0
550	0.63900	0.89285	-0.25385	-0.52	1.0
551	C.76500	0.94531	-0.18031	-0.37	1.0
552	2.2030	2.3335	-0.13046	-0.27	1.0
553	19.060	17.074	1.9856	4.05	1.0
554	2.0230	2.1412	-0.11820	-0.24	1.0
555	4.6980	4.5272	0.17078	0.35	1.0
556	1.3260	1.7205	-0.39453	-0.80	1.0
557	3.5010	3.3328	C.16816	0.34	1.0
558	0.75500	0.83492	-0.78917E-01	-0.16	1.0
559	1.7550	1.8174	-0.62435E-01	-0.13	1.0
560	2.3280	2.3260	0.19846E-02	0.00	1.0
561	C.65000	0.94996	-0.29996	-0.61	1.0
562	0.64000	0.50063	0.13937	0.28	1.0
563	2.0730	2.2615	-0.18853	-0.38	1.0
564	18.579	18.366	0.21263	0.43	1.0
565	1.7850	2.0327	-0.24774	-0.51	1.0
566	4.5620	4.5461	0.15898E-01	0.03	1.0
567	1.1360	1.3687	-0.23269	-0.47	1.0
568	3.5670	3.4060	0.16103	0.33	1.0
569	0.73200	0.71550	0.16498E-01	0.03	1.0
570	1.6240	1.8465	-0.22248	-0.45	1.0
571	2.0490	2.3137	-0.26465	-0.54	1.0
572	0.58400	0.74987	-0.16587	-0.34	1.0
573	0.76900	1.0129	-C.24387	-0.50	1.0
574	2.2860	2.2737	0.12347E-01	0.03	1.0
575	18.002	18.058	-0.56183E-01	-0.11	1.0
576	1.3860	1.8391	0.46865E-01	0.10	1.0
577	4.2930	4.4148	-0.12181	-0.25	1.0
578	0.99900	1.0947	-0.95744E-01	-0.20	1.0
579	3.4100	3.4855	-0.75470E-01	-0.15	1.0
580	C.66700	0.73855	-0.71549E-01	-0.15	1.0
581	1.6200	1.6784	-0.58435E-01	-0.12	1.0
582	2.1010	1.8885	0.21250	0.43	1.0
583	0.57100	0.49664	0.74360E-01	0.15	1.0
584	0.81800	0.68043	0.13757	0.28	1.0
585	2.2000	2.1772	0.22779E-01	0.05	1.0
586	18.485	17.605	0.87971	1.79	1.0
587	1.4030	1.8062	-0.40317	-0.82	1.0
588	4.3500	4.2860	0.63957E-01	0.13	1.0
589	0.68800	0.95869	-0.27069	-0.55	1.0
590	3.4440	3.3261	0.11792	0.24	1.0
591	0.79200	0.88431	-0.92313E-01	-0.19	1.0
592	1.6570	1.8490	-0.19200	-0.39	1.0
593	2.1370	2.1627	-0.25670E-01	-0.05	1.0
594	0.60800	0.74946	-0.14146	-0.29	1.0
595	0.84400	1.0696	-0.22556	-0.46	1.0
596	2.2530	2.0442	0.20883	0.43	1.0
597	16.501	17.505	-1.0042	-2.05	1.0
598	1.6950	1.0472	0.64781	1.32	1.0
599	4.1290	4.1403	-0.11299E-01	-0.02	1.0
600	0.88100	0.37443	0.50657	1.03	1.0
601	3.3240	3.4075	-0.83500E-01	-0.17	1.0
[illegible]	[illegible]	0.81923	-0.13423	-0.27	1.0



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605	0.48400	0.38854	0.95456E-01	0.19	1.0
606	1.0350	1.3537	-0.31875	-0.65	1.0
607	2.5900	2.6352	-0.45156E-01	-0.09	1.0
608	19.710	16.452	3.2581	6.64	1.0
609	2.2780	2.1052	0.17284	0.35	1.0
610	4.3410	4.2453	0.95678E-01	0.20	1.0
611	1.1120	1.0642	0.47764E-01	0.10	1.0
612	3.1530	3.3963	-0.24330	-0.50	1.0
613	0.56900	0.85528	-0.28628	-0.58	1.0
614	1.4750	1.4610	0.13977E-01	0.03	1.0
615	1.8890	1.9885	-0.99530E-01	-0.20	1.0
616	0.51800	0.44348	0.74521E-01	0.15	1.0
617	1.3650	1.4868	-0.12180	-0.25	1.0
618	2.6870	2.9464	-0.25938	-0.53	1.0
619	20.431	19.357	1.0739	2.19	1.0
620	1.8900	2.7345	-0.84449	-1.72	1.0
621	4.5250	4.6209	-0.95899E-01	-0.20	1.0
622	1.1470	1.5463	-0.39931	-0.81	1.0
623	3.4860	3.4566	0.29351E-01	0.06	1.0
624	0.60000	0.76455	-0.16455	-0.34	1.0
625	1.5450	1.6684	-0.12339	-0.25	1.0
626	2.1350	2.0652	0.69784E-01	0.14	1.0
627	0.60100	0.83317	-0.23217	-0.47	1.0
628	1.2500	1.5567	-0.30674	-0.63	1.0
629	2.6180	2.7268	-0.10882	-0.22	1.0
630	20.255	19.592	0.66278	1.35	1.0
631	1.4540	1.9893	-0.53528	-1.09	1.0
632	4.5030	4.4686	0.34419E-01	0.07	1.0
633	1.2950	1.3649	-0.69869E-01	-0.14	1.0
634	3.3150	3.5009	-0.18586	-0.38	1.0
635	0.81200	0.71553	0.96474E-01	0.20	1.0
636	1.4120	1.4987	-0.86660E-01	-0.18	1.0
637	2.1110	2.2022	-0.91177E-01	-0.19	1.0
638	0.57600	0.57666	-0.66006E-03	-0.00	1.0
639	1.2820	1.3270	-0.45031E-01	-0.09	1.0
640	2.3960	2.9511	-0.55511	-1.13	1.0
641	19.515	19.551	-0.36026E-01	-0.07	1.0
642	1.4680	1.6987	-0.23074	-0.47	1.0
643	4.4290	4.4928	-0.63811E-01	-0.13	1.0
644	0.94500	1.4566	-0.51159	-1.04	1.0
645	3.3550	3.2411	0.11390	0.23	1.0
646	0.68200	0.75395	-0.71946E-01	-0.15	1.0
647	1.3580	1.4868	-0.12881	-0.26	1.0
648	2.1270	2.0590	0.67956E-01	0.14	1.0
649	0.57100	0.62324	-0.52238E-01	-0.11	1.0
650	1.3460	0.80344	0.54256	1.11	1.0
651	2.3400	1.8275	0.51246	1.05	1.0
652	16.920	18.411	-1.4906	-3.04	1.0
653	1.4550	1.1127	0.34226	0.70	1.0
654	4.0930	4.0294	0.68616E-01	0.14	1.0
655	1.1340	0.65939	0.47461	0.97	1.0
656	2.8900	2.9073	-0.17294E-01	-0.04	1.0
657	0.58300	0.29482	0.28818	0.59	1.0
658	1.4500	1.5062	-0.56216E-01	-0.11	1.0
659	1.9110	1.9909	-0.79923E-01	-0.16	1.0
660	0.51600	0.64674	-0.13074	-0.27	1.0
661	0.62400	0.53159	0.92406E-01	0.19	1.0
662	1.7840	1.8398	-0.55844E-01	-0.11	1.0
663	13.300	16.167	-2.8672	-5.85	1.0
664	0.95900	0.92858	0.30420E-01	0.06	1.0
665	3.3450	3.6110	-0.26597	-0.54	1.0
666	0.67100	0.56773	0.10327	0.21	1.0
667	2.1440	2.4705	-0.32654	-0.67	1.0
668	0.54900	0.24922	0.29978	0.61	1.0
669	1.4110	1.2392	0.17180	0.35	1.0
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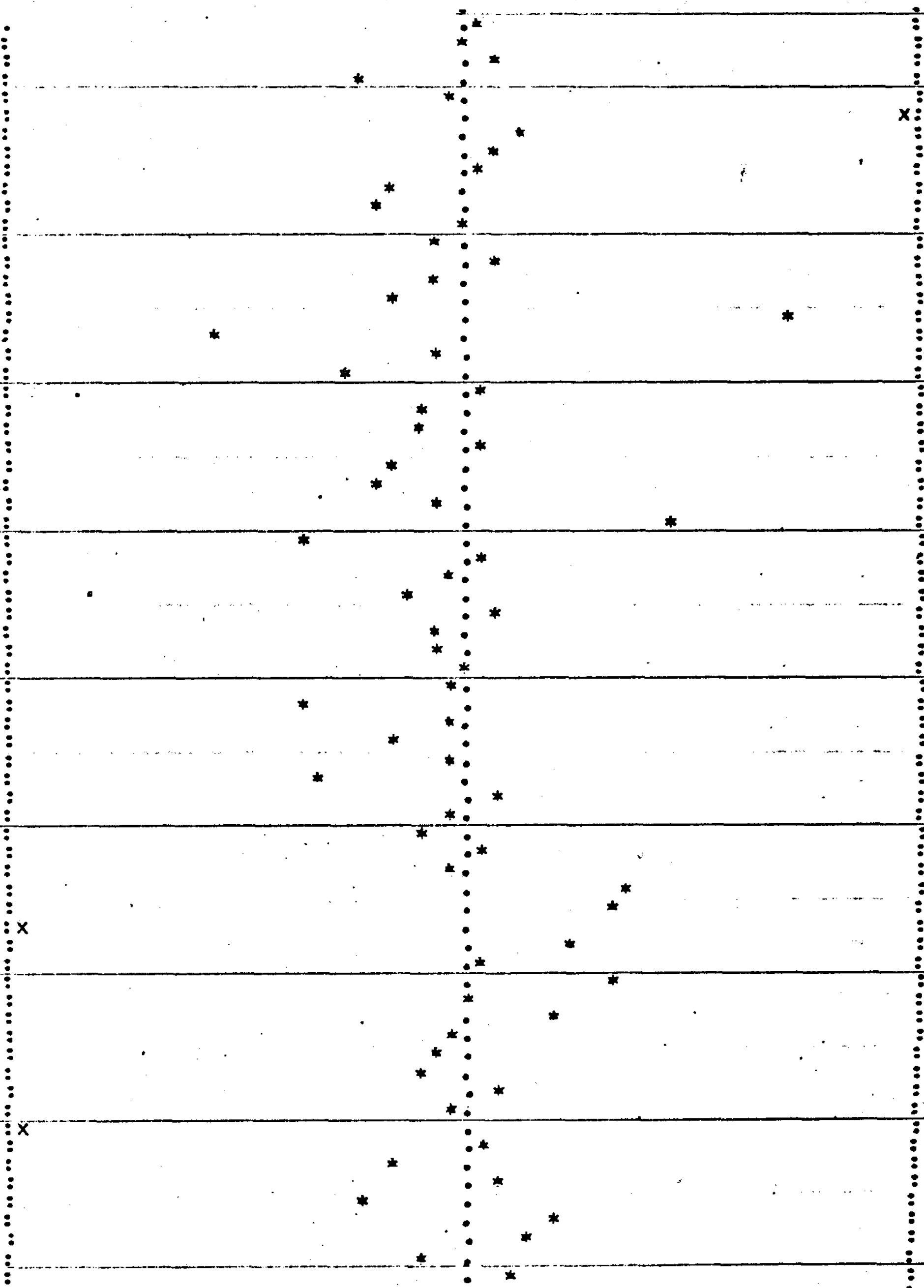

672	0.64900	0.52941	0.11959	0.24	1.0
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674	12.933	13.1[illegible]	-0.20203	-0.[illegible]	1.0
675	1.5270	0.75866	0.76834	1.57	1.0
676	3.3790	3.3198	0.59233E-01	0.12	1.0
677	0.49000	0.40451	0.85492E-01	0.17	1.0
678	2.1670	2.1330	0.33998E-01	0.07	1.0
679	0.34800	0.47269	-0.12469	-0.25	1.0
680	1.3330	1.4785	-0.14554	-0.30	1.0
681	1.5950	1.2045	0.39052	0.80	1.0
682	0.35200	0.39264	-0.40644E-01	-0.08	1.0
683	0.54300	0.26572	0.27728	0.57	1.0
684	1.7360	1.4433	0.29273	0.60	1.0
685	11.704	12.751	-1.0474	-2.14	1.0
686	2.1430	1.3318	0.81122	1.65	1.0
687	3.2350	3.0833	0.15169	0.31	1.0
688	1.1320	0.21131	0.92069	1.88	1.0
689	2.2050	2.0059	0.19909	0.41	1.0
690	0.57200	0.18880	0.38320	0.78	1.0
691	1.3340	1.3450	-0.10968E-01	-0.02	1.0
692	1.6640	1.4958	0.16822	0.34	1.0
693	0.29800	0.36472	-0.66723E-01	-0.14	1.0
694	0.55200	0.28214	0.26986	0.55	1.0
695	1.4830	1.3427	0.14030	0.29	1.0
696	11.076	11.626	-0.55007	-1.12	1.0
697	2.0990	1.7798	0.31918	0.65	1.0
698	2.7850	2.9651	-0.18011	-0.37	1.0
699	1.2410	0.85994	0.38106	0.78	1.0
700	1.9050	1.8600	0.44993E-01	0.09	1.0
701	0.41200	0.26227	0.14973	0.31	1.0
702	1.1240	1.1346	-0.10554E-01	-0.02	1.0
703	1.4950	1.5491	-0.54124E-01	-0.11	1.0
704	0.28300	0.29583E-01	0.25342	0.52	1.0
705	0.68100	0.34527	0.33573	0.68	1.0
706	1.3560	1.5857	-0.22967	-0.47	1.0
707	10.55[illegible]	11.554	-0.96652	-1.97	1.0
708	2.2480	2.1845	0.63487E-01	0.13	1.0
709	2.7240	3.0447	-0.32070	-0.65	1.0
710	1.4700	1.5199	-0.49951E-01	-0.10	1.0
711	1.9340	1.9766	-0.42612E-01	-0.09	1.0
712	0.41900	0.36902	0.49982E-01	0.10	1.0
713	1.1090	1.0050	0.10398	0.21	1.0
714	1.4560	1.4561	0.39904E-01	0.08	1.0
715	0.29700	0.18605	0.11095	0.23	1.0
716	0.57100	0.85508	-0.28408	-0.58	1.0
717	1.4900	1.6480	-0.15804	-0.32	1.0
718	11.224	11.235	-0.10715E-01	-0.02	1.0
719	2.0140	2.3894	-0.37545	-0.77	1.0
720	2.9050	2.7004	0.20459	0.42	1.0
721	1.2490	1.3465	-0.97460E-01	-0.20	1.0
722	2.1620	2.2258	-0.63846E-01	-0.13	1.0
723	0.48700	0.56776	-0.80762E-01	-0.16	1.0
724	1.4140	1.3981	0.15899E-01	0.03	1.0
725	1.7400	1.6103	0.12972	0.26	1.0
726	0.39700	0.56955	-0.17255	-0.35	1.0
727	0.70100	0.62868	0.72324E-01	0.15	1.0
728	1.6620	1.5324	0.12960	0.26	1.0
729	11.533	11.473	0.60472E-01	0.12	1.0
730	1.6780	1.7827	-0.10474	-0.21	1.0
731	2.9990	2.9037	0.95262E-01	0.19	1.0
732	1.1660	1.1075	0.58462E-01	0.12	1.0
733	2.1490	2.0792	0.69830E-01	0.14	1.0
734	0.43100	0.30437	0.12663	0.26	1.0
735	1.1770	1.2894	-0.11244	-0.23	1.0
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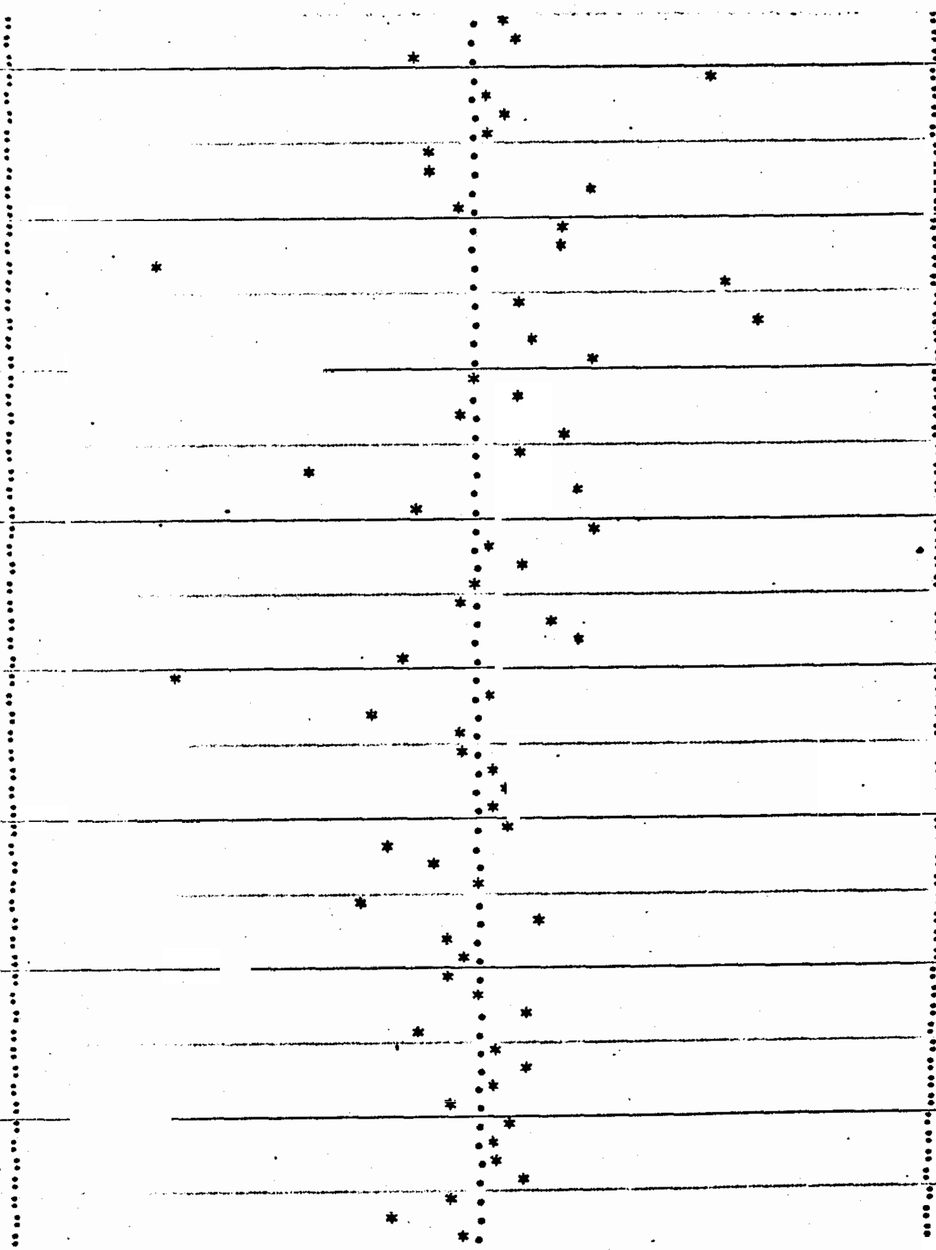

ERROR MEAN	SKEWNESS
0.6978E-05	-0.369

NATURAL GAS DAILY FORECASTING MODEL (MMCF) RUN DATE AUG 07

AREA FORECASTED	DATE	ACTUAL	FORECASTED	RESIDUAL	PER CENT	
REGION 01	FEB 22 75	.308	.217	.091	29.5	
REGION 02	FEB 22 75	1.564	1.380	.184	11.8	
REGION 03	FEB 22 75	9.961	10.506	.545-	5.5-	
REGION 04	FEB 22 75	2.735	2.765	.030-	1.1-	
REGION 05	FEB 22 75	1.880	2.040	.160-	8.5-	
REGION 06	FEB 22 75	.492	.320	.172	35.0	
REGION 07	FEB 22 75	1.140	.926	.214	18.8	
REGION 08	FEB 22 75	1.341	1.189	.152	11.3	
REGION 09	FEB 22 75	.276	.266	.010	3.6	
REGION 10	FEB 22 75	.816	1.003	.187-	22.9-	
REGION 11	FEB 22 75	.698	.695	.003	.4	
TOTAL FOR	FEB 22 75	21.211	21.307	.096-	.5-	* *
REGION 01	FEB 23 75	.624	.465	.159	25.5	
REGION 02	FEB 23 75	1.511	1.572	.061-	4.0-	
REGION 03	FEB 23 75	9.907	10.571	.664-	6.7-	
REGION 04	FEB 23 75	2.928	2.998	.070-	2.4-	
REGION 05	FEB 23 75	1.797	1.848	.051-	2.8-	
REGION 06	FEB 23 75	.348	.113	.235	67.5	
REGION 07	FEB 23 75	.966	1.058	.092-	9.5-	
REGION 08	FEB 23 75	1.286	1.088	.198	15.4	
REGION 09	FEB 23 75	.251	.126	.125	49.8	
REGION 10	FEB 23 75	1.527	.964	.563	36.9	
REGION 11	FEB 23 75	.632	.626	.006	.9	
TOTAL FOR	FEB 23 75	21.777	21.429	.348	1.6	* *
REGION 01	FEB 24 75	.772	.829	.057-	7.4-	
REGION 02	FEB 24 75	1.364	1.890	.526-	38.6-	
REGION 03	FEB 24 75	11.820	10.765	1.055	8.9	
REGION 04	FEB 24 75	3.230	3.244	.014-	.4-	
REGION 05	FEB 24 75	2.143	2.149	.006-	.3-	
REGION 06	FEB 24 75	.450	.681	.231-	51.3-	
REGION 07	FEB 24 75	1.046	1.255	.209-	20.0-	
REGION 08	FEB 24 75	1.516	1.329	.187	12.3	
REGION 09	FEB 24 75	.342	.550	.208-	60.8-	
REGION 10	FEB 24 75	2.037	1.906	.131	6.4	
REGION 11	FEB 24 75	.596	.873	.277-	46.5-	
TOTAL FOR	FEB 24 75	25.316	25.471	.155-	.6-	* *
REGION 01	FEB 25 75	.738	.777	.039-	5.3-	
REGION 02	FEB 25 75	1.397	1.604	.207-	14.8-	
REGION 03	FEB 25 75	11.287	12.019	.732-	6.5-	
REGION 04	FEB 25 75	3.399	3.321	.078	2.3	
REGION 05	FEB 25 75	2.229	2.233	.004-	.2-	
REGION 06	FEB 25 75	.408	.466	.058-	14.2-	
REGION 07	FEB 25 75	1.105	1.182	.077-	7.0-	

NATURAL GAS DAILY FORECASTING MODEL (MMCF) RUN DATE AUG 07

REA FORECASTED	DATE	ACTUAL	FORECASTED	RESIDUAL	PER CENT	
REGION 08	FEB 25 75	1.844	1.808	.036	2.0	
REGION 09	FEB 25 75	.405	.375	.030	7.4	
REGION 10	FEB 25 75	2.315	1.971	.344	14.9	
REGION 11	FEB 25 75	.763	.760	.003	.4	
TOTAL FOR	FEB 25 75	25.890	26.516	.626-	2.4-	* *
REGION 01	FEB 26 75	.571	.547	.024	4.2	
REGION 02	FEB 26 75	1.430	1.373	.057	4.0	
REGION 03	FEB 26 75	11.733	11.569	.164	1.4	
REGION 04	FEB 26 75	3.043	3.235	.192-	6.3-	
REGION 05	FEB 26 75	1.773	1.810	.037-	2.1-	
REGION 06	FEB 26 75	.417	.125	.292	70.0	
REGION 07	FEB 26 75	1.052	.989	.063	6.0	
REGION 08	FEB 26 75	1.675	1.773	.098-	5.9-	
REGION 09	FEB 26 75	.295	.333	.038-	12.9-	
REGION 10	FEB 26 75	2.003	2.195	.192-	9.6-	
REGION 11	FEB 26 75	.719	.769	.050-	7.0-	
TOTAL FOR	FEB 26 75	24.711	24.718	.007-	.0	* *
REGION 01	FEB 27 75	.492	.424	.068	13.8	
REGION 02	FEB 27 75	1.508	1.169	.339	22.5	
REGION 03	FEB 27 75	10.080	11.737	1.657-	16.4-	
REGION 04	FEB 27 75	2.852	2.799	.053	1.9	
REGION 05	FEB 27 75	1.754	1.773	.019-	1.1-	
REGION 06	FEB 27 75	.358	.295	.063	17.6	
REGION 07	FEB 27 75	1.039	1.031	.008	.8	
REGION 08	FEB 27 75	1.522	1.635	.113-	7.4-	
REGION 09	FEB 27 75	.291	.286	.005	1.7	
REGION 10	FEB 27 75	2.073	1.759	.314	15.1	
REGION 11	FEB 27 75	.722	.526	.196	27.1	
TOTAL FOR	FEB 27 75	22.691	23.434	.743-	3.3-	* *
REGION 01	FEB 28 75	.663	.484	.179	27.0	
REGION 02	FEB 28 75	1.305	1.496	.191-	14.6-	
REGION 03	FEB 28 75	10.771	10.496	.275	2.6	
REGION 04	FEB 28 75	2.838	2.784	.054	1.9	
REGION 05	FEB 28 75	1.843	1.748	.095	5.2	
REGION 06	FEB 28 75	.407	.247	.160	39.3	
REGION 07	FEB 28 75	.988	.625	.363	36.7	
REGION 08	FEB 28 75	1.245	1.432	.187-	15.0-	
REGION 09	FEB 28 75	.232	.293	.061-	26.3-	
REGION 10	FEB 28 75	1.554	1.898	.344-	22.1-	
REGION 11	FEB 28 75	.714	.594	.120	16.8	
TOTAL FOR	FEB 28 75	22.560	22.097	.463	2.1	* *

NATURAL GAS DAILY FORECASTING MODEL (MMCF) RUN DATE AUG 07

AREA FORECASTED	DATE	ACTUAL	FORECASTED	RESIDUAL	PER CENT	
REGION 01	MAR 01 75	.418	.678	.260-	62.2-	
REGION 02	MAR 01 75	1.567	1.164	.403	25.7	
REGION 03	MAR 01 75	9.387	10.056	.669-	7.1-	
REGION 04	MAR 01 75	2.872	2.808	.064	2.2	
REGION 05	MAR 01 75	1.936	1.688	.248	12.8	
REGION 06	MAR 01 75	.390	.205	.185	47.4	
REGION 07	MAR 01 75	1.040	.812	.228	21.9	
REGION 08	MAR 01 75	1.054	1.082	.028-	2.7-	
REGION 09	MAR 01 75	.224	.241	.017-	7.6-	
REGION 10	MAR 01 75	1.050	1.276	.226-	21.5-	
REGION 11	MAR 01 75	.829	.495	.334	40.3	
TOTAL FOR	MAR 01 75	20.767	20.505	.262	1.3	* *
REGION 01	MAR 02 75	.611	.650	.039-	6.4-	
REGION 02	MAR 02 75	1.329	1.512	.183-	13.8-	
REGION 03	MAR 02 75	8.840	9.684	.844-	9.5-	
REGION 04	MAR 02 75	2.652	2.669	.017-	.6-	
REGION 05	MAR 02 75	1.573	1.744	.171-	10.9-	
REGION 06	MAR 02 75	.320	.148	.172	53.8	
REGION 07	MAR 02 75	1.002	.864	.138	13.8	
REGION 08	MAR 02 75	1.161	.871	.290	25.0	
REGION 09	MAR 02 75	.218	.192	.026	11.9	
REGION 10	MAR 02 75	1.619	.812	.807	49.8	
REGION 11	MAR 02 75	.618	.308	.310	50.2	
TOTAL FOR	MAR 02 75	19.943	19.454	.489	2.5	* *

NATURAL GAS DAILY FORECASTING MODEL (MMCF) RUN DATE AUG 07

REA FORECASTED	DATE	ACTUAL	FORECASTED	RESIDUAL	PER CENT	
REGION 01	JUN 24 75	1.217	1.201	.016	1.3	
REGION 02	JUN 24 75	.562	.346	.216	38.4	
REGION 03	JUN 24 75	2.721	3.096	.375-	13.8-	
REGION 04	JUN 24 75	1.442	1.024	.418	29.0	
REGION 05	JUN 24 75	.655	.602	.053	8.1	
REGION 06	JUN 24 75	.046	.032	.014	30.4	
REGION 07	JUN 24 75	.606	.545	.061	10.1	
REGION 08	JUN 24 75	.627	.500	.127	20.3	
REGION 09	JUN 24 75	.057	.066	.009-	15.8-	
REGION 10	JUN 24 75	2.066	1.885	.181	8.8	
REGION 11	JUN 24 75	.972	.780	.192	19.8	
TOTAL FOR	JUN 24 75	10.971	10.077	.894	8.1	* *
REGION 01	JUN 25 75	1.233	1.423	.190-	15.4-	
REGION 02	JUN 25 75	.561	.828	.267-	47.6-	
REGION 03	JUN 25 75	3.408	3.030	.378	11.1	
REGION 04	JUN 25 75	1.357	1.560	.203-	15.0-	
REGION 05	JUN 25 75	.672	.831	.159-	23.7-	
REGION 06	JUN 25 75	.084	.150	.066-	78.6-	
REGION 07	JUN 25 75	.771	.684	.087	11.3	
REGION 08	JUN 25 75	.614	.686	.072-	11.7-	
REGION 09	JUN 25 75	.073	.043	.030	41.1	
REGION 10	JUN 25 75	1.864	2.030	.166-	8.9-	
REGION 11	JUN 25 75	.712	.781	.069-	9.7-	
TOTAL FOR	JUN 25 75	11.349	12.046	.697-	6.1-	* *
REGION 01	JUN 26 75	1.288	1.269	.019	1.5	
REGION 02	JUN 26 75	.535	.698	.163-	30.5-	
REGION 03	JUN 26 75	3.743	3.754	.011-	.3-	
REGION 04	JUN 26 75	1.633	1.532	.101	6.2	
REGION 05	JUN 26 75	.753	.794	.041-	5.4-	
REGION 06	JUN 26 75	.072	.068	.004	5.6	
REGION 07	JUN 26 75	.785	.854	.069-	8.8-	
REGION 08	JUN 26 75	.706	.729	.023-	3.3-	
REGION 09	JUN 26 75	.071	.085	.014-	19.7-	
REGION 10	JUN 26 75	1.707	1.988	.281-	16.5-	
REGION 11	JUN 26 75	.637	.702	.065-	10.2-	
TOTAL FOR	JUN 26 75	11.930	12.473	.543-	4.6-	* *
REGION 01	JUN 27 75	1.456	1.303	.153	10.5	
REGION 02	JUN 27 75	.452	.490	.038-	8.4-	
REGION 03	JUN 27 75	4.659	4.041	.618	13.3	
REGION 04	JUN 27 75	1.559	1.733	.174-	11.2-	
REGION 05	JUN 27 75	1.004	.972	.032	3.2	
REGION 06	JUN 27 75	.165	.122	.043	26.1	
REGION 07	JUN 27 75	.768	.786	.018-	2.3-	

NATURAL GAS DAILY FORECASTING MODEL (MMCF) RUN DATE AUG 07

A FORECASTED	DATE	ACTUAL	FORECASTED	RESIDUAL	PER CENT	
EGION 08	JUN 27 75	.700	.757	.057-	8.1-	
EGION 09	JUN 27 75	.073	.047	.026	35.6	
EGION 10	JUN 27 75	1.683	1.728	.045-	2.7-	
EGION 11	JUN 27 75	.812	.704	.108	13.3	
TOTAL FOR	JUN 27 75	13.331	12.683	.648	4.9	* *
EGION 01	JUN 28 75	1.054	1.349	.295-	28.0-	
EGION 02	JUN 28 75	.374	.331	.043	11.5	
EGION 03	JUN 28 75	2.803	2.592	.211	7.5	
EGION 04	JUN 28 75	1.099	1.210	.111-	10.1-	
EGION 05	JUN 28 75	.680	.886	.206-	30.3-	
EGION 06	JUN 28 75	.200	.103	.097	48.5	
EGION 07	JUN 28 75	.694	.952	.258-	37.2-	
EGION 08	JUN 28 75	.619	.668	.049-	7.9-	
EGION 09	JUN 28 75	.044	.028	.016	36.4	
EGION 10	JUN 28 75	.531	.812	.281-	52.9-	
EGION 11	JUN 28 75	.486	.531	.045-	9.3-	
TOTAL FOR	JUN 28 75	8.584	9.462	.878-	10.2-	* *
EGION 01	JUN 29 75	.784	.750	.034	4.3	
EGION 02	JUN 29 75	.074	.084	.010-	13.5-	
EGION 03	JUN 29 75	1.720	1.680	.040	2.3	
EGION 04	JUN 29 75	.699	.844	.145-	20.7-	
REGION 05	JUN 29 75	.710	.400	.310	43.7	
REGION 06	JUN 29 75	.102	.126	.024-	23.5-	
REGION 07	JUN 29 75	.448	.460	.012-	2.7-	
REGION 08	JUN 29 75	.360	.389	.029-	8.1-	
REGION 09	JUN 29 75	.051	.097	.046-	90.2-	
REGION 10	JUN 29 75	.565	.436	.129	22.8	
REGION 11	JUN 29 75	.621	.604	.017	2.7	
TOTAL FOR	JUN 29 75	6.134	5.870	.264	4.3	* *
REGION 01	JUN 30 75	.622	.717	.095-	15.3-	
REGION 02	JUN 30 75	.014	.139	.125-	892.9-	
REGION 03	JUN 30 75	2.476	2.235	.241	9.7	
REGION 04	JUN 30 75	.742	.671	.071	9.6	
REGION 05	JUN 30 75	.608	.651	.043-	7.1-	
REGION 06	JUN 30 75	.085	.030	.055	64.7	
REGION 07	JUN 30 75	.430	.292	.138	32.1	
REGION 08	JUN 30 75	.278	.205	.073	26.3	
REGION 09	JUN 30 75	.060	.020	.040	66.7	
REGION 10	JUN 30 75	1.003	.995	.008	.8	
REGION 11	JUN 30 75	.614	.518	.096	15.6	
TOTAL FOR	JUN 30 75	6.932	6.473	.459	6.6	* *